SunExpert

Serving the UNIX Client/Server Network

NOVEMBER 1994 Vol. 5 No. 11 $5.50

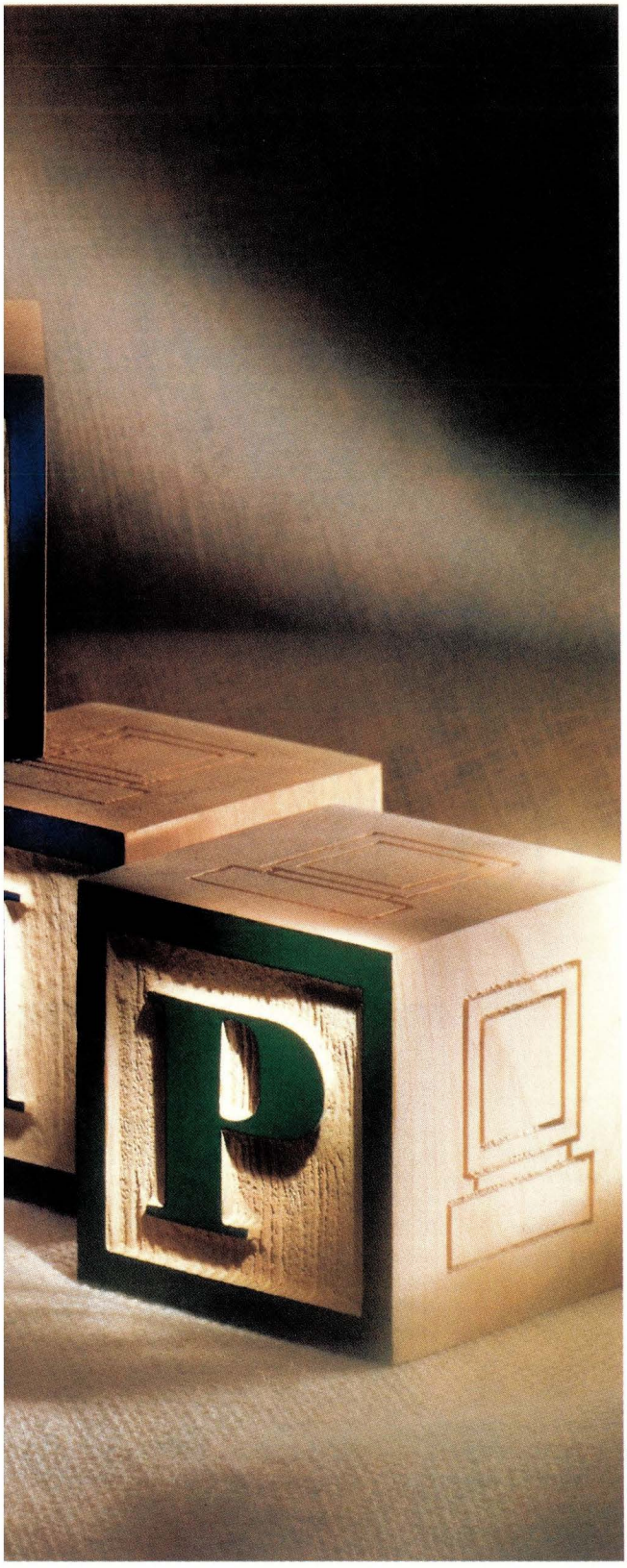
The Fate of SPARCalikes

Whither Solaris on X86?

Survey: Solaris-Ready X86s

UNIX Basics: Files

A smart way to spe



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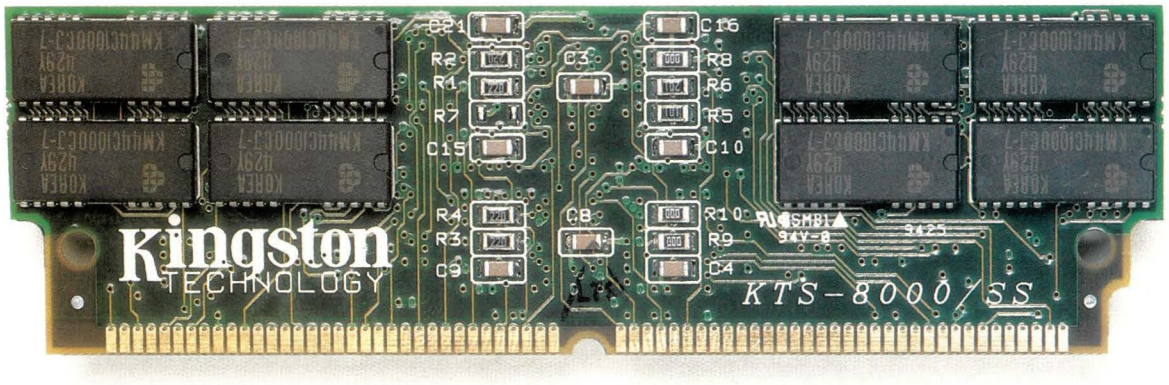

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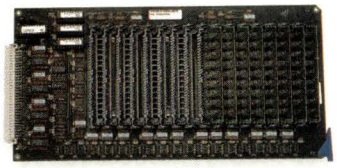
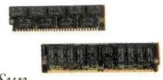


Sun Memory Enhancements



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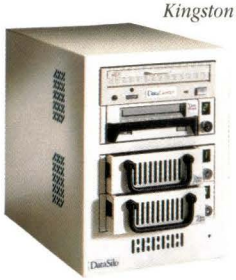

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DEPARTMENTS

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

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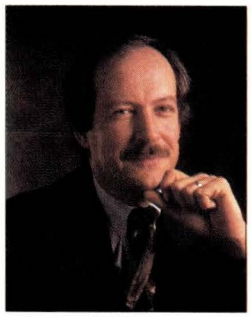
Material for publication should be sent to the attention of: Doug Pryor at the above address or electronically mailed to dpryor@cpg.com. Letters sent to the publication become the property of the publication and are assumed to be intended for publication and may be used so. *SUNEXPERT* Magazine is not sponsored or endorsed in any way by Sun Microsystems Inc. All information herein is believed to be accurate to the best of our ability.

Editorial

The More Things Change...

This month marks *SunExpert*'s fifth anniversary, and this year is the 20th anniversary of UNIX. This magazine has reported the ups and downs of both Sun and UNIX over the past half-decade. Certainly a lot has happened to both. In fact, these have been the very years that Sun Microsystems ventured out of the labs and research communities (remember Stanford University Network–S.U.N.?) into the mainstream commercial market–and, on its shoulders, carried UNIX out of Berkeley, Bell Labs and the ivory towers. So much has changed that it would be foolish to condense it all here, but one thing we can say for sure is that all of today's UNIX vendors owe Sun at least begrudging admiration for mainstreaming UNIX and, in large part, popularizing client/server architectures and befuddling us all with the term "open" systems.



I'm often asked, "If so much has changed, why is *SunExpert* still called *SunExpert?*" You could call it *Client/Server Thingy* or *Open Systems Thingamabob* or *UNIX Doohicky*. Why not get away from that platform-specific name? It's a heterogeneous world, after all. Well, the answer is threefold. When you can call Client/Server Inc. and buy generic hardware, we'll rename the magazine. When you no longer have to ask developers of open systems, "What's your primary target?" we'll think about changing. When the 30-odd flavors of UNIX run the same executables and objects without recompiling, we'll have something to talk about.

Until then, *SunExpert* will continue to cover the world of client/server and open computing through the filter of *the* principal networking engine and the first UNIX target for developers. Of course, it's a mixed computing environment for our readers, too. More than 33% of you have HP, 30% IBM, 28% DEC, 22% SGI and a smattering of other UNIX workstations and servers on your networks. Most of you have PCs to manage and Macintoshes to integrate, but we feel that you want to know how these various machines work with your primary platform. If we're wrong, let us know.

Doug Pryor

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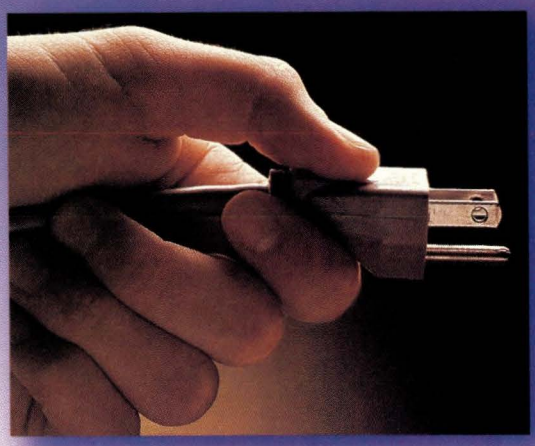

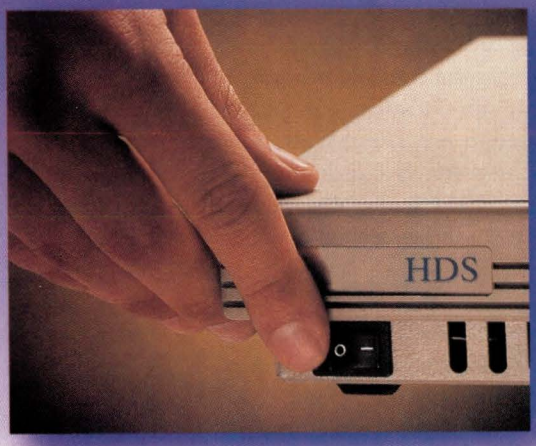

1. Plug It In
2. Turn It On

HDS X Window terminals are the easiest to install and the easiest to use. When equipped with local storage all you have to do to start using one is plug it in and turn it on. Because all of the terminal's fonts, server code and applications are stored locally there's no need to install, configure or change anything on your host computer.

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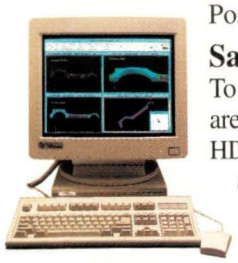

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NEWS

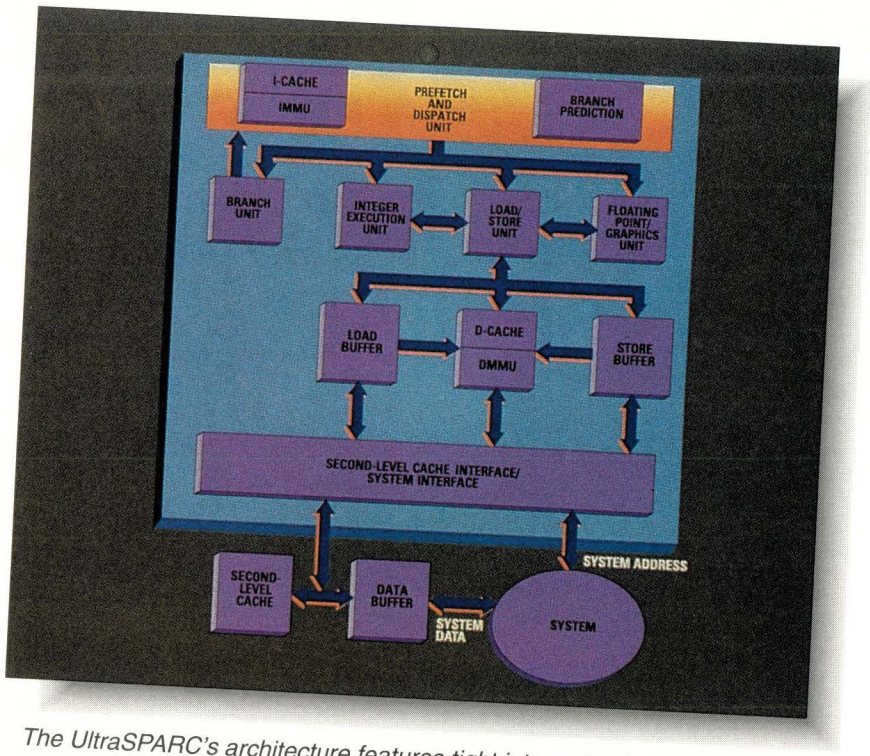
Sun's Full Frontal Assault

Sun Microsystems Inc. and its various planets are ending 1994 with a bang. In what can certainly be called a Grand Autumn Offensive, the company displayed its new UltraSPARC processor, new servers and cluster products, a SPARCstation designed exclusively as a PC server and a variety of software packages.

Some of the stories that follow take a closer look at these announcements.

Why the sudden blitz from Sun? It could, of course, be coincidental. On the other hand, as the summer of 1994 cranked to a close, the computer industry was treated to yet another round of "Sun has hit the wall" stories–the kinds of reports that have circulated at least once a year since the company's founding. In particular, the pundits targeted Sun's SPARC processor and its failure to win the corporate desktop from Intel Corp. chip-based systems and DOS/Microsoft Corp. Windows.

Perhaps the Autumn Offensive will set some of those tales to rest.



The UltraSPARC's architecture features tight integration between its various functional subsections. UltraSPARC is the next pit stop on Sun's SPARC road map and should keep the company's processor technology on par with its competitors.

Sun Shows UltraSPARC

At the heart of any computer maker's success or failure is, of course, its processor. Sun's processor has been the SPARC, and since its introduction in the mid-1980s, SPARC has been a middle-of-the-road RISC chip–providing better performance than x86 and 680X0 CPUs, at a cost below higher-performance alternatives.

But SPARC has never been a leading-edge technology. In recent months, the industry has noted that SPARC has been falling further and further behind such architectures as Hewlett-Packard Co.'s PA-RISC, the PowerPC and even Intel Corp.'s Pentium.

Now, however, Sun's SPARC Technology Business group has shown both its specifications for the next generation of SPARCs, and a chip based on those specifications: the UltraSPARC. The UltraSPARC's CPU will boast performance of 200 to 400 SPECint92 and 250 to 500 SPECfp92. This is well within the range of future PowerPCs, for example, and well beyond x86 performance.

The new specification for SPARC is Version 9, which is officially the product of SPARC International, the SPARC-oriented standards group established by Sun and an assortment of SPARC makers and users. Version 9 calls for a 64-bit system, superscalar design, on-chip support for advanced operating system concepts (for example, it attempts to support microkernel approaches and lightweight threads in silicon) and similar on-chip support for advanced compilers.

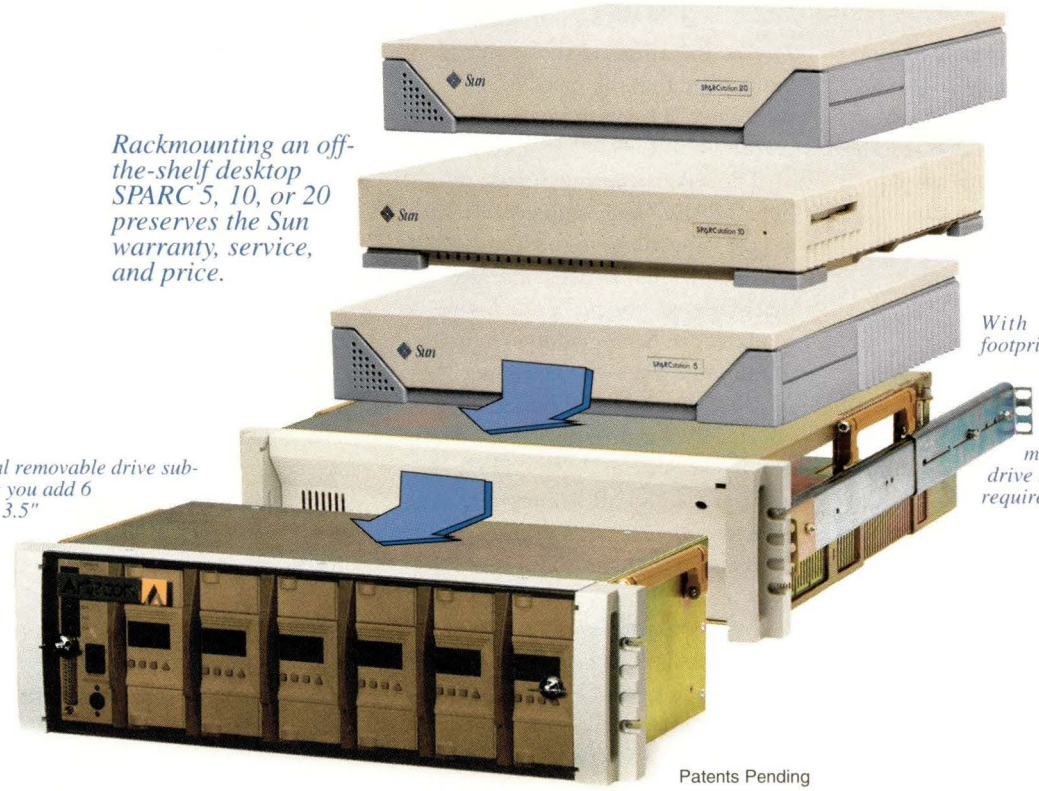
UltraSPARC is being described as the first implementation of Version 9. It will be designed, marketed and sold by Sun's SPARC Technology Business group and manufactured by Texas Instruments. In its first implementation, the processor will offer 200 to 300 SPECint92 and 250 to 350 SPECfp92. However, STB says that over time it will scale upward to 400 SPECint92 and 500 SPECfp92. In terms of clock speed, meanwhile, the UltraSPARCs will range from 140 to 200 MHz.

UltraSPARC is composed of five main blocks: two arithmetic logic units (ALUs), a load and store unit, a branch unit, three floating point units (one each for addition, multiplication and division/square root), a graphics adder and a graphics multiplier. It has a peak instruction rate of four instructions per cycle.

UltraSPARC will have a variety of features that lend themselves to advanced computing. Notably, it has on-chip support for multiprocessing. It supports, for instance, a distributed arbitration protocol for the shortest possible bus ownership latency. Up to four UltraSPARCs can share the same address bus.

Rack & Roll

Rackmounting an off-the-shelf desktop SPARC 5, 10, or 20 preserves the Sun warranty, service, and price.



With essentially the same footprint as a desktop SPARC, the Sphinx adds two additional 3.5" or half height 5.25" devices, as a stand alone chassis or mates with the removable drive subsystem for high capacity requirements.

An optional removable drive subsystem lets you add 6 additional 3.5" devices, including up to 25GB of hot plug disk.

Patents Pending

Off-The-Shelf.

Artecon's slender new Sphinx™ chassis is the only product today that allows you to rackmount an off-the-shelf desktop SPARC® 5, 10, or 20 workstation or server. And the optional hot plug removable drive subsystem lets you add all the devices you need to build a powerful server – for thousands of dollars less than a preconfigured package. All in only 5.25" of vertical rack space.

For The First Time Ever.

The Sphinx neatly encapsulates a SPARCstation™ 5, 10, or 20 workstation or server and fits any 19" EIA rack. It comes with side mounted slides, whisper quiet forced air fans, tuck-away lug handles, and up to two additional 3.5" or half height 5.25" devices – disk, CD, or tape.

In the rear you'll find completely unobstructed access to the SPARCstation backplane, as well as side access to the SPARC 5/20 internal CD-ROM.

Modular, Expandable, Reliable.

The optional removable drive subsystem supports as many as six additional 3.5" disk or tape devices, including up to 25 GBytes of hot plug, high performance, removable disks on one or two SCSI busses. Power, keyboard, and RS-232 for the workstation feed through to the front of the enclosure, supporting easy access to power on/off, terminal or modem devices, and rackmounted keyboards.

New!

And now Artecon's Sphinx48 supports the requirements of the telecommunications central office with a Sphinx that provides -48 VDC to an off-the-shelf SPARC.

You've never seen this much potential in such a small footprint. Nor so many ways to configure I/O devices. And every SPARC retains Sun's warranty, service, upgradeability, and price, because it never leaves the original case.

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The processor has also been optimized for graphics, video and multimedia-oriented applications. It supports an additional 30 instructions (the Visual Instruction Set [VISual]) that deal with graphics and video. In addition, the MPEG-2 standard for video compression is directly supported on the chip.

STB says that samples of the UltraSPARC will be available by early next year. However, UltraSPARC design data, including simulation data, can be obtained now. The company would not say, however, when users can expect Sun to start shipping UltraSPARC-based workstations and servers.

Sun Shows Servers and Clusters

While the SPARC Technology Business group was showing its UltraSPARC, Sun Microsystems Computer Corp. was continuing its push into corporate MIS. The company announced a series of upgrades to its servers and showed the next step in its strategy for clustered systems: a database cluster.

Sun has been counting on its servers to carry it into the world of corporate computing. In fact, industry insiders claim that the company's revenues from MIS applications are far more attractive in terms of profit per part than sales in its more traditional scientific and engineering markets.

This fall, SMCC announced a series of upgrades to its SPARCserver 1000E and SPARCcenter 2000E servers. In particular, the company announced that the speed of the machine's XD system bus has been increased by 25%.

The servers continue to use the SuperSPARC, but company officials say that upgrading to the UltraSPARC will be (literally) a snap, since the machine's existing processor MBus modules can be upgraded in a matter of minutes. Even with the SuperSPARC, which is now available at 60 MHz, a dual-processor SPARCserver 1000E can provide 3,999 SPECrate_int92 and 4,584 SPECrate_fp92. An eight-processor version scores 15,414 SPECrate_int92 and 17,113 in SPECrate_fp92.

Perhaps a more important measure of the machines' performance is transactions per section (TPS). TPS numbers are not yet available for the dual-processor SPARCserver, but Sun estimates that a 1000E with eight CPUs can perform 500 TPS.

The 2000E, meanwhile, with two or 20 CPUs, can perform 1,300 TPS. A 2000E with two CPUs, meanwhile, scores 4,282 in SPECrate_int92 and 4,952 in SPECrate_fp92. A 2000E with 20 processors, however, can hit 38,213 SPECrate_int92 and 44,722 SPECrate_fp92.

A 1000E with two CPUs, 64 MB of RAM, two 1-GB disks and a CD-ROM drive would be $54,300. The same machine with eight SPARCs, 256 MB of RAM, four 1-GB disks, a CD-ROM drive and a 4mm tape drive for backup would cost $176,350. A 2000E, meanwhile, with two CPUs, 64 MB of memory, a 5.8-GB disk drive, a CD-ROM drive and an 8mm tape backup would be $124,795. The same machine with 20 SPARCs, 640 MB of memory, a 5.8-GB disk, a CD-ROM drive and an 8mm tape drive would be $659,395.

SMCC also announced further developments in its clusters. This year, Sun declared that it would be pursuing a clustering option as one path to mainframe performance. With the proper software and networking, a Sun customer can link multiple 1000Es and/or 2000Es for certain tasks. The first clusters were meant expressly for file serving and network acceleration.

However, at that first introduction, Sun also displayed one of its many road maps, this one for clusters. The initial file server clusters were to be joined by database-serving clusters in the near future, while compute-serving clusters were to show up somewhat later.

Sun officials now waffle on the need for compute clusters, but clusters acting as dedicated database engines have shown up right on time. In September, SMCC introduced the SPARCcluster PDB Server, a cluster optimized for database tasks.

SMCC says that clustered systems are a natural for database tasks. By nature, database searches and updates are easily broken up among multiple processors, so parallelism is effective and easy. Moreover, a cluster can grow with the needs and resources of the customers—starting with two boxes and then growing with an addi-

Clusters of SMCC servers can provide mainframe-style computing at microcomputer prices. Sun hopes these clusters will continue its push into corporate MIS.

The SPARCserver 1000E is designed for divisions of larger companies that need local computing without significant investments in space and resources.

Proven, high-performance storage, and backup solutions.

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While other companies were talking Terabytes, Cranel was installing them. Our Network Optical File Server (NOFS®) is a proven 5.25" high-performance Terabyte solution. A self-contained optical server featuring *Hewlett-Packard* optical drives and media, NOFS provides on-line storage from 20 GB to 5.4 TB, compatible with any network protocol. An on-line directory and high-speed magnetic disk cache minimize the number of swaps in the autochanger. Plus, the cache optimizes multi-task, multi-user access while assuring recently accessed data resides on magnetic disk for fast access. The use of *Hewlett-Packard* optical products in our NOFS solution ensures outstanding reliability and performance.

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Cranel's Network Tape File Server (NTFS™) combines the proven data management hardware and software used in our Network Optical File Server with a high-capacity tape library to provide a fully self-contained Terabyte tape solution. NTFS uses an innovative tape format that provides fast data transfer (2 MB/sec) and a low cost per gigabyte without compromising data integrity. Each cartridge is capable of holding up to 18 GB of data so a single tape library has a capacity of up to 10.8 TB, making NTFS an ideal solution for data backup or archiving in storage-intensive applications.

Storage Management Software

Selecting the right storage system software can improve file management, reduce access times, and eliminate conflicts with application software. For optical and tape autochangers, Cranel recommends Advanced Archival Products' AMASS software. AMASS follows open system design principles and adheres to filesystem interface standards. It provides unlimited filesystem size and can provide direct file access on autochangers of any size. Transparent to both applications and network protocols, AMASS is used to support applications under TCP/IP, NFS, RFS, NetWare, DECnet, Appleshare, LAN Manager and others.

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tional node each time the customer buys a new system.

At the moment, up to eight node clusters can be linked for a total of 160 processors. This yields a distributed system with storage in excess of 7 TB.

Initially, the clusters will support the Oracle database from Oracle Corp., as Sun and Oracle have discovered an increasing affinity for each other. However, a Sybase Inc. version of the database is already planned.

At the moment, the cluster's nodes are linked via standard TCP/IP-based networking. However, in time, SMCC plans to move to a higher performance solution. The company has developed a switching technology called the Redundant Fiber Switch, which will provide a 50-MB connection between nodes. The Switch is expected to be available in late 1995.

Sun Scores Server Successes

The SPARCclusters designed for database applications come into a market where Sun is already winning its laurels. According to a recently released study by market research firm International Data Corp., Sun's servers are the leading brand of UNIX machine being used for RDBMS applications.

According to the survey, 27.2% of the UNIX database server market is owned by SMCC. IBM Corp., the commercial system maker par excellence, trails at 19.6%. Moreover, according to IDC, the total market for UNIX database servers grew by 44% in the past year. Sun says its own business in that market has increased by 58%.

All of this is excellent news for Sun, which is pushing hard to enter the lucrative back-office systems business. In fact, Sun's fortunes actually seem to have improved since it dropped its ill-fated attempt to put Sun systems on desktops and instead promoted a strategy in which PC clients are supported by Sun servers. MIS officers seem delighted to have an alternative to NT for server software.

However, this success raises some questions for Sun's traditional users in the scientific and technical markets. Increasingly, some of these users wonder if their needs and requirements are being met.

Sun Plugs Into PCs, Invests in Internet

In further announcements, Sun has introduced SPARCstation variants expressly designed to manage PC LANs and to provide business with an easy path to the Internet. Called the Netra series, the new systems have two missions and two models–the Netra System Management Server and the Netra Internet Server.

The first system is a device designed to ride hard on PCs. It represents a significant shift in direction for Sun itself; in the late 1980s, some observers thought that UNIX might have a chance to displace DOS as *the* operating system on the commercial desktop. It made sense at the time. DOS was showing its age and was simply too limited to support the 32-bit chips and graphical interfaces that were increasingly the norm.

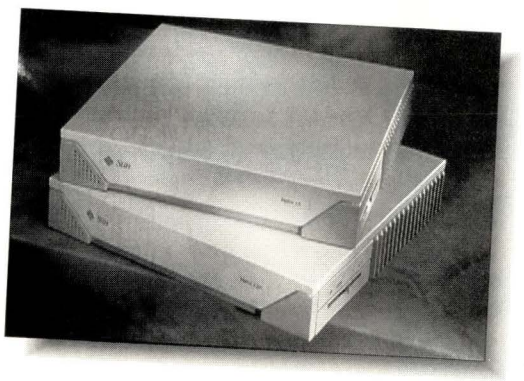
At the time, Sun was one of the industry's most ardent proponents of desktop UNIX. Indeed, Sun originally allowed other vendors to license its operating systems and hardware architectures because it assumed that other computer makers would produce low-cost SPARC-based personal systems to compete with Intel Corp. chip-based platforms.

However, commercial users stuck to DOS, rejecting not only UNIX, but even IBM's OS/2. Windows, which had originally been intended only to tide users over until OS/2 was ready, emerged as one of the great success stories in modern computing. Meanwhile, desktop, commercial and personal UNIX remains as far away as ever.

Until late this year, Sun seemed as devoted as ever to developing desktop UNIX. In reality, however, the company was quietly adopting a very different position. It had long ago come to terms with Windows' popularity. Sun had actually come to see PCs as an opportunity–for something had to manage those PCs on their unruly LANs.

That something was often a workstation, Now, Sun has introduced a workstation for that express purpose: the Netra System Management Server. The Management Server is a SPARCstation bundled with SolarNet PC administration software and other network administration tools; it is essentially a plug-and-play PC LAN man-

Sensing a major business opportunity in the Internet, Sun has introduced a new line of dedicated Internet-access systems, called the Netra Internet Servers. These machines are specially configured SPARCstations designed to give small (and large) organizations a quick and easy way to attach to and use the Internet.



PCs are the client of choice on most corporate desktops, but managing those systems can be troublesome. For that reason, Sun has introduced the Netra Systems Management servers, which are SPARCstations specifically configured to administer PC LANs.

agement box. The product goes into the same market as a high-end Compaq Computer Corp. PC configured as a Novell Inc. LAN server–except that the Management Server has the performance advantages of a RISC processor. The workstation is also designed to coexist with Novell Inc.'s NetWare and Microsoft Corp.'s Windows for Workgroups.

Presumably, the Management Server could also coexist with servers running Windows NT. However, Sun clearly intends the Netras to be a fierce competitor of NTs. Netras are exactly the sorts of servers that NT was supposed to run on.

There are two Netra models. The Netra s5–essentially a modified SPARCstation 5–is based on a 70- or 85-MHz microSPARC II. It has 24 KB of on-chip cache, a base memory of 32 MB (up to 256 MB), an internal disk capacity of 1 to 2.1 GB, an external disk capacity of 29 KB and three SBus slots. Pricing begins at $10,399.

The Netra s20 is based on the SPARCstation 20. It comes with one to four 50- to 60-MHz SuperSPARC processors, 36 KB (up to 1 MB) of cache, 32 MB of base memory (up to 512 MB), 1 to 2.1 GB of internal disk, up to 37 GB of external disk and four SBus slots. Pricing begins at $18,299.

But Netras come in two flavors–the other flavor is an Internet server. While desktop PCs were emerging as the dominant client, their users were discovering the joys of the Net. And while the commercial user may not have seen any particular advantage to UNIX, the benefits that came with it–like email, newsgroups, gopher and the World Wide Web–were another story entirely.

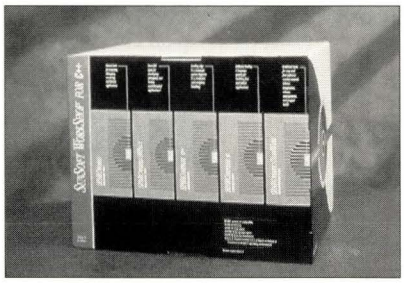
Sun has apparently kept its potential customers in mind with the Netra Internet Server. Again, residing at the center of a PC LAN, the Internet Server acts as the clients' Net connection. It comes with the same administration tools as the other Netras, plus configuration utilities, security software, an email gateway and file transfer facilities.

The Internet Server also has two models–one based on the SPARCstation 5, the other on the SPARCstation 20. The former is the Netra i5, which comes with one 70- to 85-MHz microSPARC II, 24 KB of on-chip cache, 16 MB of memory (expandable to 256 MB), up to 2.1 GB of internal disk, up to 56 GB of external disk and three SBus slots. Pricing on the i5 begins at $6,149.

The latter is the Netra i20. The i20 has one to four 60-MHz SuperSPARC processors, 36 KB of on-chip cache (expandable to 1 MB), 32 MB of memory (expandable to 512 MB), 1 to 2.1 GB of internal disk, up to 138 GB of external disk and four SBus slots. Pricing begins at $8,499.

SunSoft Upgrades Workshop

SunSoft, the Sun planet responsible for software, has introduced an enhanced version of WorkShop, an integrated tool kit for software developers. The new version includes an upgrade of the product's C++ language facility. It now supports templates and exception handling, as well as a rapid header processing system for accelerating C++ compilation.



New and improved, SunSoft's WorkShop is poised to take on still more of the developer tools market. Whether this is good or bad news depends greatly on whether or not you're competing against WorkShop.

WorkShop comes in C and FORTRAN versions. The FORTRAN version now features a variety of tools for debugging and development. It has, for instance, a Global Program Checking facility that scans source code to detect programming errors that might escape detection prior to compilation. It now also has POSIX.9 bindings to allow developers to incorporate their FORTRAN code with UNIX-oriented interfaces.

SunSoft has also enhanced iMPact, a software tool designed to assist developers in the production of multiprocessing and multithreaded applications. Although part of WorkShop, iMPact is a separate product and has been announced as iMpact 2.0. The new release features Thread Analyzer, which collects performance information for multithreaded applications at runtime, and LockLint, which analyzes ANSI C source code during compilation and compares the results to the developer's design assumptions.

Also featured is LoopTool, which analyzes and tunes parallel programs by collecting runtime performance information. And iMPact 2.0 contains features meant to make FORTRAN multiprocessor coding easier.

WorkShop is now available for SunOS as well as Solaris users, and is also supported on Hewlett-Packard Co. platforms. Says David Spenhoff, SunSoft's manager of product marketing for developer products, "Today's developers are working in a heterogeneous platform environment, and they insist on homogeneous development tools to support that heterogeneous environment."

Finally, WorkShop now integrates with Xemacs, the X Window version of the emacs editor. "We have included tight integration with Xemacs," says Geoff Fitch, senior product manager for SunSoft developer products, "for customers who are using it–and that's a significant proportion of our customer base."

Prices for SunSoft Workshop 1.1 for C, C++ and FORTRAN are $2,995, $2,195 and $3,195, respectively. iMpact, if purchased separately, is $995.

WorkShop's current location may be somewhat confusing. First, it has recently changed its address. When it was introduced last January, it was a product of SunPro, which was in turn a division of Sun Technology. Now, Sun Technology is no more, and SunPro (like much of the rest of Sun Technology) has been absorbed by the energetic and expansive SunSoft.

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SunSoft, formerly SunPro, employees say that the transition from one home to another was uneventful. "It's been pretty smooth," says Spenhoff. "It happened in the middle of our six-month product cycle. Yet we reorganized ourselves and still got our product out. I think that's a pretty good indication of how smoothly it went."

Less smooth is SunSoft's relationship with the companies that sell competing products. A year ago, many of these companies were not competitors, and some, in fact, thought of Sun as an ally. WorkShop's surprise release in January was a shock to them. "It was a sneak attack," said one vendor who asked not to be named. "It was Pearl Harbor."

In fact, the third-party vendors of development tools have actually united as a trade group expressly to "increase customer awareness" of products other than SunSoft's. Called the Coalition for Software Productivity Through Open Systems, the group includes such development heavyweights as Alsys Inc., in Burlington, MA; Atria Software Inc., in Natick, MA; Case-Ware Inc., in Irvine, CA; CenterLine Software Inc., in Cambridge, MA; Expersoft Corp., in San Diego, CA; Integrated Computer Solutions Inc., in Cambridge, MA; Imperial Software Technology, in Berkshire, UK; and IXI Ltd., in Cambridge, UK. (See "Soft-ware Coalition: Anti-Sun Front?" *SunExpert*, September 1994, Page 12.)

It was the opinion of at least some coalition members that SunSoft had a large and unfair advantage over competing companies. In fact, some industry insiders, notably Pure Software Inc.'s chief executive officer, Reed Hastings, argue that control of the compiler is of strategic importance to any hardware, and therefore any ISV that offers a compiler-based development product gets dangerously close to a hardware vendor's strategic interests. Many of these ISVs do not survive.

This interpretation of events was further confirmed when SunSoft announced a generous trade-in program for owners of competing products. The trade-in program continues with the enhanced WorkShop.

SunSoft insists that it is not trying to do away with third parties. "We value each of those companies," says Spenhoff. He notes as well, "I know for a fact that members of the coalition are still members of our core ISV catalyst programs. They are getting help from us in multithreading and other areas."

Spenhoff also hurries to reassure ISVs that there is "plenty of room" for makers of software development tools. But he also has words of caution. "There are people who are ISVs, and who are in [the software development tools market], and they are thriving," he says. "And they are thriving because they are innovating."

Sun Goes by the Numbers

Sun Microsystems Inc. has just announced its fourth-quarter numbers. Its fourth-quarter revenues were $1.40 billion, up from the $1.26 billion reported for the corresponding period a year ago. Also in the fourth quarter, Sun reported record net income of $77.9 million, or $0.82 per share. This compares with $76.1 million, or $0.72 per share for the corresponding period last year.

For the fiscal year, Sun posted record revenues of $4.69 billion, up from $4.31 billion in fiscal 1993. Net income for the entire year was at an all-time high of $195.8 million, up from $156.7 million the previous year. Earnings per share rose to a record $2.02, compared with $1.49 for the prior fiscal year.

And, just in case you're curious, Sun also says that it shipped 82,000 systems and SunSoft distributed 111,000 Solaris/UNIX licenses.

This Just In...

• Sun and *pc-plus INFOMATIK*, a Munich-based communications technology vendor, have announced a joint marketing agreement. Under this agreement, the two companies will make pc-plus' National Directory Inquiry System (NDIS) directory assistance database product available on SPARCstations and servers. The pc-plus product allows phone companies and telecommunications and cable service providers to field directory assistance applications in a distributed computing environment.

• *SITE* is about to expand. Internet junkies already know that SITE is Sun's sponsored Internet database. The database provides up to 140,000 users a day with "everything from public domain software to cooking recipes." Currently, there is a SITE site at the University of North Carolina at Chapel Hill. Now there will also be SITE databases at Imperial College, London; Science University, Tokyo; and Moscow State University. Another SITE server is scheduled to go into operation at the University of Witwatersrand, South Africa, sometime in the near future.

• Sun and *Mosaic Communications Corp.*, in Mountain View, CA, have announced plans to collaborate on new security technologies for Net-based commerce. Sun has already announced that it will include a coupon for a discount on Mosaic's server software and network navigator with its Netra products.

• In more Internet news, Sun has arranged with the Israeli software developer *Checkpoint Software Technologies Inc.* to offer FireWall-1 security software with its systems. FireWall-1 is designed to protect against unwanted computer system entries.

• In what could be a dramatic development, Sun and *Amdahl Corp.*, in Sunnyvale, CA, have announced that they have jointly developed a new product, A+Editor, for Solaris Enterprise Server. A+Editor will enhance throughput and scalability on large microprocessor SPARC systems. Sun and the mainframe maker have had a close relationship since the mid-1980s, and the two companies have recently agreed to joint R&D efforts.

• *Apex Computer Co. Inc.*, in Redmond, WA, a fourth-party provider of parts, training and repair service for a variety of systems, including Suns, has been purchased by *Cerplex Group Inc.*, in Anaheim, CA. Clint Morse will continued as president of Apex, which will now be a wholly owned subsidiary of Cerplex. ⊸

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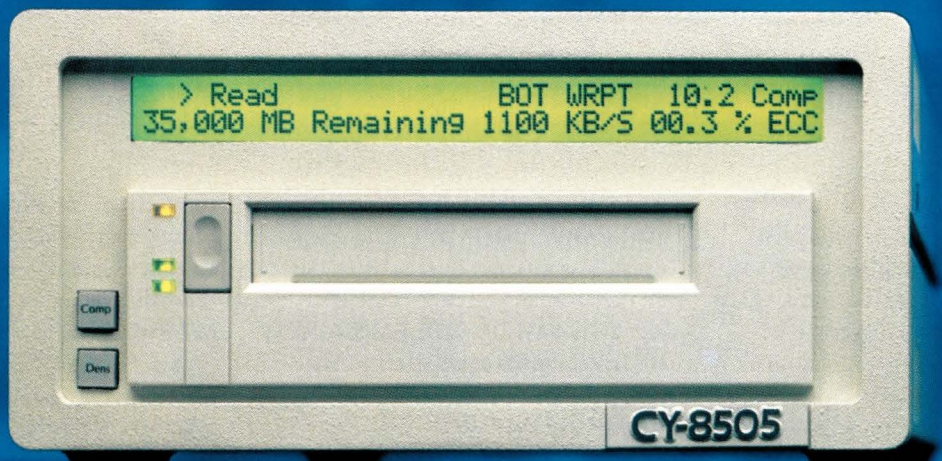

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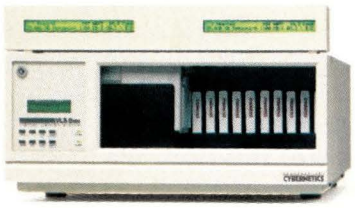

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Basic-4	IBM RISC/6000	PC 386/ix	Ultimate
Concurrent	IBM RT	PC MS-DOS	Wang
Convergent	IBM S/38	PC Xenix/Unix	Windows NT
Data General	ICL	Pertec	*— and more*
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Circle No. 9 on Inquiry Card

by MICHAEL O'BRIEN

Ah. Yes. They're called marker switches for a reason. Play with the lower rotation.

"I should never have left my library unchecked for so long!"

–Atrus

"Remember, dear brother, take only one page."

–Sirrus

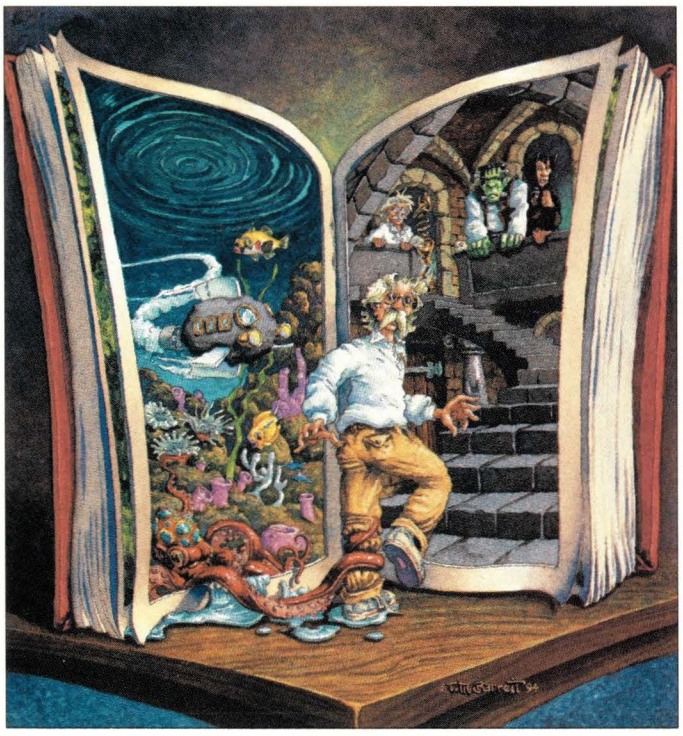
"Hee hee hee hee hee hee!"

–Achenar

Mr. Protocol and the House of Atrus

Q: Oh. My. HEAVENS! I've *never* seen anything like this. This place is *gorgeous!* Where in the world are we? And what's going on? And where *is* everybody?

A: You are feeling confused, no doubt, because you opened the wrong book. You are in the Stoneship Age, and that is the underwater view from this not-quite-a-ship we're in. Lovely blue light, isn't it? I enjoy spending an idle hour down here from time to time. It's so peaceful, and the view is unparalleled. You will find Mr. Protocol looking through the telescope at the top of the island, waiting for anyone else who might happen to see the lighthouse to swim on over and join us. So far, we haven't seen anybody. But meanwhile, let me call your attention to this wooden table over here. Just rap on the surface once, and...



There. Now, open the book.

Ah. Lovely ceiling, isn't it? We're now at the starting point of our discourse this month, which concerns itself with new ideas. We have left the Stoneship Era and are now back on the island of Myst.

I see you're confused. You believe that either Mr. Protocol is wasting your time with games when he could be doing something useful, or else has gone even further over the edge than usual. It is thus my duty to grab you by the earlobes and yell, "YO! WAKE UP AND SMELL THE EARL GREY! WHERE DO YOU THINK THE BIG MONEY IS GOING TO COME FROM?"

Now you've got it. They aren't talking about 500 channels of interactive television for no reason. And, as it happens, Mr. Protocol has undergone an epiphany of sorts. Unfortunately, like most such experiences, it's a difficult one to communicate, especially when it concerns the limitations of this form of communication: the printed page. Well, not so much limitations, as vast differences. And to put those differences in perspective, some history is, as usual, in order.

Mr. Protocol does not, in general, play computer games. There's a very solid reason for this, and it is not because he has sacrificed his sense of fun on the altar of adulthood, like a lot of the useless, blinder-wearing fuds one finds grotting around in the corners of the Internet. No, it's because Mr. Protocol was converted early. He grew up on the Plato computer-based education system, which he has always regarded as the best of a bad lot in that arena, but also coincidentally the finest gaming system ever devised by the mind of man: six hundred simultaneous graphics terminals connected to a CDC Cyber mainframe, with an authoring language that could be (demonstrably) learned by dolts. Those who were not dolts often devised games. Some of these games were very, very good. So good that Mr. P. has seldom been tempted since.

That is, until he ran across *Myst*.

Myst is a game. It also points the way toward a new order of the world.

TOM BARRETT

In much of the 20th century's finest literature and film, the plot and setting of the story become evident only as the action progresses. Sergio Leone was a master of this, as is Gene Wolfe. We discover the true situation of the story only as the author gradually reveals it to us, almost as an incidental side effect of the action described. Yet, as in all literature, we make these discoveries at a pace and in a manner prescribed by the author. Art does not imitate life here. There are some situations in life where we determine the pace at which we explore a new scenario. (Romances and vacations constitute two situations in which this is the ideal, if seldom the reality.)

While literature has been moving toward allowing the reader (or viewer) to discover the nature of the story from context, entertainment in general has been moving toward increasing the vividness with which the story is presented. Storytellers were the first entertainers, and they are, thank heavens, still around. Words on a page extended the storytellers' range. Actors on a stage were the next step in evolution.

Matters stood thus until this century. The invention of motion pictures brought about a revolution in entertainment whose depth we cannot conceive today. Think back to the earliest days, when motion pictures were presented on makeshift screens by itinerant vaudeville impresarios, and were just one crowd-pleaser among many.

One of the very first such films showed, in black and white, a steam locomotive apparently bearing down on the audience. Now, to be fair, the grainy, scratchy, blotchy and faded black and white prints we see today were not typical of what the audiences of the time saw. A recent program displaying long-hidden work prints of Charlie Chaplin shows that the films of the time were just as clear as black-and-white films of today. The frame rate was not all that might be desired, but still, the pictures were stable, clear and good. They all lacked sound, of course. But the totally new experience of seeing through an apparent window to real, moving objects was too much for audiences of the day. As the locomotive drew closer, audience members bolted for the door, and one man rose and screamed, "Run for it, boys! She's going to hit!"

The next evolutionary leap that Mr. Protocol wishes to blow out of proportion is the 1933 film *Frankenstein*. Although Boris Karloff's portrayal of Frankenstein's monster is now one of the best-known of all cultural icons (it is doubtful if Sherlock Holmes is better known around the world), it must be remembered that at the time, no one had ever seen a figure like the monster, in a movie or anywhere else. Karloff's monster entered the racial unconscious because people ran screaming from the theater. These weren't quaint people of another age, either. These were people just like us. The impact of the monster's face–which we now take for granted–was so immense not because it represented something with which people weren't familiar (horror novels, including *Frankenstein,* had been around for centuries) but because the monster's presence had a degree of vividness totally unfamiliar to the audience. The subject was not new. The realism was.

There are some situations in life where we determine the pace at which we explore a new scenario.

Mr. Protocol now turns to a subject that has engendered far more heat than light. When the Excess Hype of the Decade awards are handed out, Mr. P. feels that virtual reality will win in a walk. No matter how realistic it may be, VR is fundamentally sterile. One can wander around in a static environment, perhaps even manipulating objects, receiving tactile feedback through special gloves. Big, as they say, whoop. So what? I can wander through my house, crossing rooms diagonally, picking up and putting down small, loose objects. I can do this 'til four in the morning, and the only thing it means is that it's time to see my shrink again. The only excitement in this kind of virtual reality is that it is virtual. I'm sure you'll join with me in the chorus: "So what?"

Mr. Protocol is glad you asked.

Good books are good precisely because they involve the reader. Good movies and good television (no, this is not an oxymoron, merely a rarity) are good because they make the viewer forget that he or she is watching a screen. Readers and audience are mentally and emotionally active while working through the story *du jour*. However, they are still marching to the author's route and pace. Life is not like that. In reality, we do our own observing and ask our own questions.

It is Mr. Protocol's contention that fitful starts are being made toward an art form that encompasses this–and the medium of this form, currently, is the computer game.

Modern computer games come in two main varieties. The first hasn't really changed since the days of *Lunar Lander*. You control some type of vessel, and in real time, you (usually) attempt to shoot things that, if encountered in real life, would easily destroy anything between the size of a city and the size of a planet. Well, old art forms generally don't die. So much for this sort of thing. It'll be around forever.

The next kind of game is the one that was first invented in the game *Adventure*. Here, the players wander around at their own pace, choosing their own path, attempting to solve a variety of puzzles to progress in the game. In *Adventure*, of course, as well as its successors, *Zork*, *Haunt* and the like, the puzzles are the whole point. Without the puzzles there is no game. The appeal of this sort of thing was strong, but only to a limited audience that enjoys this sort of puzzle-solving.

The next stage of evolution was to add a plot. This has developed into a rather interesting subgenre. Some

sorts of plots lend themselves better to puzzle games than others. Mysteries are very popular, but the action-adventure genre also has its adherents. *Indiana Jones and the Temple of Atlantis*, for example, is much like watching a new Indiana Jones film–although a peculiar one, because everyone in it is a cartoon figure, and because you have to keep figuring out more puzzles to move things along. There are limits to this sort of thing, and they're hit pretty quickly. Yes, you can wander around, but there's only one place you can wander that will do any good at advancing the plot. The rest of the locations are sterile as deserts, at least until you figure out what to do next.

Enter *Myst*.

If you've read anything about *Myst* in the popular press, it's probably about how it's vastly entertaining, addictive, fascinating, gorgeous, yaddah, yaddah, yaddah. It's all true, at least for some people, but that's not the point. The point is that something different is going on here, something that has gotten not only the attention, but also the active, long-term involvement of a LOT of people. Mr. Protocol has spent considerable time trying to figure out what that something is, and he has a few clues, he thinks.

Myst is enthralling because it is integrated, seamless and vividly realistic. This isn't a cartoon, unless we're talking *Snow White*. *Myst* is a cross between a movie and a painting. And it is subtle. Oh, great heavens, it is subtle. It begins, not as a game begins, but as a novel or a movie begins: slowly, with no instructions and no explanations. You are there. It is up to you to figure out where you are, what is going on, and what happened. The puzzles, such as they are, are like those of any strange environment. While games such as *The 7th Guest* stop the action dead to present you with the Eight Queens Problem (a show-stopping snorefest if ever there was one), *Myst* merely presents you with entire worlds. You may go anywhere, look at anything. Some things are fully realized merely because they are indicative, beautiful or both. In most games, the ability to look closely at a painting indicates that there is something to be gained by doing so, by manipulating the painting, removing it, etc. In *Myst*, the ability to look closely at a painting often means only that it is a beautiful painting, and that you may learn something about the person whose painting it is by their choice in art.

For as much as *Myst* is a game, it is a movie, or a novel. There is a story here, and it is not an incidental story line to frame the puzzles. The story is the point of the exercise, to discover the deeds and natures of the people who built and inhabited Myst and its surrounding worlds. And it is the fascination of that discovery, of the slow unraveling of events and characters, that is the whole point of *Myst*.

And that, Mr. Protocol thinks, is the point. This is not merely a game. As much as it is anything, it is art, and serious art at that.

To be sure, there are flaws. In order to establish such a perfectly realized

world, the creators of *Myst* found it necessary to write an entire novel (soon to be published by Disney) to contain the backstory. That story is straightforward in its conception and workings, and unless its author were a great stylist, it would not be an enthralling novel. However, as the plots of most movies are short stories, not novels, we should not be surprised if the story behind *Myst* is a simple one. The art lies in its working out.

Until recently, the longest-running stage show in Los Angeles was *Tamara*. *Tamara* was a play staged in an old American Legion hall...all over the hall. First floor, second floor, basement, even the parking lot. The play was performed by everyone in sight. The rules for the audience were simple: if an actor departed the room and left the door open, you could either follow that actor, or stay behind. The play opened in a large central atrium, then quickly fragmented into about seven or eight different plot lines. The plot was comprehensible on a single viewing, following any of the threads, but all of the action could not be seen without returning and seeing the play multiple times–which probably had something to do with the length of its run. *Tamara's* run was so long that the cast was changed three times.

This nonlinear form of theater (the uncharitable called it "theater in the runaround") could only be staged in a building like the American Legion hall. An ordinary theater could not possibly have contained it. As it was, it did seem strange and required comfortable shoes.

A certain type of children's book has appeared lately, involving a nonlinear story line. As decision points are reached, the reader chooses one path, and follows a page reference to a body of text where that plot line continues. Of course, because not all paths can be followed on a given reading, each reading results in a story about as long as a short story.

These are all attempts at interactive fiction, in which the reader is presented with one of several choices. What they all have in common is that they feel contrived. The plot has been tortured in service to the novelty of presentation, and real art suffers.

So, on the one hand, we are presented with games in which the player may wander at will but is presented with a sterile environment. Only one location will serve to advance the plot. On the other hand, we have a plot that moves right along, but which is interrupted by decision points that may or may not agree with the viewer or reader.

Myst points the way toward a new type of entertainment. It is a truly interactive entertainment in which the audience may move at will, but in which the plot is not distorted, nor sterile–there are things to be learned in all quarters. A complete traversal of all the worlds will lead the audience to understand who these people are, and what has happened. The worlds are barren, desolate, chilling in some aspects, enthralling in others, and wholly engrossing. They are fully realized to an extent that has never been achieved before. And, as no software has done thus far, they engender a

sense of wonder. Mr. Protocol feels very strongly that *Myst* is the first really worthwhile piece of interactive fiction ever created. It points the way, and Mr. Protocol is eager to see what good writers who follow that path will produce.

Imagine, if you will, a production of *Tamara* that is put on for an audience of one. You enter the hall alone, and see no one. You wander at will from room to room, and in each room, you find the remains of some mysterious activity. Actors appear, and you see scenes from the past reenacted for your benefit. At your own pace, and in your own way, you discover the nature and sequence of events.

Mr. Protocol thinks the next few years are going to be entertaining. Very entertaining indeed. ➸

Myst, *available on CD-ROM for the Macintosh and PC-compatibles, is distributed by Broderbund Software Inc.*

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@cpg.com.

An Invitation

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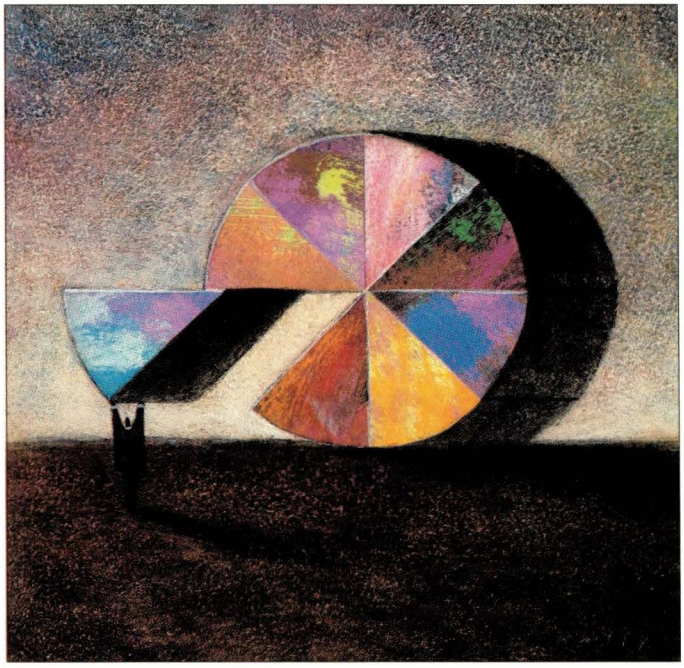
by PETER COLLINSON, Hillside Systems

Files

So, what's a file? Well, let's take another step back and ask: What's a disk? A disk is a magnetic surface used to store chunks of data called "sectors." A sector is usually 512 bytes. These sectors are actually laid out in concentric circles around the disk. The hardware accesses a particular sector by moving a "head" over the surface and waiting until the correct sector spins around to be under the head.

Usually, disks have more than one active surface, and the arm will contain a disk head per surface. The concentric circles of sectors form a "cylinder" up and down through the disk surfaces. Ideally, we want to concentrate all the data for one file in one cylinder so that we minimize movement of the disk heads. We would like to position the head on one cylinder and move data. This should avoid splitting data into 512-byte chunks and spraying it randomly over the disk.



GREG HALLY

Disks are connected to the CPU by a controller. The job of the controller is to manage several disks and to move data in memory to and from the disks' surface. The controller deals with complete sectors; disk hardware is told to find a particular sector and drag it all into memory or write a sector-size bit of memory out to a position on the disk. Once the disk controller has been told to move data, movement happens without any further intervention from the machine's CPU, using a mechanism called Direct Memory Access (DMA). The controller itself accesses memory to do this job and tells the CPU when the transfer is done.

The situation is usually better than the one I've described. A 512-byte sector is quite a small unit, and a controller can usually cope with requests to transfer several contiguous sectors. This is more efficient.

Back in the early days of the BSD systems, it was found that there was a huge performance improvement in making the kernel deal with pairs of sectors, by telling it that the disk was composed of 1,024-byte sectors. In general, this works because the head positioning time is reduced, and it's the head positioning that dominates the total transfer time.

At that time, there were indications that increasing the kernel block size would continue to improve disk performance. However, it's a trade-off between the space that is wasted on the disk and the speed of its operation. What's the average size of a file? How much disk would we waste if we raised the block size to 4,096 bytes? These are questions akin to "How long is a piece of string?"

When Kirk McKusick came around to redesigning the file system for 4.2BSD, he allowed the user to specify the basic size of the block that the kernel deals with, so file systems these days use kernel blocks of 4,096 or 8,192 bytes. However, he recognized that this would result in a lot of wasted disk. So the file mechanism also supports "fragments"–the basic block size can be subdivided into a fixed number of smaller chunks. Small files are stored in fragments; larger files in numbers of blocks. Some people think

this is overcomplicated. Perhaps these days we might be happy to dispense with the code that is needed to handle fragments. People who make disks would be happy. We'd need more space and would buy more disks.

Incidentally, McKusick also designed the file system to understand about cylinders and the need to keep all the data for one file in one cylinder if possible, or within several contiguous cylinders if not. This is all internal to the kernel and is invisible from the user's processes. I'll come back to this later.

UNIX and Disks

The UNIX model of a disk mostly ignores all this cylinder stuff. UNIX likes to think of a disk as an array of sectors, each with an address (its "sector number"). Perhaps we should talk of "blocks" of several physical sectors, each with a "block" number. This is a simple model that is portable to all disks irrespective of their physical attributes (their surfaces, tracks and sectors per track).

It's convenient to split the physical disk into sections called "partitions." This is done for two reasons.

First, we need somewhere on the disk that can be used to store images of processes that are swapped or paged out. This supports the ability of the system to do multiprocessing. Traditionally, this was a separate part of the disk because the kernel wanted to make swapping in and out as efficient as possible. It moved a contiguous chunk of memory on and off the disk using one controller request. This is less necessary in these days of paged systems but does allow the paging area to be managed by code that is less complex than that which manages the other partitions where the user files are stored.

The second reason for using partitions is related to systems administration. Each partition that is used for storing files contains a single "file system." All of these file systems are joined into a single tree by the `mount` system call. Files in a directory are constrained to be on the same partition as the directory itself, ignoring symbolic links for the moment. As a result, partitions allow the administration to deal with conveniently sized chunks of related data.

The reasons for choosing particular sizes have changed over the years. In the '80s, we made sure that partitions for user data would fit onto a small number of reel-to-reel tapes because we wanted to dump their data for security reasons. The `dump` program deals with one partition, writing its contents to backup media. Using 8mm videotape for dump devices obviated this need. We also tended to make sure that user partitions were the same size, so that we could move user files around machines conveniently.

When NFS came on the scene, the size of the root partition was reduced to contain only those files that are needed to boot the system. Also, the root partition contains those files that distinguish a particular machine. A small root partition could be resident on a local disk or stored remotely while taking up the minimum possible disk space dedicated to that particular machine. The remaining system files are in other partitions that are shared among all the machines on the network.

On my personal machines, I tend to minimize the number of partitions these days; they are as big as they can be. I try to separate my own files from those supplied by Sun. This makes it easier to upgrade my system. The last time I tried Sun's install process, it just failed, and I found myself pulling the old system back from tape. I was very glad that the damage was limited to system files and not my data.

I notice that my local university still uses partitions to control the tendency of some people to zealously fill up the disks to their maximum. Related users are placed in the same partition on their servers, allowing the natural process of peer pressure to restrain the greedy. System management by use of local vigilante groups was initiated by me in my previous existence as head of the UNIX Support Group at the university. I never believed in quotas and still don't. Quotas only work if the available disk space is greater than the product of the number of users and their quota size. This was never the case when I was running the systems. But as usual, I digress.

When NFS came onto the scene, the size of the root partition was reduced to contain only those files that are needed to boot the system.

Partitions

As I said earlier, each partition that holds files contains a file system–as we know, that's a tree structure composed of files. Files are referred to by "inodes," a data structure stored on the disk that describes the file. The inode does not contain the name of the file. Instead, names are stored in files called "directories." Each directory holds the names and inode numbers of all the files that it contains. The directory entry is simply a name and an inode number.

Each partition contains blocks, numbered from zero. In early UNIX systems, the partition was split into three sections. The first few blocks contained the system bootstrap code and the "superblock" that defined the file system size and a few other important things. This was followed by the inode table.

The size of the inode table was fixed by the file system building process with the number of inodes being computed by guesswork based on previous experience. The remainder of the partition stored the blocks that held the data for the files.

This was fine at the time of design, but as disk sizes grew, it became apparent that the disk heads were spending a lot of time moving from the data part of the disk to the inode table and back. Disk drives were approximately the size of washing machines, and you could see them rocking about when they were busy as if the towels had all got stuck on one side of the drum.

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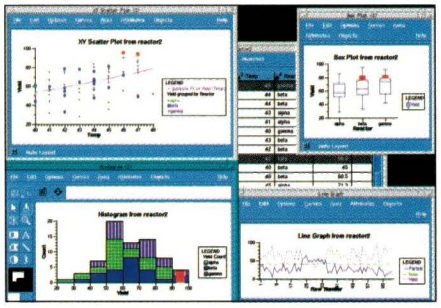

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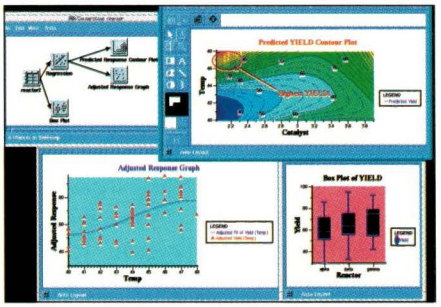

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McKusick improved on this structure by creating "cylinder groups" within the partition. To minimize head movement, the superblock, inode table and data block structure is replicated several times in one partition. Each replication forms a "cylinder group," or some disk cylinders that are physically close. The kernel tries to group all the information for a file in the same cylinder group. It also tries to keep related files in the same cylinder group, so a directory and the files it contains are close to one another. You can see this at work: Examine numbers of the inodes that are used in your root partition. You will find that directories and their contents have numerically close inode numbers, but the set of files in one directory will be spaced well away from others. Try

```
ls -i /
```

and

```
ls -i /etc
```

The replication of the superblock in each cylinder group may seem unnecessary, but it isn't. A real Achilles' heel of the old file system was the single superblock. It was too easy to lose it by overwriting by accident, either human-related (using `dd` on the partition) or hardware (the machine dying due to a power fail or closedown the very instant the superblock was being updated). When you lost the superblock, you lost the file system.

Replicating the superblock helps with this. In a dire emergency you can pick up a spare and get most (if not all) of your data back. It costs a little because it needs to be updated in several places. But I have been grateful for this procedure at least twice in my career as a UNIX hack, so I imagine there are several other grateful people out there in sysadmin land.

Files

Well, we can start to talk about files now. Files on UNIX are a series of bytes that are stored on disk. The inode holds the size of the file. This is important. Consider a one-byte file: When the kernel is asked to read the contents, it will be returned a 512-byte sector (actually a larger block) and will need to know that it must pass only one byte up to the user process that is reading the file.

The file is not written onto disk in a contiguous chunk. Its data is written into a list of blocks that can be placed anywhere in the data area of the disk. This is done for write flexibility. As a file grows, it accumulates blocks, and these blocks don't have to be pre-assigned.

It degrades read performance. To read the file, you have to dart about the disk following pointers to find the next actual block of data. There is a new file system design called the Log Structured File system, which is designed to optimize the file system for reading, not writing. It appeared to perform much more quickly than the McKusick design, but recent work by Margo Seltzer (and McKusick) has challenged this.

Pointers to the data blocks of the file are stored in the inode. It contains the addresses of the first 12 blocks of the file (SunOS 4.1). So to read a file, you pull the inode into memory and you now have the addresses of the blocks holding the first part of the file. Since you have to load the inode to access the file anyway, this is a "free" operation. The number of bytes that you can address depends on the file system block size. All the file systems on my machine have a block size of 8,192 bytes, so I can directly address files up to 98 KB in size. A scan of my file system (and a UNIX CD that was mounted at the time) shows that the average file size is 13,500 bytes and only 1% of my files are over 98 KB. I had a little under 77,000 files (about half of these were on the CD).

To address bigger files, the inode has pointers to "indirect" blocks. An indirect block contains addresses of the blocks that hold the data for the file. An indirect block can itself contain pointers to further indirect blocks. There are three indirect pointers in the inode. The first points to a single indirect block where only one indirect block is needed to find the address of the actual data. The second points to "double" indirect blocks (two indirect blocks are needed). And the third points to "triple," or three, indirect blocks where three extra blocks are needed to get to the data.

This "block" structure makes efficient use of the disk. There is no "housekeeping" penalty for small files, while you pay with some indirect blocks for larger ones. You don't pay a lot in speed. Disk blocks are cached in the kernel, and a sequential scan through a large file does not result in a huge amount of additional I/O to deal with the indirect blocks–they are likely to remain in memory until finished with.

Files with Holes

The structure also allows you to create files that contain "holes." To create a hole, you write some data, seek a long way up the file and then write some more. The hole costs no disk space; it's just a bunch of missing pointers. If a program reads from this empty space, it is returned zero filled data. This makes the hole invisible to user processes, so if you use `cp` to copy the file, then the copy will actually have zero filled blocks of data.

You can see this at work if you create a core dump for a program. This "correctly" saves the address space of the process and will create a file with a huge hole that is the gap between the process execution stack and the rest of the information.

```
$ cat
^\Quit (core dumped)
$ ls -s core
  88 core
$ ls -l core
-rw-r--r-- 1 pc 8430000 Sep 11 14:38 core
$ cp core c
$ ls -s c
8248 c
```

Here I've started the `cat` program and typed Shift-Control-\ to get a core file. The `-s` flag to the `ls` program shows you the size that the file occupies in 1-KB blocks. Using the command on the core file shows that it occupies 88 KB even though it is sized at 8 MB. Now, I copy the file to `c`. The new file occupies 8 MB of disk space. So, it's not a

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good idea to copy core images; they will fill your disks. If you want to place a core file somewhere not in the current directory, you can create a symbolic link called `core` in the current directory that points to the place where you want to drop the core file.

Creating files with holes is mostly of use in programs that maintain databases. They can have a large "address space" in the file while only occupying a small amount of actual disk space. An example of this are the storage files created by programs that use the `dbm` database routines. As we have seen, copying these files with the standard utilities makes them "grow" to occupy a large amount of space that contains nothing but zero. If you move files like these, it's a good idea to re-create the database from scratch.

Free Block Management

Using pointers to blocks in files means that there is a problem in managing the free list of blocks on the disk. The early UNIX systems were not too good at this. They maintained the free list using a linked list approach. This was carefully arranged in optimum access order when you built the file system, but quickly degraded so that files could be scattered all over the place.

When Kirk McKusick designed the file system we use today, he had an opportunity to improve on this. The file system now has more information about all the free blocks on the disk. The code is in a position to make intelligent choices about which free block it should use next when creating a file.

When choosing where to write a file's next data block, the routines try to place the block in the cylinder group where the last block was written. The problem with locating all the data blocks in the same cylinder group is that a few big files will soon fill it up. Filling up a cylinder group is a bad idea because allocations for other files in the cylinder group cannot take place. Cylinder groups should never become completely full.

To avoid this, the allocation routines will hop to another cylinder group when 1 MB of the current file has been written. A sizable chunk of data is now available to the program before a long head movement must take place.

Having selected the block it would *like* to use, the allocation code now tries to get hold of that block. If it's in use, the routines will use the next block that is "rotationally close" to the requested block on the same cylinder. This takes into account various factors of the disk's rotational speed and the speed of the CPU, and computes a block address that will appear under the heads at the time of the next request. The relative placement of optimum blocks is computed at file system build time and placed in a lookup table in the file system superblock.

All this rotational stuff has probably been superseded by technological advances. Some modern disk controllers cache a whole track from the disk in RAM, and so access to blocks does not depend on the rotational speed of the disk.

If the code cannot find a suitable block in the same cylinder group, then a new cylinder group is chosen. If this has no free space, the system does an exhaustive search of all groups.

This mechanism delivers the optimum placement of files, close to their inode table and parent directory, as long as there is space in the appropriate cylinder group. In an attempt to stop this optimization from failing, the file system is declared to be full when 90% of the total space is filled. At this point, mortals are told that the file system is full and are prevented from writing into the file system. The superuser can continue to write until the `df` program shows the file system to be 110% full.

The superuser should really remove those files that were written after the 100% mark–those files are sitting in places that break the optimum behavior of the allocation mechanisms. Frankly, I doubt that people do this except by accident while applying last-in, first-out policies to reduce disk usage. After all, it's hard to know which files are offenders.

Further Reading

Yet again, I have resorted to examining *The Design and Implementation of the 4.3BSD UNIX Operating System*, by Sam Leffler, Kirk McKusick, Mike Karels and John Quarterman. It's published by Addison-Wesley Publishing Co. and is ISBN 0-201-06196-1. ⊸

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

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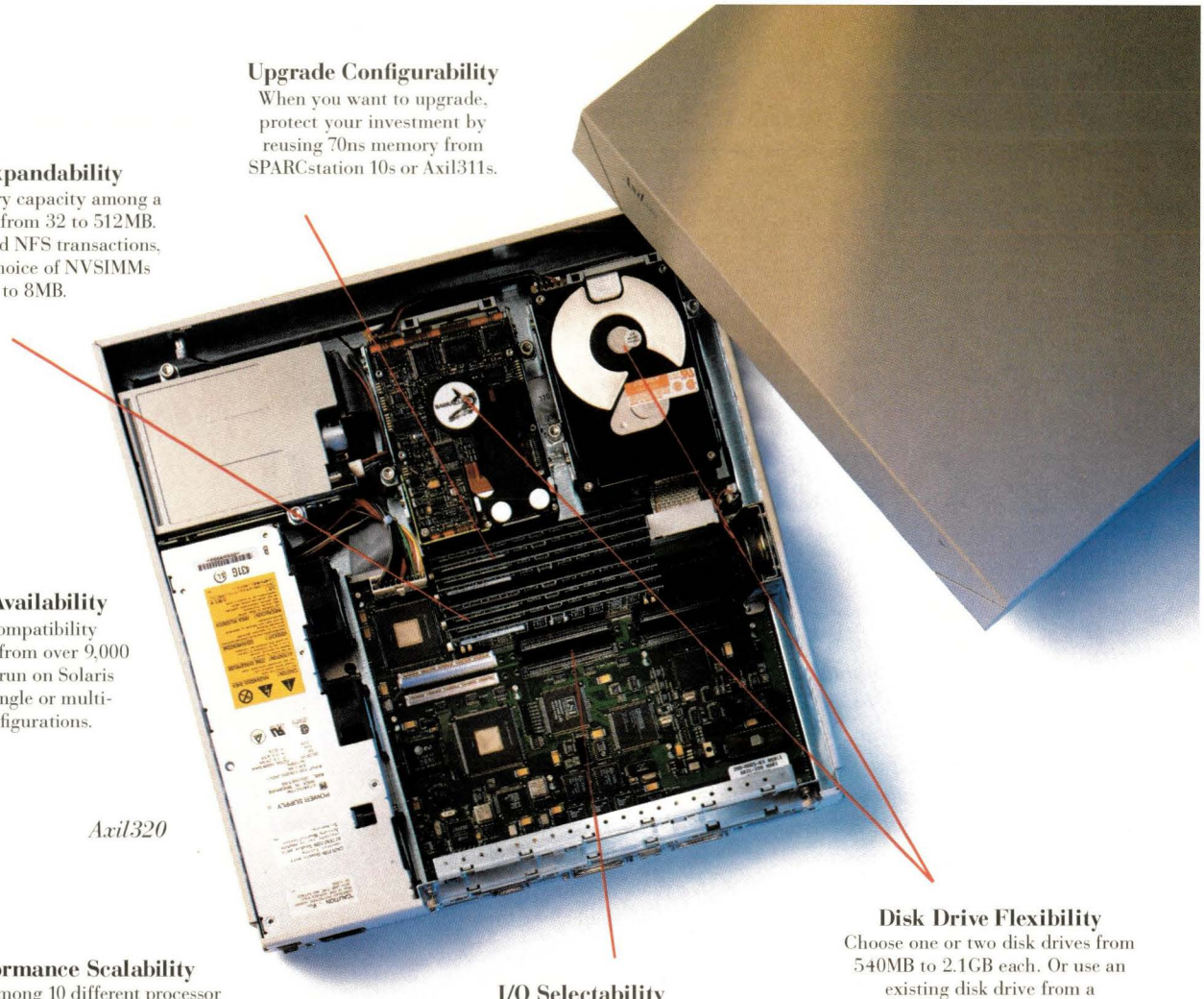

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by RICHARD MORIN, Technical Editor

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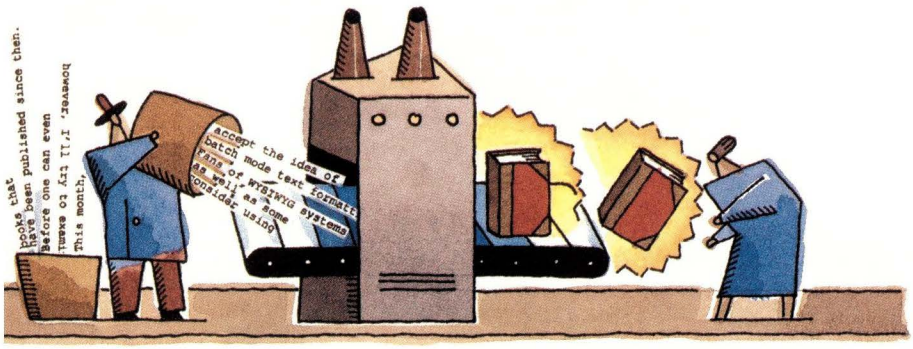
Preface, *The TeXbook*, by Donald E. Knuth (Addison-Wesley Publishing Co., 1986, ISBN 0-201-13448-9)

I like that quote quite a lot, so I feel very little guilt in using it again. Besides, it's been a little over a year since I wrote "Tangled up in TeX" (*SunExpert*, October 1993, Page 42), and some of your fellow readers may have forgotten it by now.

A lot can happen in a year. In the case of TeX, more than a dozen new books have emerged, expanding the available library by about 50%. The previous column covered most of the books available at that time.

Next month's column will address some books that were overlooked last year, as well as books that have been published since then. This month, however, I'll try to examine the allure of TeX, which seems to mystify both WYSIWYG fans and troff devotees.



Why Use Batch Formatting?

Before one can even consider using TeX, one must accept the idea of batch mode text formatting. Fans of WYSIWYG systems point to advantages like instant feedback and rapid editing. Why, they ask, would you want to give up all this for a batch mode system that uses a plethora of arcane formatting commands?

Well, there are several reasons. First, what you see in WYSIWYG frequently *isn't* what you'll get. The displays on today's workstations typically have resolutions of about 70 to 100 dots per inch (dpi). Laser printers, in contrast, range from 300 to 1,200 dpi, and phototypesetters can do better than 2,000 dpi.

There is no way to display full-page images in anything like their true resolution on a typical workstation screen. Consequently, WYSIWYG systems use lower-density fonts, loosely approximating the appearance of the final document. It isn't all that easy to spot incorrect fonts, let alone kerning problems, on such a display.

Next, as Brian Kernighan commented, what you see may be *all* you'll get. WYSIWYG document preparation systems tend to be limited in their formatting and data preparation options. UNIX users commonly string together arbitrary sets of filters and scripts to achieve desired results. Batch systems allow this; WYSIWYG systems typically do not.

There is also no guarantee that what you see will be what your editor gets. A while back, I was exchanging Microsoft Word documents between a Mac and a PC. Even after we empirically (and somewhat painfully) determined a viable way to exchange Word's binary files via electronic mail, the results were not consistent on the two systems. I was forced to do a tremendous amount of hand-editing to reconcile the versions. The clean ASCII files used by batch systems are easy to

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mail, don't require any special handling, and produce consistent results.

Finally, what you see may distract you from what you actually need. By emphasizing the document's appearance, WYSIWYG systems encourage writers to spend time making things look "pretty." Leslie Lamport observes: "As you are writing your document, you should be concerned with its logical structure, not its visual appearance." The abstract formatting commands and raw ASCII presentation used by LaTeX and troff encourage writers to spend time on the text itself.

My text editing style, borrowed from my late friend Jim Joyce, takes advantage of the separation between raw and formatted versions. As I write, I break to a new line at the end of each sentence. If a sentence is too long for a line, I break it into phrases. This allows me to see the logical structure of the text clearly and also facilitates moving around sentences and phrases.

As a side effect, the separation of edited text from formatted output improves my ability to catch errors. Like most writers, I am frequently blind to my own errors, seeing only what I *intended* to say. By presenting the text in a radically different form, batch formatting systems allow me to see a "fresh" document.

The question of "arcane formatting commands" is a bit misleading, by the way. WYSIWYG systems have their share of arcana; they just make it invisible. Having typed any number of Control-Alt-Meta-Splat key sequences into Word, I can attest to the fact that there are plenty of arcane commands involved. The invisibility looks nice on the screen, but it hides important details and makes it difficult to remember how to achieve a desired effect. On balance, I prefer to see what is being requested, and how.

Why Use TeX?

Assuming that you're going to use a batch formatting system, why would you want to use TeX? After all, troff comes as part of UNIX; why get a separate system? There are several reasons, including documentation, support, flexibility, innovation, portability and acceptance.

There is very little useful documentation for troff. I know of only four books on troff and related packages. The most recent of these is nearly five years old. Add in some manual pages and an occasional article, and you have the entire available literature. TeX, in contrast, can boast more than three dozen books, with more coming out each month.

Nor can troff claim a particularly active user community. I haven't heard of any Troff Users Group, let alone dedicated publications, international conferences or FTP archives containing contributed troff materials. I can't even find a Usenet group or mailing list for troff! TeX has all of these, and more. For details, contact:

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tug@tug.org

The Comprehensive TeX Archive Network (CTAN) is an international consortium of TeX-related FTP sites. The archives (try /tex-archive on pip.shsu.edu) contain hundreds of fonts, filters of every description, complete source code for a variety of TeX and TeX-related implementations and a large number of papers and articles. Using these resources, TeX users can set type in a wide variety of languages, produce sophisticated scientific diagrams and even generate totally new fonts.

Most vendor-supplied troff implementations, in contrast, are hard-pressed to do more than format simple text documents in the font set supplied with the venerable CAT-4 phototypesetter. Even the commercial troff implementations don't come close to the variety available to TeX users.

TeX also wins big on portability. TeX operates on a wide variety of hardware platforms. Most current operating systems are supported by one or more TeX implementations. A TeX document will generate exactly the same output on any of these implementations.

Finally, TeX has achieved nearly universal acceptance in the scientific community. There are very few mathematical and scientific journals and publishers that aren't willing to accept TeX as input. More to the point, many journals specify TeX as their standard, often publishing an official set of macros for authors to use.

The Bad News

The flip side of all this capability and versatility, unfortunately, is a fair degree of size and complexity. The TeX system is not small, and every font or filter adds to its footprint. A large TeX installation can have hundreds of files that take up many megabytes of disk space. Installation and maintenance can be challenging, to say the least.

On the other hand, all these problems are being addressed. Standards for the layout of TeX directory trees are being hammered out. A new release of LaTeX has emerged, solving a number of compatibility problems. Installation scripts and documentation are being improved. Mountable CD-ROM file systems of TeX materials are also emerging.

In short, the TeX community has the same problems and advantages as most other active freeware communities. If a bit of disorder is a necessary adjunct to evolution and growth, I think I can deal with that. ➸

Richard Morin operates Prime Time Freeware (ptf@cfcl.com), which publishes mixed-media (book/CD-ROM) freeware collections. He also consults and writes on UNIX-related topics. He may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at rdm@cfcl.com..

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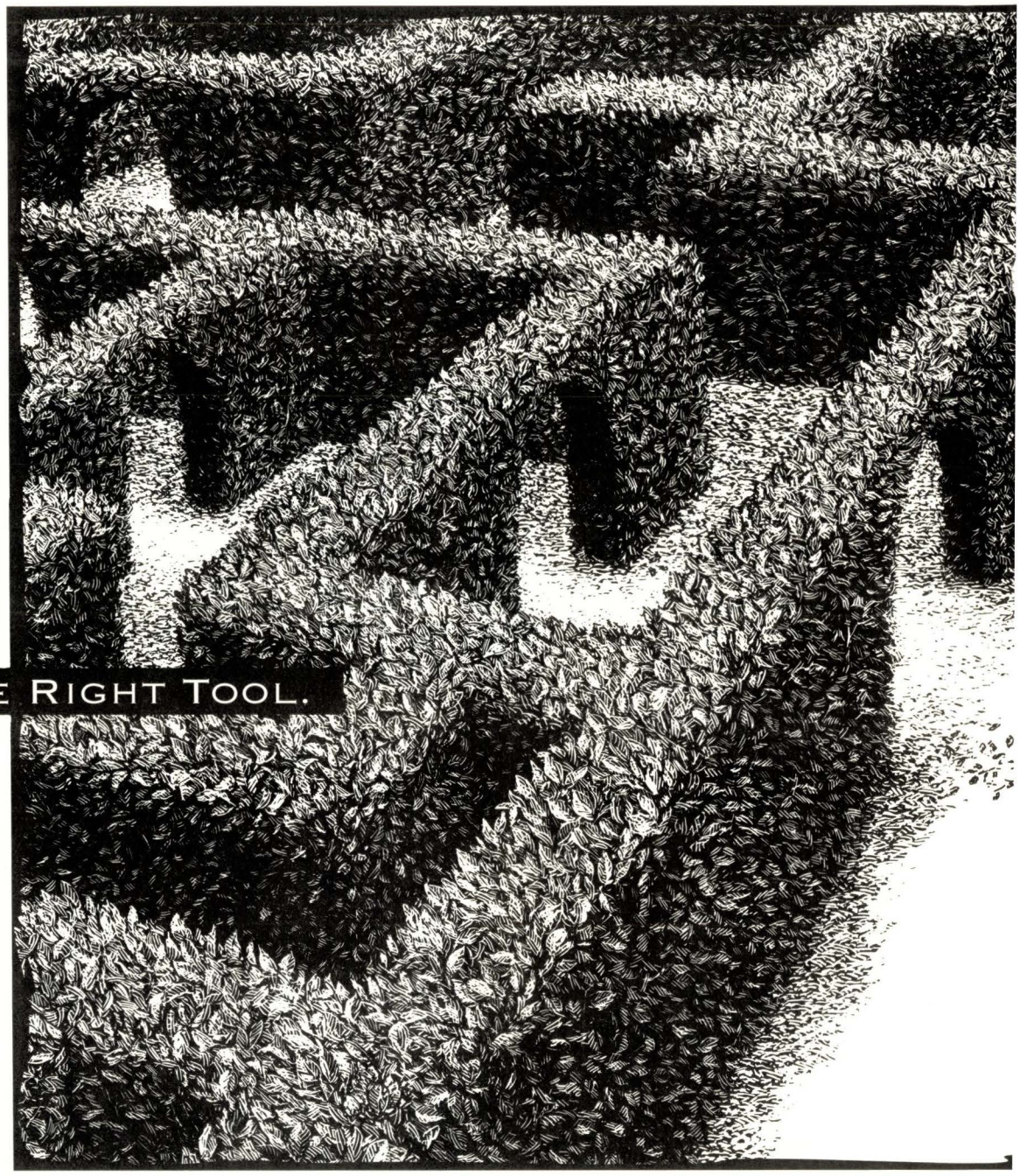

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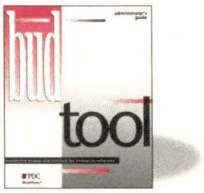

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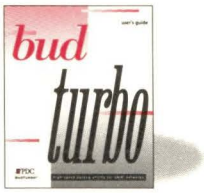

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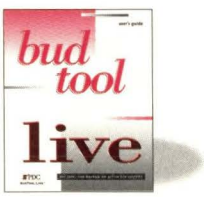

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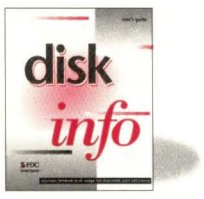

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by S. LEE HENRY

PC NFS for UNIX Wizards

I used to think that PCs were easy. If I ever needed to know anything about DOS I could learn it in half an hour. Well, PCs *are* easy–except when they're not. Installing PC NFS on a couple of seemingly twin PCs, I learned about this dichotomy in the nature of PCs all too well.

The first PC installed so easily that I patted myself on the back, saying, "See, self, you were right. This is easy." The second PC, on the other hand, caught me off guard. Three days and two exploited grad students later, I was still scratching my head. Finally, in a fit of frustration, I yanked the Soundblaster card out of the thing and tried again. PC NFS installed in minutes. There were still a number of things that I had to do so that mounting and printing would work the way I wanted, but it was all downhill once turning on PC NFS no longer turned the PC into a zombie.

The moral of this story is that PCs are easy when you are selective about the combination of cards you try to use with them. The rest of this column, on the other hand, will describe some of the things I've learned about PC NFS in the process of installing and learning to manage it in my primarily Sun and UNIX network.

RUSS WILLMS

What Is PC NFS?

PC NFS is a "client-only" implementation of NFS. "Client-only" means that the PCs can mount file systems that are exported by NFS file servers, but they cannot export their own disks either to other PCs or to the NFS servers. To set up PC NFS, you install software almost exclusively on the PC. Of course, you must be running NFS on the file servers that you intend to use. This is usually the case with Sun systems, but you may have systems for which NFS is unbundled, e.g., Silicon Graphics Inc. systems.

PC NFS also comes with an implementation of NIS. This means that a PC can be a client of an NIS server. Alternatively, you can run it off local files on the PC (e.g., `\nfs\hosts`) if you prefer. When you use PC NFS with NIS, you'll bind to an NIS domain during start-up. The `net nisdomain audit.irs.gov` command acts like the `domainname` command in SunOS and binds, in this case, to the domain `audit.irs.gov`. You can bind to a particular server for that domain with the `net nisset taxman` command or use an asterisk in place of the server name `net nisset *`.

PC NFS uses only three of the NIS maps: passwd (to authenticate users and determine what files they can access), hosts and networks.

Installing PC NFS

Installing PC NFS is usually extremely easy, despite my experiences to the contrary. It depends on whether your PC is a "vanilla" model or whether you're hosting a number of specialized boards that may complicate the PC's setup even without PC NFS.

Starting with Version 5.1, PC NFS includes the driver for the 3Com 3C509 cards–the Ethernet adapters I use almost exclusively. Given this, I no longer have to go back and customize my start-up files (`autoexec.bat` and `config.sys`) after installing PC NFS. The configuration tool, `nfsconf`, is used to select the adapter and enter information about your environment (your NIS domain and the server that will be used to authenticate users).

Most of the PC NFS start-up commands will be installed in your `autoexec.bat` and `config.sys` files. It is the `net start rdr` command that actually starts up PC NFS.

After the initial setup, you'll still have to customize your PC NFS configuration by specifying network printers and file systems to mount at bootup. You'll also need to be sure that your NFS servers are ready for PC NFS.

Readying Your Servers

For systems already running NFS, there are only a couple of things that you need to do to support PC NFS. For one, you need to have an RPC daemon running. On Sun systems, this daemon is called `rpc.pcnfsd`. It is an RPC server usually started at bootup through the `/etc/rc.local` file. If the configuration file, `/etc/pcnfsd.conf`, exists, the daemon will read it on startup. You'll also need to have a single line in your `/etc/inetd.conf` file for the daemon.

```
pcnfsd/1   dgram    rpc/udp wait root
/usr/etc/rpc.pcnfsd      rpc.pcnfsd
```

On my Suns, the `pcnfsd` serves both Versions 1 and 2 of the protocol, as you can see from this response from the `rpcinfo` command that lists registered RPC programs.

```
sunwiz# rpcinfo -p | grep pcnf
    150001    1    udp    651    pcnfsd
    150001    2    udp    651    pcnfsd
    150001    1    tcp    654    pcnfsd
    150001    2    tcp    654    pcnfsd
```

You should already have an entry for PC NFS in your `/etc/rpc` file that identifies the daemon's program number (150001).

You also need to make sure that the file systems you plan to use on the PC are exported to it. I simplify this process by maintaining a list of PC hosts in my netgroup like this:

```
pc   larry curly moe bill hillary
```

Then, I can use the netgroup name in my exports file rather than listing each of the PCs. To enable the PCs to use network printers, you have to export the spool directory, `/var/spool/pcnfs`, for their use. Here's an excerpt (OK, it's simplified a bit) from my `/etc/exports` file.

```
/export/pcstuff       -access=pc:mysun
/export/home          -access=sun:sgi:pc
/var/spool/pcnfs      -access=pc
```

User Authentication

PC NFS requests a userid and password when it starts up. This may seem outrageous to PC users who aren't used to operating systems that incorporate security. The userid and password entered help determine the user's identity and what access they have to files on the NFS servers. When this information is entered, `pcnfsd` on the server returns the uid, gid, home directory and umask of the user. It also makes an entry in the server's `wtmp` file (unless this option is overridden in the configuration file).

If you want to switch users without having to do that Control-Alt-Delete thing on the PC, you can use `net name jones *`. User "jones" will then be asked to provide his password so that the daemon can authenticate him and his access permissions can be used to retrieve files.

Mounting File Systems

When you mount a UNIX file system on a PC, it mounts as if it were an additional hard disk; that is, it takes on an identity like F: or G:. During installation, you select the range of device names that you want to have available as mount points.

Similar to NFS on "real" computers, mounting can be invoked on demand with a "net use" command like `net use F:\export\pcstuff /ro`, or you can use the `mt` tool. You can also make permanent mounts by putting the "net use" commands in the PC NFS equivalent of the `/etc/fstab` file–`\nfs\drives.bat`.

Filenames and Line Endings

UNIX filenames often end up looking really odd when viewed through the eyes of PC NFS. This is because DOS's filename limitations make it necessary to translate filenames that are not legal in DOS to something that will be recognizable but still unique. Say, for example, that I had files named `stardata1.sdbfmt`, `stardata2.sdbfmt` and `stardata3.sdbfmt`. If PC NFS simply truncated these names, they would all look the same. Instead, it makes changes in the filenames to accommodate the two naming conventions. These particular files were called `STARD^AA`, `STARD^BA` and `STARD^CA`. You will see lowercase characters appear in uppercase and dots change to the ~, as well as some characters that are used to randomize names that would otherwise map to the same thing. Don't be alarmed.

PC NFS incorporates `dos2unix` and `unix2dos` utilities. Since the line-ending conventions differ between UNIX, which uses only a linefeed to mark an end-of-line, and DOS, which uses both a linefeed and a carriage return, these utilities are included to compensate. When you store PC files on an NFS-mounted partition, they will be stored using the DOS convention. On the other hand, if you access UNIX files on the PC, they will take on a "steplike" appearance as each line starts further to the right, but you can use the `unix2dos` command to add the carriage returns.

Printing

The first thing to do to give your PCs access to network printers via PC NFS is to include them in your `\nfs\drives.bat` file with a command something like

```
net use LPT1: benny:elmo /fmt=p -t=90
```

This command defines a PostScript printer called elmo that is being accessed through the NFS server benny. We've added a timeout option so that larger PostScript files will print.

The printer does not have to be directly attached to the system that you use for spooling. It simply has to be in that host's `/etc/printcap` file. In addition, don't forget that the server must be exporting the spool directory.

Printing is requested by the PC client. The print host's response is the name of the spool directory to be used.

The printer does not have to be directly attached to the system you use for spooling. It simply has to be in that host's `/etc/printcap` file.

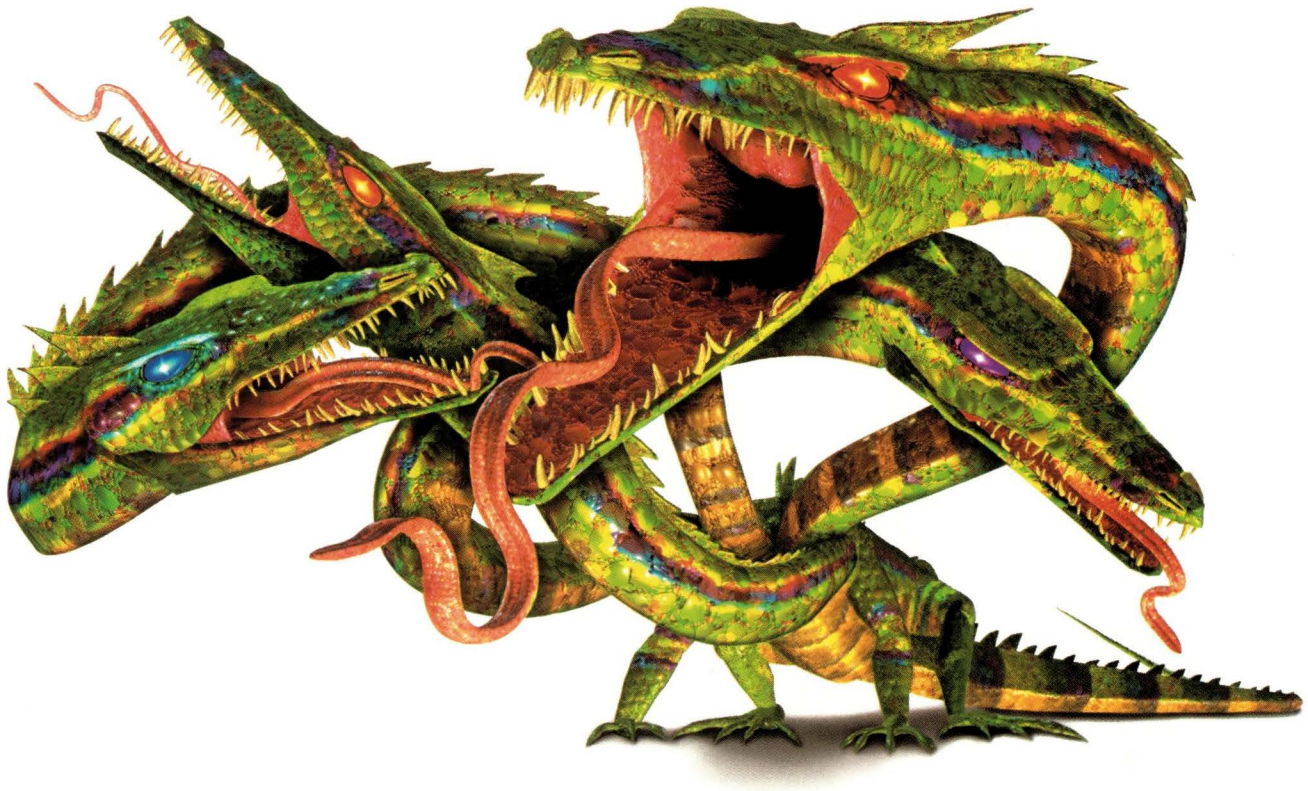
When you look at this directory on your NFS server, you'll see directories within the spool directory corresponding to the names of PCs that have sent files for printing. The daemon, `pcnfsd`, creates these directories if they don't already exist.

```
/var/spool/pcnfs/larry
```

Good Reading

PC NFS comes with a hefty box of documentation. There are installation, users' and reference guides, as well as books on stuff like telnet. In short, there's probably a lot more to read than you'll have time to, but there's a lot of good information there. If you're interested in knowing how PC NFS works, however, and how NFS works more generally, you should pick up a copy of Hal Stern's book, *Managing NFS and NIS*, published by O'Reilly & Associates Inc. ⊸

S. Lee Henry is on the board of directors of the Sun User Group and manages computer and networking services for the Physics and Astronomy Department at Johns Hopkins University. Send mail to `slee@expert.com`.



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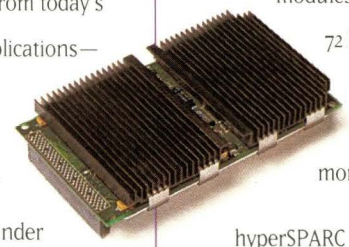

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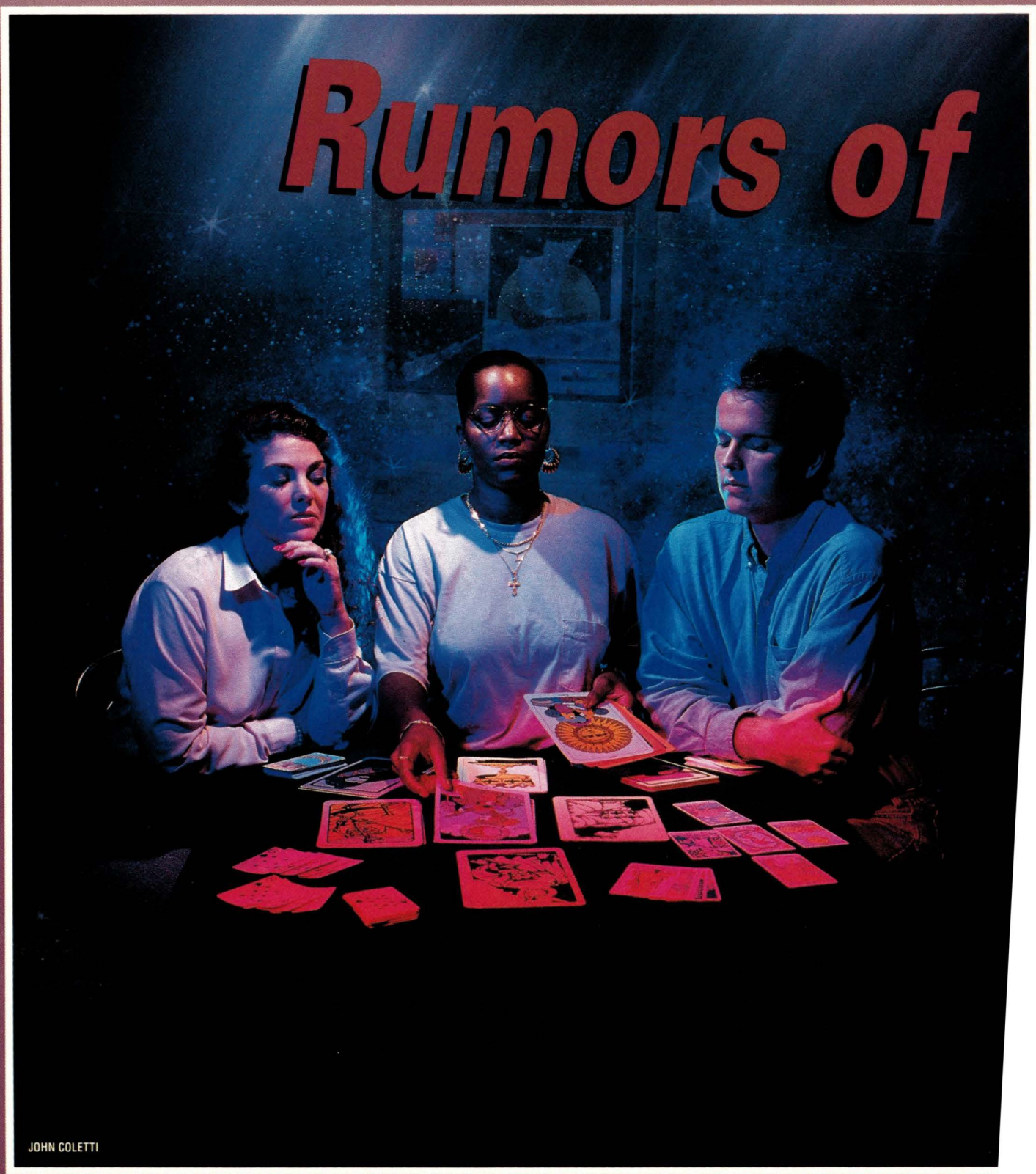


JOHN COLETTI

Their Death...

SPARCalikes. It's a difficult word. For a long time, it was an ugly market, too.

The term means systems that are based on the SPARC processor and compatible with Sun Microsystems Computer Corp. systems, but are not from Sun. More specifically, it means SPARCstation compatibles. In the 1980s, and even into the early 1990s, it was one of the hottest markets in computing. It seemed that everyone wanted to get into the business of making "Sun clones." Every little garage shop operation in the world seemed to think it would play Compaq to Sun's IBM.

SPARCalikes never became the mass-market product their supporters anticipated. But they haven't died out, either–and have recently won some significant sales.

In fact, SPARCalikes died horribly. Of the dozens of companies that rushed into the market, almost none survive. Sun itself outmaneuvered, outfought, outspent and out-R&Ded its would-be competitors.

---

by **MICHAEL JAY TUCKER**, Executive Editor

Yet today, a small group of SPARCalike vendors remains. Their numbers are even increasing. They are scoring sales. Very quietly, and in a limited way, the SPARCalike market is coming hesitantly back to life.

To find out why, *SunExpert* tried to track down that elusive creature, the SPARCalike user.

Drastic Mortality

SPARCalike users are rare for good reason–there aren't many SPARCalike vendors left. If we define a SPARC-alike as a SPARCstation clone, then there are few doing business. There are successful makers of laptops, such as Tadpole Technology Inc. and RDI Computer Inc., and even SPARC-based supercomputer makers, such as a San Diego, CA-based division of Cray Computer, but few real clone makers remain alive and well.

The SuperCOMPstation 20, from Tatung, is a SPARCstation 20-compatible. Based on the 60-MHz SuperSPARC, the device is available in both uniprocessor and multiprocessor models.

Actually, Sun will argue that point. Or rather, Scott Hickman, acting director of Sun's SPARC Technology Business group (the organization tasked with promoting SPARC to system vendors, among others), will do so. "I think a lot of those people aren't perishing. They are trying to jump on business opportunities as they see them. They are flexible companies. They have the ability to change products and architectures–from SPARC to Intel to whatever–just by flipping a switch on their production line."

But no matter how hard you flip switches or anything else, a lot of SPARCalike vendors have died out there. Just how dramatic a mortality rate they've had may be judged by the fact that in 1990, reporters from this publication (the author, and Mary Jo Foley, then senior editor) wrote a 100-page market report on SPARCalike systems and their makers. Of the 22 vendors in that report, only two remain in the business today–specifically, Tatung Science & Technology Inc. and Hyundai Electronics America. The latter's workstation operation took the name Axil Computer Inc. early this year. Others have come into the field—such as Aries Research Inc., DTK Computer Inc. and Pinnacle Data Systems Inc. But the vast majority of the early entrants into the field have disappeared. They're bankrupt or vanished or have moved into other markets.

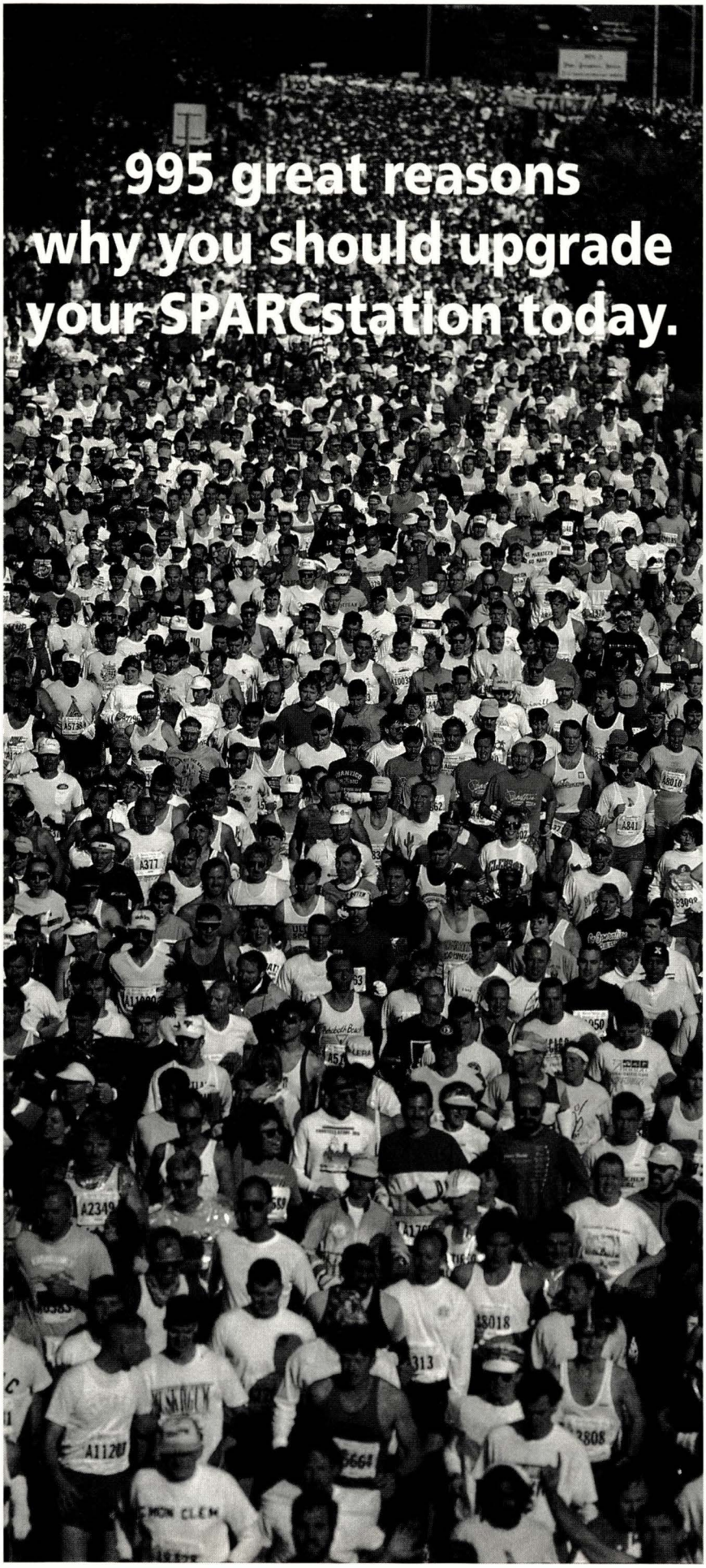
In fact, even makers of SPARC-based, Sun-compatible servers haven't fared well. Solbourne Computer Inc., for instance, was once among the most promising computer makers in the country. Its multiprocessor servers were the envy of Sun itself. Today, it is a humbled remarketer of Sun equipment and an Oracle Corp. value-added reseller.

Quite simply, competing with Sun is not a very healthy thing to do. Why, then, would anyone buy a SPARC-alike, given the history of their makers?

"The answer is very simple," says Dr. Norman Pieniazek of Atlanta's Centers for Disease Control (CDC)–"price."

Pieniazek uses the SuperComp-Server 10, a SPARCalike from Tatung, as part of a CDC project to analyze the DNA of the HIV/AIDS virus. He says he is looking at other disease organisms as well.

Pieniazek finds the Tatung attractive because of its cost, and also for one unusual reason: its chassis. "It has



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a unique type of enclosure," he says. "It's good because you can fit a lot of peripherals inside. And it comes with an SBus expansion facility. That's good in my case."

Pieniazek particularly likes the fact that the chassis lets him eliminate cabling. "We need a lot of disk space because of the size of the databases we're running," he says. "And this enclosure lets you put in at least seven hard drives and four additional devices you can access just by opening a small door. You don't have to buy an expansion chassis. Problems with cabling are simply gone."

He's never had problems with software compatibility. Sun is even providing his operating system support. "I got, without problems, a software service contract from Sun itself."

Pieniazek, however, is unusual in having discovered a unique technical advantage to a SPARCalike, even if that advantage is just the chassis. For most SPARCalike users, the advantages of SPARCalikes boil down to one thing: "Price, obviously," explains Jeffery L. Wisniewski, system engineer at Indy Equipment, a division of

Solaris on PowerPC: Better Times Are Here at Last!

Instead of running Solaris on a SPARCalike, you might consider running Solaris on a PowerPC system. In fact, PowerPC could be a home for Solaris in a way that has escaped Intel Corp. chip-based systems. The two reasons are speed and standardization.

Whereas Intel's 486DX4 and Pentium chips have not been able to challenge SPARC's performance lead, the PowerPC chips designed jointly by IBM Corp., Motorola Inc. and Apple Computer Inc., and manufactured by each company, could easily seize the performance lead within the next year. Systems built around the 601 and 603, the initial PowerPC chips, could offer performance similar to a SPARCstation 5. Sometime next year, IBM and Motorola will begin shipping the 604 chip, which will nearly double the performance of the 601 by adding a second arithmetic execution unit. (Systems equipped with 601 will be field-upgradable to the 604 by simply plugging an upgrade card into the L2-cache slot.) Another chip, the 620, promises 64-bit integer operations, and perhaps another doubling in performance.

All PowerPC chips have been designed with multiprocessor systems in mind. Since Windows NT supports multiprocessing, it is likely that low-cost, multiprocessor PowerPC systems will be available by the end of 1995. Such systems could further erode Sun's lead with SPARC.

Rather than repeat its mistake with the original PC, IBM has developed a hardware standard for PowerPC systems called PReP (the PowerPC Reference Platform), designed to create an environment that is open, multivendor and expandable from the start. With PReP, operating systems such as Solaris do not need to interact directly with the PowerPC system's hardware. Instead, the operating system goes through a set of standard interfaces.

Thus, whereas Solaris on Intel has meant a nightmare of system configuration problems, incompatibility between different SCSI cards and video adapters and sound cards that won't configure, PReP-based systems promise to have the same sort of tight integration that characterizes Sun's own SPARC systems. For example, PReP systems won't be configured with jumpers and switches. Instead, all interface cards will be self-configuring PCI cards that plug into a high-speed (132-Mb/s) bus.

The Solaris port to PowerPC is being performed by engineers at SunSoft, but the final operating system will be distributed and marketed by IBM's Power Personal Systems Division under an OEM agreement. Neither company is willing to set a firm date on availability, other than to say that it will be available sometime in the first half of 1995.

The date "is governed by IBM, since they will be aligning the release of Solaris with their other products," says Tony Hampel, SunSoft's workgroup server product marketing manager.

"The best that I have right now is the first half of 1995. I expect that SunSoft will update that. They are doing most of the work on the port," says IBM spokesman Tim Ohsaan.

Hampel says the version of Solaris on PowerPC will be the same as the version of Solaris on Intel and SPARC. "All of the features, functionality and even bugs that we have on Solaris 2.4 [on other platforms] will follow over to the PowerPC platform." Hampel promises "source-code compatibility" between versions of Solaris running on alternative platforms. Engineers are making the port by starting with the SPARC and Intel versions of Solaris and creating the necessary modifications. This means that the PowerPC release will not initially be synchronized with the SPARC version, a problem that has plagued the Intel version of Solaris. "I

Continued on Page 43

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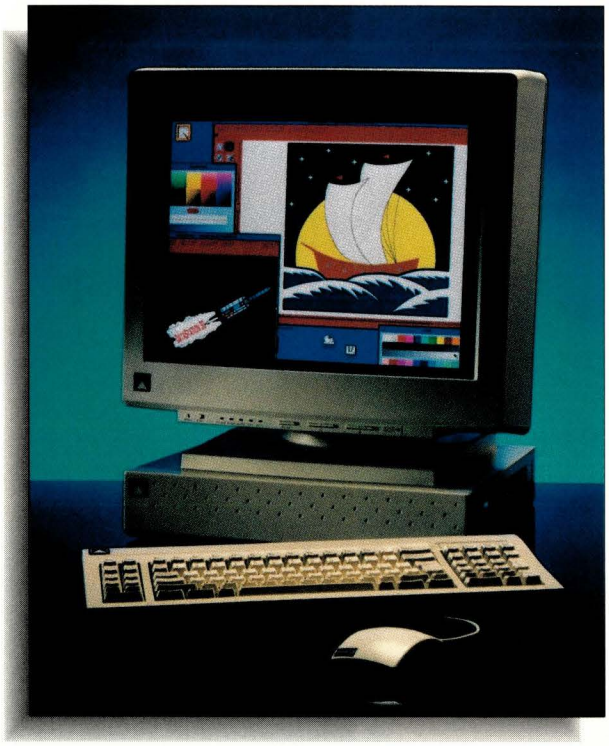

The DataStation 30, from Pinnacle Data Systems, is a SPARCstation 20-compatible based on one or more hyperSPARC processors. Pinnacle is a relative newcomer to the SPARCalike market although it has a long history in the refurbished Sun market.

Independence Excavating Inc., in Independence, OH. Wisniewski's company owns "four or five" SPARCalikes from Pinnacle Data.

Pinnacle Data provides Sun service and system integration. It also has a used and reconditioned Sun business. In recent months, it has begun manufacturing its own SPARCalikes as well. These DataStations range from SPARCstation 5- to SPARCstation 20-compatibles.

Wisniewski says that the company uses its DataStations for "AutoCad. We design construction equipment." He also runs a word processor on the machines. Previously, Indy had been performing these tasks with PCs but decided it needed more than the 486 or Pentium could offer. "The Pentium is pretty much a broken patch," says Wisniewski. "We wanted more power and more compatibility with the main office's UNIX machines. The PCs just aren't cutting it anymore."

It may be that Indy's PC background is one reason it went with SPARCalikes rather than Sun systems. As a company, it was comfortable dealing with compatibles. "I tend to

"...Better Times," Continued from Page 42

would expect synchronization in a future release of Solaris, but it is too early to say which future release that will be," says Hampel.

Plans have not been finalized as to whether or not Wabi will be offered in the PowerPC version of Solaris, Hempel says.

Ohsaan says IBM will be selling Solaris for PowerPC pre-installed on its own PowerPC systems and as a shrinkwrapped product for people who bought their PowerPC systems along with other operating systems.

IBM expects its Solaris-equipped PowerPC systems to compete with "high-end PCs and low-end workstations," according to Ohsaan. "The initial systems you are talking about are 66-MHz 601s and 603s. I'm sure that doesn't compare with a high-end or a midrange SPARC." Such systems, Ohsaan says, might be priced anywhere from $3,000 to $5,000. (Because Apple Computer Inc.'s new Power Macintosh computers are not PReP-compliant, they will not be able to run Solaris even though the computers are equipped with the same CPU.)

Solaris 2.4 will not have an architecture-neutral distribution format, or a system of "fat applications," which would allow object code for SPARC, Intel and PowerPC be to bundled together in a simple file. (Two other multiplatform operating systems, NextStep and the Apple Macintosh Operating system, both support fat applications.)

Because there are already three other operating systems available for PowerPC (Apple's Macintosh System 7.x, Microsoft Corp.'s Windows NT, and IBM's own version of UNIX, AIX), porting Solaris to PowerPC does far more to strengthen the "openness" of Solaris than the "openness" of the PowerPC chip. For users that have already committed to the PowerPC, Solaris simply gives them the choice of one more UNIX operating system. But for committed Solaris users, Solaris on PowerPC offers the real promise of low-cost hardware that outperforms what Sun has to offer.

"I think that the PowerPC machines on the surface look very good," says Hampel, adding, "I don't believe that SMCC will allow themselves to fall behind on the technology curve for the product performance."*–slg*

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go for clones," says Wisniewski. "I know that the clone makers have to do more to impress their clients. They don't have big names. They have to come out with new features."

The DataStations' relatively low cost was another reason Wisniewski picked them over Sun's products. (The company's top-of-the-line SPARCstation 20-compatible, the DataStation 30, is $22,886. Pinnacle Data says a comparable SPARCstation would be $31,995.) In addition, though, there was a personal touch. Wisniewski knew Pinnacle Data's people. "A lot of them were at Ohio State. I knew them when they were working there. I had been in class with them."

By contrast, Sun didn't know Wisniewski–and, frankly, didn't seem interested in making his acquaintance. "Sun doesn't go after a lot of these smaller sales, where you are just buying four or five systems at a time," says Wisniewski. That left an opening for Pinnacle Data.

'Sun Was Less Than Stellar'

That, in fact, is the second reason users cite for their SPARCalike purchases. They tend to have a personal connection with a SPARCalike vendor, and also to have been burned, in some fashion, by Sun itself.

Consider Brian Holgate, systems manager of Cyrix Corp., in Richardson, TX. Holgate, too, is a SPARCalike user. But he is no four or five systems purchaser. "We have probably 100 or so Tatung [SPARCalikes]," he says. "Mostly it is the CompWorkStation 7s and CompWorkStation 40s."

Cyrix is a semiconductor house. "We design microprocessors," says Holgate. Originally, they did so on Sun workstations. "But Sun's customer service was less than stellar," he notes. "They didn't seem to care who you were or what you wanted."

By contrast, Tatung was eager to please. "Their service is quite good," he notes. "Customer support is very good. Usually it is 24-hour support. They have a one-year guarantee, which is better than Sun's 90 days. And, they don't care if I use third-party peripherals. Back when I was using Sun, they tried to dissuade me from doing that."

And, again, there was that all-important personal touch. "The guy who is the Tatung area sales manager is someone I had dealt with at another

The Reseller Angle

There are customers...and then there are customers. A computer company can live and die by its value-added resellers. Sun Microsystems has never had the best of relationships with its resellers. SPARCalike vendor Axil Workstation, a division of the South Korean Hyundai Corp., has done somewhat better.

Axil's premier U.S. reseller is San Diego-based Andataco. Formerly a Sun VAR, Andataco split with Sun after a widely publicized quarrel and took up with Axil instead.

"One of our biggest reasons is that we were able to offer a much more flexible configuration [with Axil]," says Steve McAllister, Andataco's director of worldwide OEM and distribution sales. "We can offer exactly the amount of memory, disk space and graphics that the customer needs." He notes that this wasn't always the case with Sun's products.

In addition, he says, Axil "doesn't really make clones. They make compatibles, but they have their own future mapped out with SPARC. They're not in the business of knock-off products." In particular, he says, his company was impressed with Axil's recent investments in its own ASICs. He thinks that Axil has R&D facilities at least as good as Sun's. "One of the things that attracted us was their engineering talent. They have some people on staff who used to be the head designers at Sun."

Doesn't he worry that his customers will balk at a non-Sun brand? "Oh, no," he says. "I think customers are much less loyal to brand names than they were even two or three years ago. Today, their real issues are software, compatibility and deliverability. That, and whether the product meets their specific requirements."

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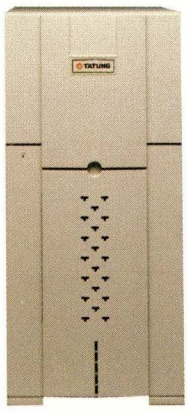

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The Axil245, from Axil Computer, is a SPARCalike that features the company's own set of graphics- and performance-oriented ASICs. Axil Computer is the former Axil Workstations and is a division of Hyundai Electronics.

company. I like him."

So far, he's had no problems with software compatibility. "I have heard stories where software firms told their customers, if you're not running on a Sun, then you're not supported," he says. "But no one's ever said that to me."

In fact, the only advice he has for anyone else planning to buy Tatungs is "make sure you get the right price."

Similar words come from Steve Wiederrich, computer and systems manager for corporate venture products at Texas Instruments Inc., in Dallas, TX. Wiederrich too is a Tatung user. "We have between 25 and 30 of them," he says. "We're using them mostly for ECAD and MCAD."

TI, as a company, is a major Sun user. "But," says Wiederrich, "my group was small enough that I could go off and give [SPARCalikes] a try." "I looked at Tatungs and Integrix," he says. "They both scored well in compatibility, and I liked the local [Tatung] reseller."

He basically has nothing to say about them as systems. They work just like Suns. The reason he bought them was "price. Initially, I could get six of their machines for five of Sun's. That margin has slimmed since then, but a year ago, it was the case."

In fact, he says, in the end, the hardware may be sort of irrelevant. "It is my opinion that the VAR makes far more difference than the equipment."

"QED...Opportunity"

SPARCalike users in the '90s, then, reveal a number of common characteristics. First, they bought their systems for price. Second, they had some personal contact with a SPARCalike vendor. Third, they may also have had some unpleasant experience with Sun.

But there is one other, perhaps more important, common characteristic. While there are exceptions, SPARCalike buyers as a group tend to be in the technical, scientific and engineering market segments–the groups that gave Sun its start and which had been its bread and butter.

Why are these people buying SPARCalikes? SPARC Technology's Hickman thinks that SPARCalike vendors and sci-tech buyers are made for each other. "I haven't got any market statistics, but my gut says that technical users are buying these [SPARCalike] systems. And I'll tell you why. These clone makers run a lean ship. That means they haven't got money

Companies Mentioned in This Article

Aries Research Inc.
46791 Fremont Blvd.
Fremont, CA 94538
Circle 140

Axil Computer Inc.
3151 Coronado Drive
Santa Clara, CA 95054
Circle 141

DTK Computer Inc.
17700 Castleton St.
Ste. 300
City of Industry
(Los Angeles), CA
91748
Circle 142

Integrix Inc.
1200 Lawrence Drive
Ste. 150
Newbury Park, CA 91320
Circle 143

Pinnacle Data Systems Inc.
1350 W. 5th Ave.
Columbus, Ohio 43212
Circle 144

RDI Computer Inc.
6695 Mesa Ridge Road
Bldg. A
San Diego, CA 92121
Circle 145

Solbourne Computer Inc.
1900 Pike Road
Longmont, CO 80501
Circle 146

Tadpole Technology Inc.
12012 Technology Blvd.
Austin, TX 78727
Circle 147

Tatung Science & Technology Inc.
1840 McCarthy Blvd.
Milpitas, CA 95035
Circle 148

available for things like support, service and development." But in the technical markets, where users are likely to fix their own problems and don't need a lot of hand-holding, that's not a problem.

In recent years, SMCC has worked very hard to escape its roots. It has attempted to enter corporate computing. Could it be, then, that in the attempt to storm the gates of MIS, Sun has neglected the scientific and technical market? And is this the reason for the revival of the SPARCalike market?

Hickman chooses his words carefully when he answers these kinds of questions. "You'd have to talk to SMCC about the kind of resources they've committed to different markets," he says. "And I'm sure they'd tell you that they are continuing the care and feeding of the traditional market."

But, he adds, "from our perspective, [STB's] sales to clone makers are increasing. And we think the clones are selling into the technical markets. So, QED, the opportunity must be increasing."

Perhaps that explains the return to life of a market that seemed beyond reviving. As Sun has pushed into commercial markets, it has been accused of losing interest in the technical markets. And that left the field clear for SPARCalikes–many of which resemble the younger Sun. The long-awaited flowering of the SPARCalike market could finally be at hand–even if in a smaller, more limited way than once hoped.

But there's the rub. Once customers have taken a step away from Sun toward SPARCalikes, might they not also be tempted to go to a new architecture entirely? ⊸

Smoking Gun: Will Sun Kill the SPARCalikes?

When the SPARCalike market faltered in the early 1990s, many observers blamed Sun Microsystems Computer Corp. SPARCalike vendors claimed they were denied access to current versions of SunOS, and that the fastest and newest SPARCs were somehow always available to Sun but impossible to get for anyone else.

Given that history, will Sun once more shut down the SPARCalike market? Absolutely not, says Scott Hickman, acting director of marketing for the SPARC Technology Business (STB) group within Sun Microsystems Inc. "My job depends on people using SPARCs, even in clones."

Hickman denies that Sun stamped out the clone makers in the late '80s, though, he acknowledges, "I can understand why you might have heard things like that in the past. The model we have now is very effective in avoiding those kinds of problems."

He means the system of "planets"–semiautonomous divisions–into which is Sun is now divided. SPARCalike vendors can now go to a separate company, SunSoft, for their operating system, and to STB for their chip- and even board-level products. In theory, these organizations are responsible for their own destinies.

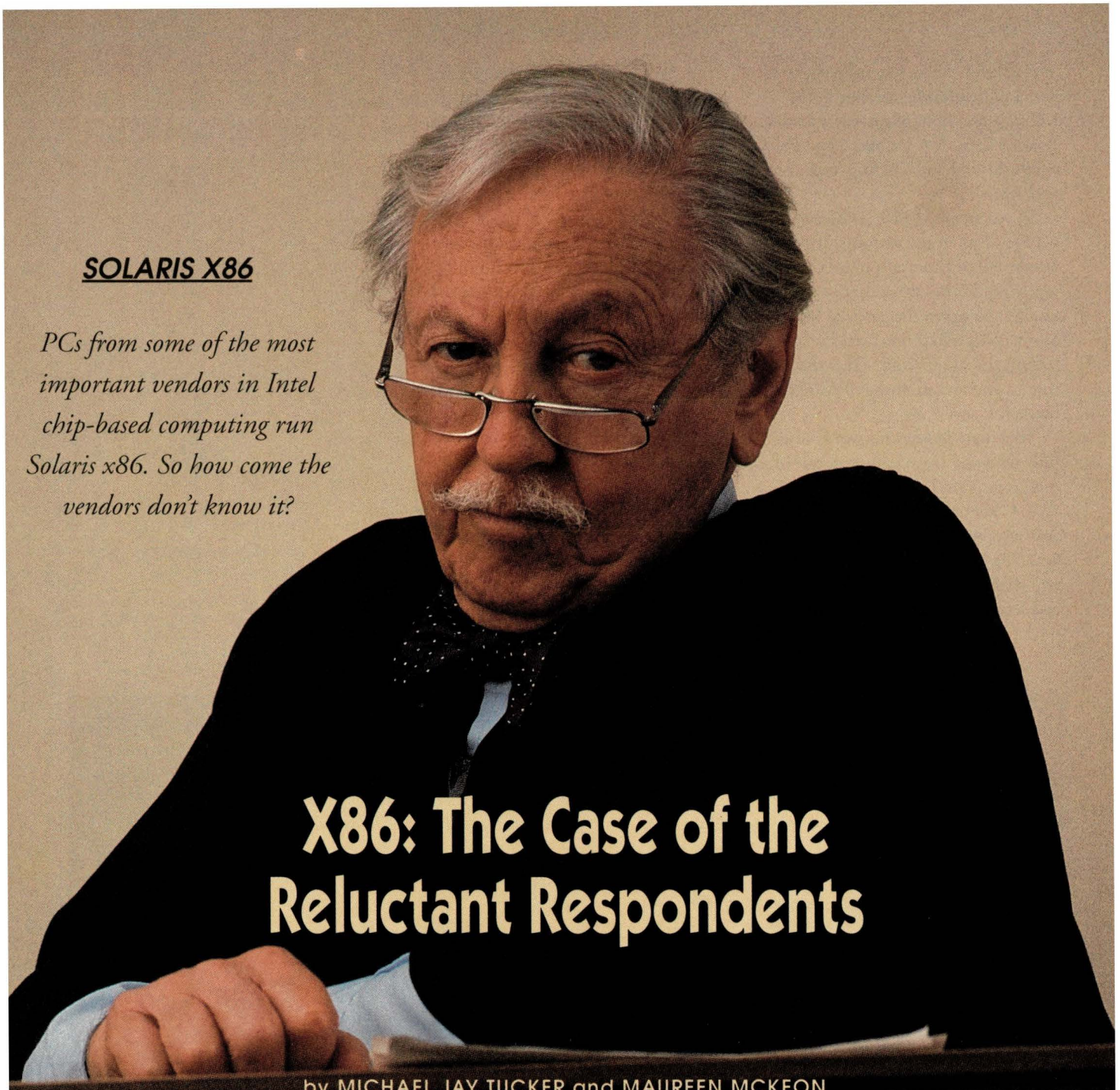
Thus, in theory, a SPARCalike vendor should have access to the same technology as Sun Microsystems Computer Corp. (SMCC). "It was in recognition of the perception that certain customers may not have been given a level playing field that we set up this model," says Hickman.

He insists that once and future SPARCalike vendors have nothing to fear. "For me," he says, "SMCC is just a customer."

There are, however, other opinions. Jason Lo is the president of Integrix Inc., in Newbury Park, CA, which manufactures a variety of add-in products for Suns, as well as its own line of SPARCalikes. He isn't so sure about Sun's benevolence. "When we talk to Sun, they say they want to be open," he says. "But, on the other hand, you see odd things going on." For instance, he notes, Sun made a design kit for the SPARCstation 10 available to the SPARCalike community. "They said they were going to do so as well with the SPARCstation 5 and 20, but then, they changed their minds."

In fact, he thinks, for SPARCalike vendors, "it is getting harder and harder to survive in this market."

Which is why he is now considering the PowerPC. "We see a big opportunity in the PowerPC," he says. "We are seriously considering introducing product based on it–running Solaris. Our channels are in Solaris, but not necessarily in SPARC."



SOLARIS X86

PCs from some of the most important vendors in Intel chip-based computing run Solaris x86. So how come the vendors don't know it?

X86: The Case of the Reluctant Respondents

by MICHAEL JAY TUCKER and MAUREEN MCKEON

Sun Microsystems Inc.'s Solaris is a versatile beast. As everyone knows, it runs on SPARC. And, as *almost* everyone knows, Sun's energetic and determined software planet, SunSoft, is pushing the operating system hard on Intel Corp. chip-based platforms.

But there's a mystery here. Some Intel platform vendors seem to be actively dissuading users from trying to run Solaris on PCs.

Note: *The following table is based on information obtained from SunSoft. However,* SunExpert *has been unable to verify or obtain additional information for it, except where noted, because of PC vendors' reluctance to return or even acknowledge our queries. Readers are cautioned to seek actual product specifics from their vendors or resellers.*

Francie Manning, THE PICTURE CUBE

This curious story began in August. *SunExpert* had planned to put together a chart showing the various PC products that run Solaris. SunSoft had provided us with a list of x86 machines that it had tested and certified as compatible with Solaris 2.4.

SunExpert's research editor, Maureen McKeon, then faxed a questionnaire to each of the vendors on that list. The magazine's usual practice for compiling tables on any product is to send questionnaires to vendors of a particular product type–disk drives, for example. The vendor must respond by a certain date if it wishes to be listed in the table. Usually, vendors cooperate.

But not this time.

At press time, the vast majority of the PC vendors on the list had failed even to acknowledge our questionnaire–despite repeated phone calls to each company. Several vendors denied that their products run Solaris. Some asked that they not be included in any table of Solaris-compatible PCs.

For example, in mid-August, *SunExpert* contacted Dell Computer Corp., in Austin, TX, which in the past had widely promoted its "partnership" with Sun regarding Solaris x86. By mid-September, the company had not responded to several faxed questionnaires, nor had it returned our repeated calls–including calls to the office of Michelle Moore, the company's vice president of corporate communications.

When *SunExpert* initially contacted Compaq Computer Corp., we were told that the systems on SunSoft's list were no longer in the company's product line. Further, Compaq spokeswoman Hedy Baker said her company did not normally take part in buyers' guides and asked that Compaq not be included in *SunExpert*'s survey.

A *SunExpert* reporter contacted Baker again in September. At that time, she again said that the products on SunSoft's list were obsolete. "They are all discontinued," she said. She also said that it was her belief that Compaq's products do not run Solaris x86. "When I talked to people here," she said, "they said [Solaris x86] did

not run on the platforms as far as they knew."

Another company on SunSoft's list is CompuAdd Computer Corp., also based in Austin, TX. In August, when *SunExpert* first contacted CompuAdd, we were told that the company did not wish to be included in any survey of Solaris PCs. We interpreted comments made by its employees to mean that CompuAdd did not support Solaris x86.

A month later, a reporter from *SunExpert* again contacted the company. At this time, Chuck Crisafulli, the company's product marketing manager, indicated that he believed there had been a misunderstanding. "We support Solaris on our stuff," he said. "In fact, we use the [Solaris] logo on some of our literature."

Asked why he thought his previous statements had been misunderstood, he replied that perhaps there had been confusion between Solaris and SPARC. "It may be that [*SunExpert* research editor McKeon] was thinking Solaris and I was thinking SPARC," Crisafulli said. CompuAdd had, at one time, a SPARCalike in its product line. It has since discontinued the product.

Regardless of any misunderstandings that took place in this conversation, why has it proved impossible for

Usually vendors cooperate. But not this time.

SunExpert to compile a seemingly straightforward table? A SunSoft spokeswoman indicated that since the list, after all, represents SunSoft's own testing efforts, not the vendors', the vendors may have had no way of knowing that their products are Solaris-compatible. "They might not even know the testing had taken place," said the spokeswoman.

SunSoft employees also suggested that the PC vendors might know their hardware runs Solaris but also might not want to be responsible for supporting it.

According to some industry watchers, PC hardware vendors are so fixated on DOS and NT that they may not be aware enough of Solaris to respond to questions about it. "[PC vendors] don't know what UNIX is, anyway," says John Cornelius, president of Carlsbad, CA-based Lighthouse Technology Inc., a Sun aftermarket vendor that has worked with Solaris x86. "They are focused on Microsoft; in other words, they are oriented toward getting things to work correctly with a piece of software–Windows, DOS, NT–that is broken in the first place. Where they add value, in effect, is making that operating system work at all."

Another firm that has worked with Solaris x86 is Aurora Technologies Inc., in Waltham, MA. "We have just intro-

duced some of our boards with x86 compatibility," says Al Balasco, the company's director of marketing. "We are getting a good response from our customers. We think this is a really big opportunity for us in the OEM world."

However, there is another explanation for these vendors' reticence, one that is far less charitable to Solaris: While you can run Solaris on Intel machines, it isn't easy. A glance at the SunSoft list reveals an extensive number of caveats. Here a driver is unavailable, there a video adapter is not supported and someplace else a certain SCSI configuration is not yet available.

X86's problems can be dramatic. David G. Hough, a consultant who runs the San Jose, CA-based validgh (dgh@validgh.com) recently posted to Solaris-oriented Internet newsgroups a 20-page report detailing his own experiences in attempting to configure a Solaris PC using hardware from SunSoft's own list of compatible hardware. His understated conclusion was that such a project was "surprisingly complex."

Hough notes that, in fact, the problems of systems integration–for instance finding the right driver or the right device–are so great that for all but the most determined users, it isn't worth the effort to do the work yourself. "It is worthwhile to have an expert spend a little time instead of you spending a lot of time," he says, "unless you want to become an expert." To that end, SunSoft Press (through Prentice Hall Inc.) has published *PC Hardware: A Configuration Guide*, by Ron Ledesma, which addresses many of the integration issues.

Which brings us, finally, to the few exceptions to our otherwise failure to get a PC vendor to return our phone calls. One cooperative company is EIS Computers Inc., in Moorpark, CA. EIS does nothing but produce Intel-based platforms to run Solaris. "They look like any other PC," says company president David Van Beveren, "except that they are guaranteed to run Solaris."

Van Beveren thinks there may have been serious configuration problems in the past, but that the 2.4 release of Solaris x86 will largely cure them. "Initially, there were only a handful of devices that were supported. Maybe that turned a lot of people off," he says. "It is definitely different with 2.4."

EIS is a start-up and still a small company. It has sold only "a couple of systems" since its product was introduced in April. However, Van Beveren expects his business to start in earnest in the near future. He thinks that Intel's Pentium chip makes his product more than a match for RISC systems. "Six months to a year from now," he says, "unless the workstation vendors come out with major innovations, [Intel platforms] are going to make a very good case for themselves."

But suppose they don't. Suppose driver problems and configuration difficulties make Solaris PCs more trouble than they're worth. "Well," says Van Beveren, "we're also looking at the PowerPC. We're not tied to Intel. We are tied to non-SPARC." ⊷

Solaris on X86 Primer

compiled by MAUREEN MCKEON

Company/Address	SCSI Adapter	SCSI Disk Array	Ethernet Adapter	Tape Drives	Audio	CD-ROM	Pointing Device	Video Display Adapter	Notebook Displays	Systems	Motherboards	MP Systems
Acer America Corp. 2641 Orchard Pkwy., San Jose, CA 95134. **Circle 200**										✔		✔
Adaptec Inc. 691 S. Milpitas Blvd., Milpitas, CA 95035. **Circle 201**	✔											
Advanced Logic Research Inc. 9401 Jeronimo, Irvine, CA 92718. **Circle 202**										✔		✔
American Megatrends Inc. 6145-F Northbelt Pkwy., Norcross, GA 30071. **Circle 203**											✔	
Ambra Computer Corp. 3200 Beechleaf Court, Ste. 1000, Raleigh, NC 27604. **Circle 204**									✔			
Archive Corp. 1650 Sunflower Ave., Costa Mesa, CA 92626. **Circle 205**				✔								
AST Research Inc. 16215 Alton Pkwy., Irvine, CA 92619. **Circle 206**									✔	✔		✔
AT&T Global Information Solutions 1700 S. Patterson Blvd., Dayton, OH 45479. **Circle 207**	✔									✔		
CH Products 970 Park Center Drive, Vista, CA 92083. **Circle 208**							✔					
Chinon America Inc. 615 Hawaii Ave., Torrance, CA 90503. **Circle 209**						✔						
Compaq Computer Corp. 20555 State Highway 249, Houston, TX 77070. **Circle 210**	✔							✔	✔	✔		
CompuAdd Computer Corp. 12303 Technology Blvd., Austin, TX 78727. **Circle 211**								✔		✔		
Corollary Inc. 2802 Kelvin Ave., Irvine, CA 92714. **Circle 212**												✔
Creative Labs Inc. 1901 McCarthy Blvd., Milpitas, CA 95035. **Circle 213**					✔							
Dell Computer Corp. 9505 Arboretum Blvd., Austin, TX 78759. **Circle 214**		✔						✔		✔		

** Company that supplies systems but has not been tested by SunSoft.*

Company/Address	SCSI Adapter	SCSI Disk Array	Ethernet Adapter	Tape Drives	Audio	CD-ROM	Pointing Device	Video Display Adapter	Notebook Displays	Systems	Motherboards	MP Systems
Diamond Technologies Inc. 1275 South Lewis St., Anaheim, CA 92805. **Circle 215**								✔				
DPT 140 Candace Drive, Maitland, FL 32751. **Circle 216**	✔											
Digital Equipment Corp. 146 Main St., Maynard, MA 01754. **Circle 217**										✔		
Dynapoint Inc. 18325 Bedford Circle, City of Industry, CA 91744. **Circle 218**							✔					
EIS Computers Inc. 11904 River Grove St., Moorpark, CA 93021. **Circle 219**										✔		
Elsa Inc. 400 Oyster Point Blvd., Ste. 109, South San Francisco, CA 94080. **Circle 220**							✔					
Exabyte Corp. 1685 38th St., Boulder, CO 80301. **Circle 221**				✔								
Gateway 2000 Inc. 610 Gateway Drive, North Sioux City, SD 57049. **Circle 222**										✔		
Genoa Systems Corp. 75 E. Trimble Road, San Jose, CA 95131. **Circle 223**								✔			✔	
Hewlett-Packard Co. 5301 Stevens Creek Blvd., Santa Clara, CA 95052. **Circle 224**										✔		
Hitachi America Ltd. 2000 Dierra Point Pkwy., Brisbane, CA 94005. **Circle 225**						✔	✔	✔				
IBM Corp. Old Orchard Road, Armonk, NY 10504. **Circle 226**	✔						✔	✔	✔	✔		
Intel Corp. 5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124. **Circle 227**			✔					✔		✔	✔	✔
Lighthouse Technology* 5933 Sea Lion Place #103, Carlsbad, CA 92008. **Circle 228**												
Microsoft Corp. One Microsoft Way, Redmond, WA 98052. **Circle 229**							✔					
MicroSpeed Inc. 5005 Brandin Court, Fremont, CA 94538. **Circle 230**							✔					
Miro Computer Products Inc. 955 Commercial St., Palo Alto, CA 94303. **Circle 231**								✔				
Micronics Computers Inc. 232 E. Warren Ave., Fremont, CA 94539. **Circle 232**											✔	
Mouse Systems Corp. 47505 Seabridge Drive, Fremont, CA 94538. **Circle 233**							✔					
Mylex Corp. 34551 Ardenwood Blvd., Fremont, CA 94537. **Circle 234**		✔										
NEC Technologies Inc. 1414 Massachusetts Ave., Boxboro, MA 01719. **Circle 235**						✔			✔			

** Company that supplies systems but has not been tested by SunSoft.*

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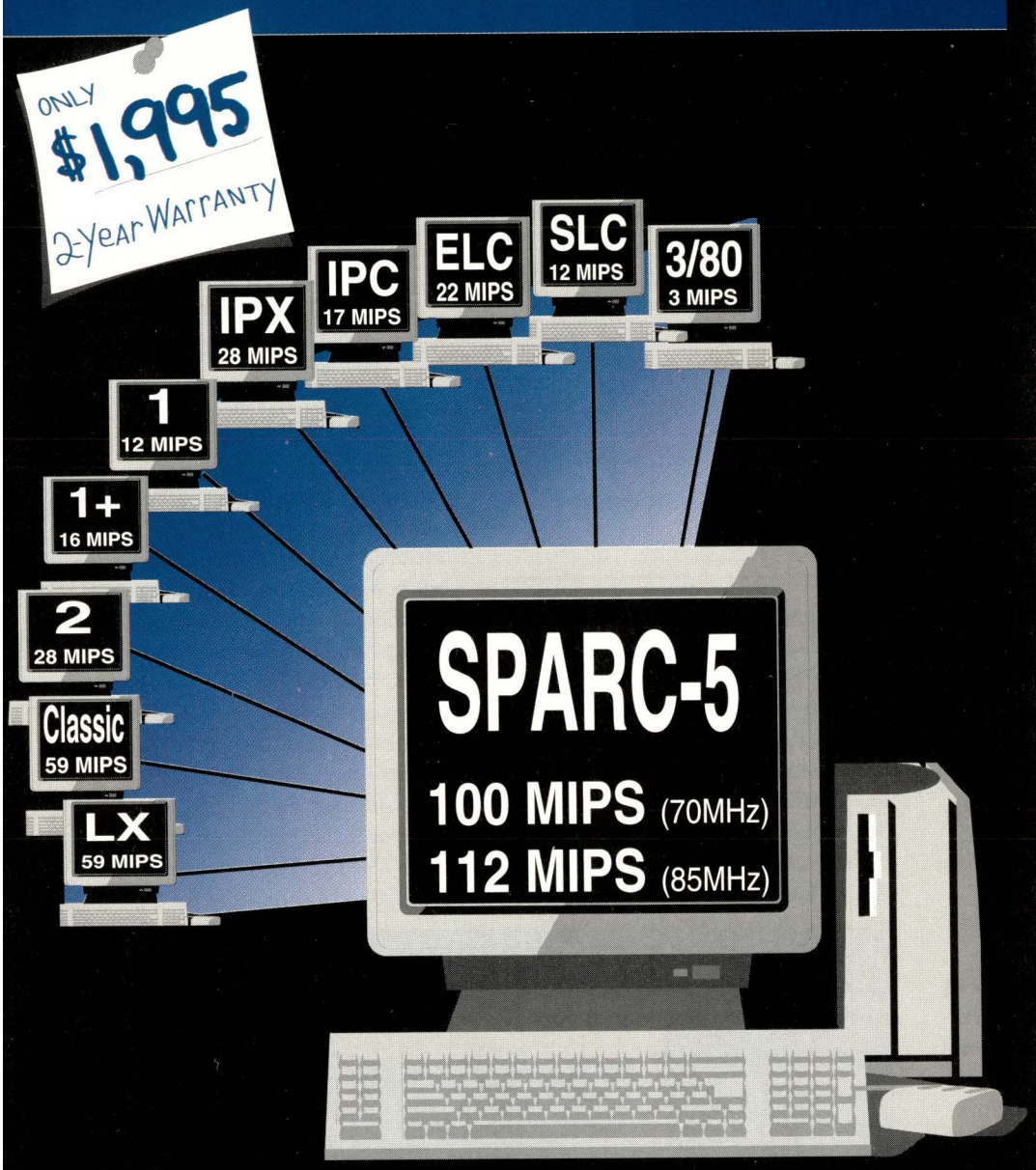

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ViewStation FX, Intersect Bridge and S-TRAC Trackball

by **SIMSON L. GARFINKEL**, Senior Editor

This month we take a close look at a low-cost, high-performance multimedia X terminal, a wireless communications solution and an alternative to mice.

HDS ViewStation FX

In its advertisements, Human Designed Systems Inc. says there are just two steps to making one of its new X terminals work on your network: Plug it in and turn it on.

Of course, the advertising is a fib. Besides turning on this X terminal, you have to assign it an address on your local-area network. You then have to click the mouse on the HDS Setup icon, navigate through a menu or two, and type in the IP addresses of your terminal, gateway and DNS server. Then, you need to decide if you are going to be using the X terminal with XDM. Finally, you reboot the terminal and off you go. It's not the two-step process HDS describes in the advertisements, but it is a lot simpler to get up and running than other X terminals I've configured.

Powered by RISC

Once you get the X terminal running, the first thing you notice is the speed. HDS claims the terminals clock in at 104,000 Xstones with Xbench. In user testing, applications such as Frame Technology Corp.'s FrameMaker, Sun's mailtool and cmdtool executed noticeably faster on the FX (served from a loaded SPARCstation 2 running SunOS 4.x) than they did when run locally on a SPARCstation 5 running Solaris 2.3.

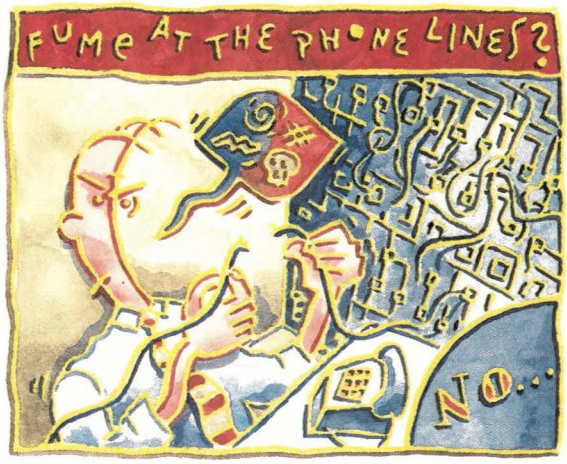
What makes the FX run so fast? The answer is an Intel Corp. 33-MHz i960 (a RISC processor specially optimized for graphics operations), cache memory and custom ASICs. (HDS also has a screaming Ultra series that boosts performance another 50% by adding an interleaved memory subsystem.) The terminals run a proprietary UNIX-like microkernel operating system that's tuned for real-time performance (and has considerably less overhead than Solaris).

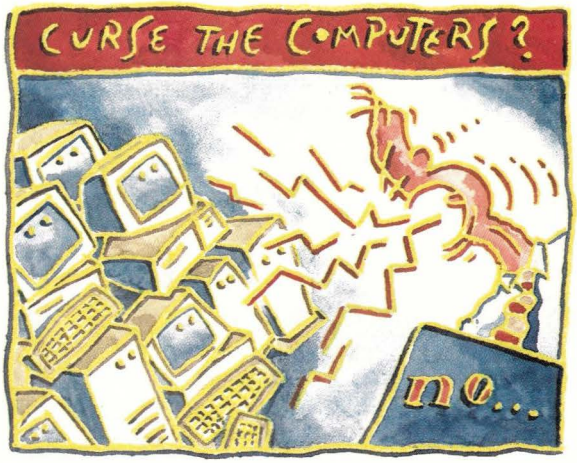
To get the plug-and-play installation, you'll also have to purchase HDS' $99 PCMCIA adapter (holds two PCMCIA cards) and the $499

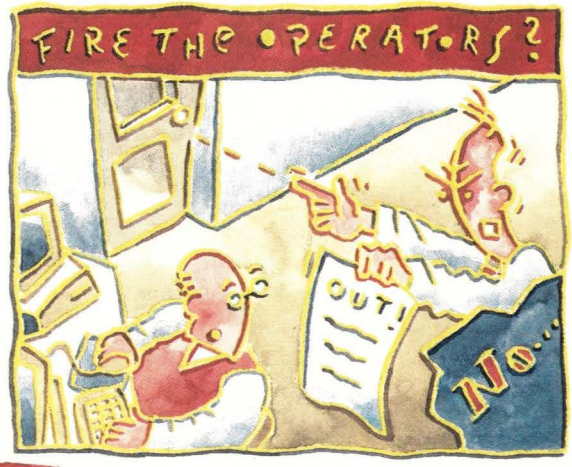
HDS ViewStations are fast, easy to set up and moderately priced with a range of options.

After A Network Problem Threatened To Shut Down His Company's Mission-Critical Applications,

WHAT DID DAVE DO?







That's because there was really no reason to worry. Dave, like managers at more than 3,000 organizations around the world, knew he could depend on Unison Software's networked systems management solutions to keep not only his mission-critical applications running, but all his other processing as well. Unison's products were designed for distributed systems from the outset—redundant management platforms take over if there's a failure of the primary host or network links to the primary. Unison Maestro, Load Balancer and Express are reliable, commercial-strength workload management products for distributed computing. Across both the network and the enterprise. On all the most popular UNIX and open systems platforms. And the products are supported by Unison's nearly 10 years of experience helping companies manage demanding commercial processing environments. So if you'd rather have your managers going to lunch instead of going berserk, call Unison Software today.

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42-MB PCMCIA hard drive. Otherwise, you'll be running diskless, which will necessitate installing HDSware on your SPARCserver. (The terminals use tftp for their remote file system.) An attractive compromise is to order a single HDS terminal with a hard drive and use it as a file server for the others.

Hardware

The FX is a multimedia terminal with the extra-priced options of video capture, digitizing, compression, decompression and display-in-an-X-window. Ports are provided on the back of the terminal for video in, audio in, audio out, keyboard, mouse, RJ11 serial, DB25 bidirectional Centronics parallel and RJ45 twisted-pair Ethernet. An optional $79 communication board equips the machine with ThinWire Ethernet, AUI Ethernet and a second serial port. The terminals can be configured to run SLIP over the serial port for remote applications.

Other optional hardware includes a $249 PCMCIA floppy disk drive that the company says will integrate transparently with Insignia Solutions Inc.'s SoftWindows and Apple Computer Inc.'s Macintosh Application Environment. (HDS did not provide *SunExpert* with a floppy drive for review.) You can also purchase a $500 PCMCIA token-ring adapter or a $199 PCMCIA multimedia stereo sound card.

Off-the-shelf PCMCIA equipment is just one of the ways that HDS has tried to keep prices down. HDS also uses stock PC-style keyboards and a stock three-button mouse. A Digital Equipment Corp.-style keyboard is $60 extra, a Sun Microsystems Computer Corp. Type 4 keyboard is $109 and a Type 5 keyboard is $199. A replacement three-button trackball costs $79.

If you want to do anything with multimedia, you'll need either the HDS netVideo (analog video capture and digital playback) at $499, or the HDS netVideo playback module at $199. You'll also want a video source: HDS sells its ViewCam video camera and microphone for $599, and a computer-controlled TV tuner for $399.

Unfortunately, the push for off-the-shelf hardware also means a lack of integration among all these peripherals. Set up the ViewStation with an external speaker, a TV receiver or a video camera, as well as the external power supplies necessary to power these devices, and you'll soon have a tangle of cables on your desk. HDS would do well to investigate monitors with built-in microphones, speakers and cameras.

The terminal base is just 2.2 inches high, 13.5 inches wide and 12.5 inches deep, and weighs only 7.5 lbs. HDS sells two versions of the FX color base. One is capable of 1,024-by-768 resolution; the other is switchable between 1,152–by-900 and 1,280-by-1,024.

The HDS ViewStation FX: The Naïve View

Once again I've been asked to give the "naïve user's" perspective on a piece of equipment–this time the HDS ViewStation FX. Now, if I were a less secure, more paranoid individual, I'd wonder why my co-workers keep coming to me for naïveté.

About the ergonomics of the HDS ViewStation:

- It's an X terminal.
- It runs X stuff.
- So far it hasn't given me carpal tunnel syndrome.

The ViewStation is smaller than the Sun 3/50 I was using as an X terminal. Ditto sleeker, neater, keener and so on. In fact, it has one of those high-tech-looking designs that big-name industrial designers churn out for people who can appreciate the prices.

This machine is a "multimedia" device. That means that there's this little camera that comes with it. The lens is on a long, flexible lead. It's sitting next to me right now. Makes me nervous. The lens looks a little like the heat ray thingies the Martians used to incinerate California in the '50s movie version of *The War of the Worlds*.

Also, as near as I can tell, actually using the multimedia apps screws up the system's performance right royal. I could be wrong. It could just be an installation problem. But at the moment I've got the video window open and each keystroke takes a full second to register. I feel like I'm telneting to Guam.

The HDS ViewStation has a PC-style keyboard, so PC users should feel right at home. I hate PCs myself. Hate 'em with a passion. The Delete isn't up in the right-hand corner. It's down on one side. And all the arrow keys are sort of scrambled up together next to the number keys. I keep trying to go up a line or two and instead get this string of 8s. I hate that.

Oh, and it makes noise. Nice noise, but noise. It's pretty quiet normally, but this particular HDS ViewStation has a local disk. This means things happen faster than if you're bashing on the host–which is good. Though I gotta confess that it's a little disconcerting to have a terminal (that's "terminal," as in no local storage) make disk noises at you. It's easy to have an identity crisis when you log out and hear a buzz in the background. You have the vague feeling that you're either working on a Mac and no one told you, or you've just discovered a nest of killer bees in your file drawer.

All in all, I guess the ViewStation's OK. I mean, I don't have anything really forceful to say about it one way or another. Which, I suppose, is a good thing. You want your users to pay attention to their work rather than the machine they're working on.

Still, I miss my 3/50. Now, there was a system with character. I knew what all the food stains were. And, I'd burned it up twice. You bond with a system after you've had the fan fail and watched it go up in smoke a few times. *–mjt*

Software

If you buy the ViewStation FX's hard drive, you'll find that it comes preloaded with HDSware–the terminal's system software and a suite of productivity applications. Bundled applications include a terminal, calculator, clock, screen saver, window manager (both OpenWindows and Motif) and the multimedia applications. Unfortunately, HDS does not make its software available over the Internet and will charge you $300 to $600 for magnetic media if you do not buy the hard drive.

The ViewStation FX we tested booted into its X server in 48 seconds. If you are running XDM, you'll get the standard X login panel. Otherwise, you'll get a blank screen with the HDSware icon in the lower right-hand corner. The OpenWindows menu is preconfigured to launch various HDS applications.

The system runs almost silently (there's no fan), although the hard disk makes a whirring noise when it spins up. (According to HDS engineer Michael Kantrowitz, spinning down the hard drive when it is not in use dramatically increases the drive's life span.)

Despite the fact that we were reviewing beta-release software, the HDS applications seemed generally trouble-free. Applications can be run either from the OpenWindows menu on a local window manager or by using the `rsh` or `rlogin` commands. Be careful, though. Unless you password-protect commands such as `shutdown`, anybody on the Internet who can reach your machine can run applications locally. What's especially troublesome is that the HDS system ships, by default, with all security measures turned off. If you really just follow the company's advertisement by plugging in the terminal, turning it on and getting to work, you may fall victim to pranksters in your office or around the world.

The ViewStation allows you to preview PostScript files with a proprietary application called hdsview–HDS doesn't support the X extensions to PostScript. (I was assured by HDS that the only thing users want to do with Display PostScript is preview PostScript files.)

The ViewStation FX's multimedia capabilities worked as advertised: Our stations could digitize video, transmit it over the Ethernet and display it in the window of another ViewStation. Multicast allows a single video source to transmit to many stations simultaneously (just the thing for piping CNN Headline News around the trading room). For conferencing, however, the 2-second delay in each direction created by the video compression/decompression hardware made real-time conversations disconcerting.

Video capture dramatically slowed down the speed of other X functions. Furthermore, the microphone sold with the FX is not well-suited to office environments. HDS would do well to explore headsets as a future offering.

The Bottom Line

HDS ViewStations are fast, easy to set up, moderately priced X terminals that offer a wide range of options. While teleconferencing with X terminals seems more like an expensive gimmick than a vital feature, the ability to drop multicast video into an X window is an important capability for some applications. The company also needs to pay some attention to the growing rat's nest of cables that its multimedia systems are creating.

ViewStation FX Built-In Applications

auhds	hdssimulcast
chooser	hdstetris
hds3270	hdstuner
hdsaudio	hdsvid
hdscalc	hdsview
hdsconf	hdsxclock
hdsdclock	ico
hdsmaze	mwm
hdsmovie	olvwm
hdsnettv	waitforserver
hdsoclock	xhost
hdsplay	xmodmap
hdsscreensaver	xset
hdsscript	

You can also write your own applications using the HDS Developer's Kit ($5,000), which is based on the GNU C/C++ compiler.

ViewStation FX

Company
Human Designed Systems Inc.

Address
421 Feheley Drive
King of Prussia, PA 19406

Phone
(610) 277-8300

Fax
(610) 275-5739

Best Feature
Fast, easy installation; inexpensive

Worst Feature
Multimedia options are pricey

Price
14-inch color FX14C (1,024-by-768), $1,399
17-inch color FX17C (1,280-by-1,024; 1,152-by-900), $1,599

Circle 149

Intersect Remote Bridge

Most computer geeks think there are two kinds of people in the world: hardware hackers and software gurus. But in reality, there is a third kind of person: the ham radio freak.

With this taxonomy in mind, it's easier to understand Persoft Inc.'s Intersect Remote Bridge as a peripheral that taps the interest of the entire user community. Persoft's product is a high-speed Ethernet bridge designed to appeal to both hackers and gurus in search of higher bandwidth, but you might also need a person skilled in the ways of radio to make this unit work.

Persoft promises a 2-Mb/s radio link–faster than a T1 leased line, not quite as fast as an Ethernet, and free of any telephone company charges. The system transmits at 900 MHz with a

Persoft's Intersect Remote Bridge is designed to appeal to hackers and gurus in search of bandwidth, but call a ham radio freak to make it work.

frequency-hopping spread spectrum technology that makes it immune to ambient noise. No Federal Communications Commission license is required, although the unit's ¼-watt transmission power limits its usable range to between 1 and 3 miles.

The Intersect Bridge is a true Ethernet bridge: When the system is turned on, all of the packets transmitted on one Ethernet are automatically sent to the other. As the system runs, it makes a map of all the Ethernet hosts on each side of the radio link. If the bridge realizes that a packet doesn't need to be sent across the radio link, it doesn't send it.

Hardware

Each bridge consists of an off-the-shelf IBM PC clone with a 486SX microprocessor, Ethernet interface with AUI, ThinWire and 10BaseT interfaces, two serial ports and a parallel port, power supply and a floppy disk drive. Persoft can also supply antenna wire and a selection of outdoor antennas.

While off-the-shelf hardware certainly keeps down the price of engineering and manufacturing, it's still a bit of a shock to unpack a $12,990 pair of radio routers and see a $500 PC. Persoft could use any one of the compact, PC-compatible embedded systems on the market; using them would cut costs and decrease the unit's size.

If the idea of sending your organization's data through the air for anybody to intercept makes you uncomfortable, you'll probably want to purchase Persoft's optional DES security chip ($390 per pair), which performs full Data Encryption Standard enciphering of every packet sent over the link. While DES isn't perfect, current estimates show that it would cost a government or major corporation between $1 million and $10 million to build a machine capable of decrypting DES-encoded data in anything resembling real time. This being the case, Persoft's encryption option would simply not be acceptable for an investment house sending hundreds of millions of dollars in trades over the wire every hour.

Installation and Setup

Installing the Persoft bridges is a two-step process. First, you have to set up the antennas for the radio link and run a program called Rangefinder at each end. Once the two bridges can listen to each other, the Rangefinder prints signal strength, packet loss, background noise and other numbers interesting to radio hams. The next step is to run the configuration program that lets you set each bridge's name, its network ID, the Ethernet interface, the units' encryption key, access control (determining which Ethernet or IP addresses don't get sent across the link), tree-spanning options (how the algorithm adapts) and SNMP options.

Once you page through the menus, the system's configuration is written to the floppy disk, and the bridge software restarts automatically. After the system is configured, no console is required for normal operation. The systems restart automatically after a power failure.

To run the configuration program, you need to connect either a terminal or a PC to one of the serial ports on the unit's back. Persoft gives you a special cable for connecting a standard PC RS-232 interface to the unit. Unfortunately, the company does not have a cable for Sun-style mini-DIN RS-232 connectors.

The most annoying feature of the software we tested was its use of serialized, copy-protected floppy disks. Each unit has a unique serial number that is typed on a white label and pasted to the unit's side. The floppy disks contain matching serial numbers, and you have to get the right disk into the right unit, or the system will not function properly. Persoft says this scheme prevents their distributors from ripping them off, but it's a pain for end users. The company claims that it will be moving to "an industry-standard dongle" system within a few months. Unfortunately, current plans are to mount the dongle outside the unit on the system's parallel or serial port. This would be a mistake, as it would make the dongles easy to lose or damage.

We found that the most difficult part of the installation procedure was establishing the radio link in the first place. Persoft provided us with three pairs of antennas: a paperback-size white omnidirectional antenna ($199

Intersect Remote Bridge

Company
Persoft Inc.

Address
465 Science Drive
Madison, WI 53711

Phone
(608) 273-6000

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(608) 273-8227

Best Feature
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each) with a range of up to 1,000 meters; a four-element directional antenna ($375 per pair) with a range of two to three miles; and a 10-element directional antenna ($395 per pair) with a range of three to four miles.

In our first test, we used the omnidirectional antenna to set up a radio link from one side of our office building to the other. The Persoft units worked flawlessly. While this may seem a high-cost alternative to Ethernet, it might make sense for a company that has offices on both sides of a downtown street.

Our second attempt involved setting up a link from *SunExpert*'s offices at Coolidge Corner (in Brookline, MA, near the top of a hill) to an editor's house in Central Square, Cambridge, MA, a distance of about two miles. Try as we might, we couldn't get the Rangefinder program to make the two units recognize each other. Eventually, we took out our maps: The two-mile distance was near the stated limit of the Intersect bridges, and there were two apartment buildings in the way. It probably wasn't a fair test.

For our third attempt, we kept one unit at the editor's house and moved the other to the 8th floor of the Massachusetts Institute of Technology's Artificial Intelligence Laboratory; the distance here was slightly over a mile. Bruce Walton, the Lab's computer operations manager, helped us try to align the antennas and establish a signal. Unfortunately, despite our best efforts, we still couldn't use Rangefinder to get the units to recognize each other.

Perhaps this was another unfair test. Outside the editor's window that points in the direction of the AI Laboratory is a large obstacle: a tree. Indeed, in a conversation with Persoft engineer Benjamin Haidri, we learned that customers sometimes have links mysteriously fail in the spring when nearby trees sprout new leaves. (Leaves absorb the 900-MHz frequency these bridges use.) Or perhaps the metal window frame at the AI Laboratory interfered with the microwave signals: We were unable to gain access to the building's roof to string the 33-foot antenna extension cable ($75) to the Lab's machine room.

After two weeks of trying different antennas, configurations, grounding arrangements and other options, we gave up and finished our tests on the omnidirectional antennas with the two bridges located in the same building.

Bottom Line

Under ideal conditions (with packet reception rates nearing 100%), the Intersect bridges functioned as reliably as the Ethernet to which they were attached.

In our laboratory tests, the speed of file transfers over the radio link was measurably slower than the speed of file transfers over copper. (We clocked the maximum TCP/IP transfer over the radio link at 108 KB/s, compared with 250 KB/s over Ethernet.) In user testing, we did not notice a perceptible delay in operations such as NFS, mail reading or net surfing with Mosaic, although large data transfers did occur at a slightly slower pace.

Compared with a T1 leased line, the Intersect units can transfer data faster and are easier to set up. And, despite their $12,990 price, they are actually cheaper to own and maintain after the first year, because a functioning T1 connection requires two high-speed routers (at $3,000 each) and a line from the telephone company ($300 to $700 per month).

Although we were unable to get the units to work for our distance testing, organizations that need to set up a short-distance link might give the bridges a try–an option made even easier by Persoft's 30-day money-back guarantee.

MicroSpeed's S-TRAC Trackball has a feature that addresses the click-and-drag problem.

MicroSpeed Trackball

For years, MicroSpeed Inc.'s trackballs have been the ideal low-cost accessory for Sun users who are sick of Sun's optical mouse. The Trackball takes up half as much desk space as a Sun optical mouse pad, doesn't mind if you turn it at odd angles, and has a built-in rest for your hand. Equivalents for Sun's three mouse buttons are neatly placed to the left, right and above the billiard-sized trackball.

Unfortunately, some people complained to MicroSpeed that using the trackball was difficult with Sun's OpenWindows or Motif, both of which require the user to frequently click the mouse and drag it to another part of the screen: Some people find that spinning the trackball while holding down one of the three buttons is an error-prone and awkward maneuver at best.

Well, no more. MicroSpeed's new S-TRAC trackball contains a nifty feature that simulates a depressed mouse button if you hold the button down for more than a few moments. A second click releases the drag operation.

I was skeptical at first when I heard of this new gimmick. After more than a month's practice, I'm still skeptical: MicroSpeed's new gimmick means that every mouse-drag becomes a double-click. To make matters worse, there is no light or other handy indicator telling you if the mouse is in "drag" mode or not. Sometimes, when I'm simply being thoughtful about pressing a button on the computer's screen, I end up going into drag mode. Other times, I'm sure that I'm in drag mode, but it turns out that I'm not.

On the other hand, for all of the

new MicroSpeed trackball's problems, it's still better than Sun's optical mouse, which I find difficult to use at best. At least with the trackball, I never run off the edge of the mouse pad.

Installation of the S-TRAC is a snap: Just unplug your existing mouse and plug it in. MicroSpeed should also work with laptops with an external keyboard/mouse connector, such as Tadpole Technology Inc.'s SPARC-Book 3. MicroSpeed makes three versions of the trackball: one with a miniDIN 8 for Sun workstations that have a Type 4 or 5 keyboard, an RJ11 version for old Sun Type 3 keyboards, and an SGI DB9 version for Silicon Graphics Inc. workstations. All come with a 4-foot cable.

MicroSpeed offers a one-year warranty on parts and labor, and a limited lifetime "smooth rolling" warranty, under which the company will replace your rolling bearings for just $10.

There's not a whole lot more to say about the S-TRAC. It's a shame that there is no way to turn off the automatic-drag feature, but if you, like me, have always hated Sun's optical mouse, then you have no excuse not to get one.

S-TRAC Trackball

Company
MicroSpeed Inc.

Address
44000 Old Warm Springs Blvd.
Fremont, CA 94538

Phone
(510) 490-1403

Fax
(510) 490-1665

Best Feature
Snap to install

Worst Feature
No way to turn off automatic drag

Price
$199

Circle 151

NEW PRODUCTS

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

SPARCstation 20-Compatible

Pinnacle Data Systems has introduced a SPARCstation 20-compatible system with more SBus slots and internal storage than Sun's original. The

DataStation 20 comes in single-, dual- and quad-processor models. It is based on the 50-MHz and 60-MHz versions of the SuperSPARC.

The DataStation 20 has four SBus slots (the SPARCstation 20 has two). In addition, the DataStation 20 can hold up to two 2.1-GB disk drives. Pricing begins at $10,450.

Pinnacle Data Systems Inc.
1350 West Fifth Ave.
Columbus, OH 43212
Circle 101

Integrix Shows SWS10+

Integrix, a vendor of SPARC-based peripherals and workstations, has introduced a SPARCstation 20-compatible. The SWS10+ has two MBus slots with room for up to four processors per system, four SBus slots and up to 512 MB of internal RAM. It also comes with Ethernet, ISDN, 16-bit audio and SCSI-2 interfaces.

The SWS10+ includes a 50-MHz processor module. Its performance parallels that of the SPARCstation. It offers 135.5 MIPS, 27.3 MFLOPS, 69.2 SPECint92 and 78.3 SPECfp92. Pricing begins at $4,495.

Integrix Inc.
1200 Lawrence Drive, Ste. 150
Newbury Park, CA 91320-1316
Circle 102

Solaris PCs

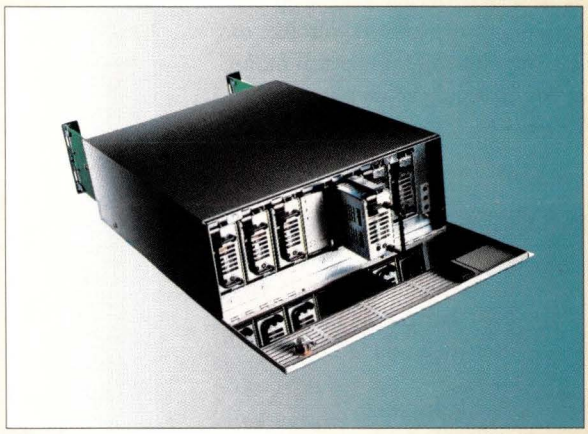
Two lines of Intel Corp. chip-based personal computers uniquely configured to run Solaris x86 have been introduced by EIS Computers. The first product line is the The Client, consisting of the Client and Client P60, both of which use the ISA bus. The first device is based on a 486 DX/2 running at 66 MHz. It comes with 16 MB of RAM and a 256-KB cache. Pricing begins at $2,059, excluding the cost of Solaris.

The Client P60 has all the features of the Client but is based on a Pentium processor and also has a network adapter. Pricing has not been fixed but is estimated to be less than $4,000, again excluding the cost of Solaris.

EIS' second line is the Developer series–EISA devices intended for users with demanding disk and memory requirements. There are three models in the series. The Developer is based on the Intel 486 DX and comes with 32 MB of RAM and 256 KB of cache. Pricing begins at $3,178. The Developer P90, meanwhile, is based on a

Storage Subsystems

Storage Dimensions has introduced the LANStore SuperFlex, a disk and tape storage system. The fault-tolerant SuperFlex system comes with interchangeable I/O modules, allowing it to be



configured to new buses on the market. The product currently supports UNIX systems and Intel Corp. chip-based platforms.

The SuperFlex's backplane is a dual SCSI bus that supports Wide SCSI, Wide Differential and Fast and standard SCSI storage modules. An optional RAIDFlex I/O module allows the SuperFlex to become a disk array.

The SuperFlex system enclosure has seven drive bays, each of which can house a disk or DAT drive. The product uses 1-, 2.1- or 4-GB drives, with a capacity of 1 to 28 GB. Each system also supports one to seven DAT tape modules. Pricing begins at $39,920.

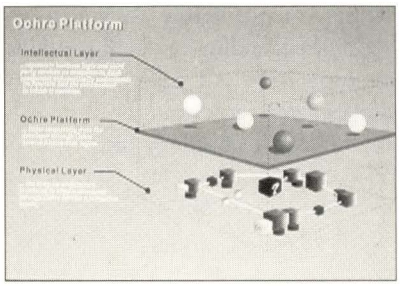
Storage Dimensions Inc.
1656 McCarthy Blvd.
Milpitas, CA 95053
Circle 100

Pentium at 90 MHz on a EISA PCI board, comes with a 1-GB disk and is priced at $4,899. Finally, the Developer P90i is also based on a 90-MHz Pentium on an ISA/PCI motherboard. It is priced at $3,859.

EIS Computers Inc.
11904 River Grove St.
Moorpark, CA 93021
Circle 103

Enterprise Software Platform

An Australian company, Ochre Development, has officially moved into the U.S. market with its announcement of the Ochre Platform. The Platform is an underlying layer of



software that systems managers can run on networked machines to assist in the linking and coordination of other applications. The product runs on UNIX, Windows, Windows NT and VMS. It works with several standard RDBMSs (e.g., Oracle) and other applications.

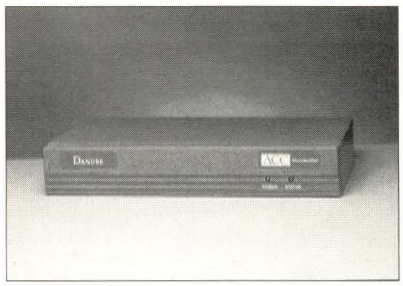
The Platform features a collaborative-development tool kit that makes it possible for entire groups of developers to work on a single project. It also has an object-oriented scripting language and can be used to develop applications or to link applications through the platform. Facilities are included for partitioning applications that might run across disparate platforms and for automatic transaction recovery in the event of a network failure.

The Platform is less than 600 KB. The Ochre Developer's Toolkit starts at $15,000, while individual Ochre Platforms range from $195 for the Windows version to $25,000 for a large, multiprocessor UNIX version.

Ochre Development Inc.
1350 Bayshore Hwy., Ste. 520
Burlingame, CA 94010
Circle 104

Danube Links Satellites

The Danube, a LAN-to-WAN router/bridge designed to link remote sites to their corporate headquarters, has been introduced by Advanced



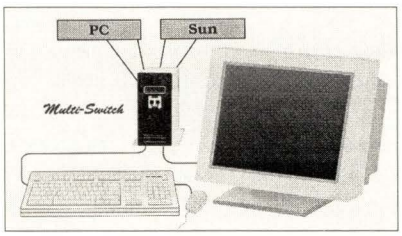
Computer. The Danube sits in a remote office LAN and provides a WAN interface. On the LAN side, the Danube comes with autosensing Ethernet connectors to link to 10BaseT via an RJ-45 connector, or to 10Base-5 via an AUI connector. On the WAN side, the product supports such WAN interfaces as RS-232, V.35, RS-422, X.21, as well as ISDN Basic Rate Interface.

The Danube supports a variety of network protocols. These include TCP/IP, Novell Inc.'s IPX and Apple Computer Inc.'s AppleTalk. Its WAN protocols include frame relay, PPP, HDLC/LAPB, CCITT X.25 and DDN X.25. The Danube supports WAN link speeds up to 2,048 Mb/s. Pricing begins at $1,995.

Advanced Computer Communications
10261 Bubb Road
Cupertino, CA 95014
Circle 105

PC-Sun Switch

Users who have both a PC and a Sun workstation but want to have only one



keyboard, mouse and monitor on their desk may wish to investigate the Multi-Switch from Lightwave Communications.

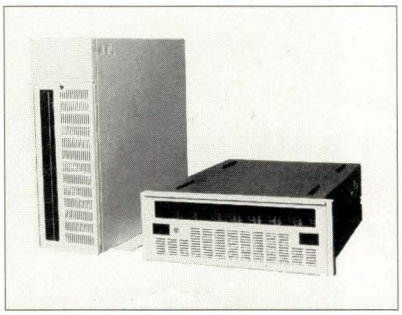
The Multi-Switch resides on a link between the Sun and PC on one side, and the user's monitor and keyboard on the other. The user can, by pushing a button, choose which system he or she wants to run the display and to react to keystrokes.

The Multi-Switch is 9 inches high by 4.3 inches wide and 10.25 inches deep. It weighs 8 pounds. Pricing begins at $795.

Lightwave Communications Inc.
84 Research Drive
Milford, CT 06460
Circle 106

Eight-Drive SCSI Chassis

Sigma Information Systems has introduced the SA-H335, an enclosure that supports up to eight Fast/Wide SCSI 3½-inch disk drives and a



RAID controller. The SA-H335 comes in tower and rack-mount configuration. In either design, the product supports eight hot-plug drive slots with steel canisters for the disk drives. It also has dual redundant hot-pluggable power supplies, a fast/wide SCSI interface, automatic drive bay power sequencing, support for multiple SCSI hosts, mounting and power for a RAID controller and an optional 3½-inch tape/optical drive canister.

The SA-H335 tower is 22¼ inches high, 7.29 inches wide, and 22.44 inches deep. It is converted to the rack-mountable version via a top cover, chassis flanges and slides. Pricing begins at $2,343, with drive canisters priced at $129 each.

Sigma Information Systems Inc.
5775 Polaris Ave.
Las Vegas, NV 89118
Circle 107

Pocket Print Server

Axis Communications has introduced pocket print servers for token-ring networks. The NPS 630 and NPS 632 are both based on Axis' own

ETRAX chip, a 32-bit device that provides both a token-ring and an Ethernet controller. The NPS 630 and 632 control the token ring by providing simultaneous printing of Novell Inc.'s NetWare, LAN Manager, LAN Server, TCP/IP and Microsoft Corp.'s NT.

The NPS 630 comes with an RJ-45 connector to support UTP Level 3 cabling. The NPS 632, meanwhile, supports DB-9 STP Level 1 cable. Both come with one parallel port, are switch-selectable to either 4 or 16 Mb/s, and support throughput up to 1,200 Kb/s. Pricing begins at $595.

Axis Communications Inc.
99 Rosewood Drive, Ste. 170
Danvers, MA 01923
Circle 108

Fiber Fox

The Fox, a fiber-optic multiplexer, has made its debut. The Fox is a four-channel device that provides full-duplex communications among eight devices over a single pair of fiber-optic

cables. Each of the four channels can run simultaneously at up to 64 Kb/s.

There are four RJ-11 connectors at the rear of the product, one per user port. Each multiplexer is supplied with four 25-foot RJ-11 cables and four male and four female RJ-11-to-DB25 adapters. The Fox begins at $450.

Telebyte Technology Inc.
270 Pulaski Road
Greenlawn, NY 11740-1616
Circle 109

Printing Typhoon Hits Town

Dataproducts has added the Typhoon 20 to its Typhoon family of RISC-based printers. The 20 is a 20-ppm laser printer for departmental printing applications. It is also Dataproducts' first product to incorporate its new Virtual Printer Technology (VPT) Version 3.0. The Typhoon 20 features a high-speed controller, PostScript Level 2, PCL5 emulation and enhanced edge printing using DpTek TrueRes technology. It handles paper sizes up to A3 (11-by-17 inches) at resolutions of 300, 400, 600 or 800 dpi.

VPT 3.0 offers support for 22 popular network operating systems. Multiple protocols, including Digital Equipment Corp.'s LAT, UNIX TCP/IP, Novell Inc.'s IPX and Apple Computer Inc.'s EtherTalk, are supported concurrently. VPT's new version offers a feature called resource accounting, which allows a network administrator to track printer usage for up to 64 users.

Prices start at $5,095 for a two-tray configuration.

Dataproducts Corp.
6219 De Soto Ave.
Woodland Hills, CA 91365
Circle 110

Antares Adds TurboGX

Antares Microsystems has added the TurboGX Graphics Accelerator to its line of SBus graphics cards. The TurboGX accelerates 2D/3D vector rendering and windows. It supports resolutions of 1,152-by-900 at 60 Hz and 77 Hz, and 1,024-by-768 at 66 Hz and 76 Hz. Software written for the GX Graphics card will run on the TurboGX. Pricing begins at $1,495.

Antares Microsystems Inc.
160B Albright Way
Los Gatos, CA 95030
Circle 111

Lighthouse RAID

Lighthouse Technology, a value-added reseller of SPARC-compliant workstations and peripherals, has introduced its Rhapsody RAID line of storage subsystems. Rhapsody's features include a "warm spare" drive, which Lighthouse describes as a drive in the enclosure that will automatically spin up and start rebuilding the data in the case of a drive failure. Other product features are up to 32 MB of cache memory and support of up to three hosts and both 3½- and 5¼-inch form factor disk drives. RAID levels 0, 3 and 5 are featured. Rhapsody RAID requires no software drivers and supports AIX, HP/UX, IRIX and Solaris operating systems.

Prices range from $15,000 to $40,000, depending on configurations and capacities. All prices include a standard five-year warranty.

Lighthouse Technology Inc.
5933 Sea Lion Place, Ste. 103
Carlsbad, CA 92008
Circle 112

Chicago-Ready X

A PC X server designed for Chicago, a k a Microsoft Corp. Windows 4.0, has been introduced by VisionWare. An upgrade of its existing XVision 5 product, the PC X server is X11R6-compliant, with support for the X Image Extension, and is also compliant with the specifications for the yet-to-be-released Chicago. VisionWare says this compliancy makes the product a means of migration for users who are running earlier Windows versions but who will be upgrading when 4.0 is available.

XVision 5 6.0 provides a number of additional features: 32-bit performance with bundled Win32s, automatic network sensing and host-aware installation. Moreover, the product offers a bundled WinSock-compliant TCP/IP stack. Pricing is $495.

VisionWare Ltd.
4500 Bohannon Drive #280
Menlo Park, CA 94025-1029
Circle 113

Intelligent Touch Screen

A new touch screen is available from Elo Touchsystems. The IntelliTouch Model 1765 TouchMonitor is a gener-

al-purpose, 17-inch flat square tube color monitor with a glass touch panel.

The company says the IntelliTouch may find roles in applications such as public information kiosks, process control and computer-based training. The monitor has a 1,280-by-1,024 resolution and a vertical refresh rate of up to 100 Hz. Pricing begins at $1,980.

Elo TouchSystems Inc.
41752 Christy St.
Fremont, CA 94538
Circle 114

Quad-Speed CD-ROM

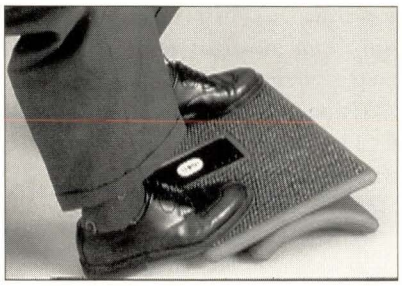
Toshiba America's Disk Products Division is calling its new quad-speed CD-ROM drive the XM-3501 Series. The company claims the Series is the fastest of its kind in the industry, with a 120-ms random seek and a 600-KB/s sustained transfer rate. Ideal situations for such high-speed drives include database and multimedia applications. The XM-3501 Series features a SCSI-2 interface, synchronous data transfer at up to 4.2 MB/s, digital audio transfer and a 256-KB data buffer.

List prices are $470 for the XM-3501B internal drive and $600 for the TXM-3501E external drive.

Toshiba America
Information Systems Inc.
Disk Products Division
9740 Irvine Blvd.
Irvine, CA 92718
Circle 115

Footrest for the Weary

A footrest for computer users has been introduced by Ergodyne. The Ergodyne WorkSmart adjustable footrest guards against the repetitive stress injuries, also known as cumulative trauma disorders, that can result from long hours spent at the keyboard. Ergodyne says the WorkSmart footrest



encourages proper sitting posture, supports the lower back and increases circulation to the legs. The WorkSmart is made of plastic with a carpeted surface. Suggested retail price is $59.95.

Ergodyne
1410 Energy Park Drive, Ste. 1
Saint Paul, MN 55108
Circle 116

Resolution Upgrade Kit

J&KH Software has introduced a kit that can upgrade the resolution of certain Sun monitors. The Resolution

Upgrade Kit works with Sun Microsystems Inc.'s 15-inch color monitor (model number 3651286-01) to upgrade the monitor's resolution from 1,024-by-768 to 1,152-by-900. The monitor model above is used with the SPARCclassic, SPARCstation LX and SPARCclassic X. The Resolution Upgrade Kit is priced at $250.

J&KH Software Inc.
242 Beachwood Road
Fort Mitchell, KY 41017
Circle 117

PC X for OS/2

Hummingbird Communications has released a PC X server for OS/2. The company says its eXceed/Xpress-OS2 is a native OS/2 PC X server based on a 32-bit X11R5-compatible X server. The product also offers serial line communications support using Tektronix's serial Xpress communication software. This allows an OS/2 PC to remotely access UNIX and/or VMS servers via standard telephone lines. Pricing on eXceed/Xpress-OS2 begins at $245, while the eXceed/Xpress host module is $125.

Hummingbird Communications Ltd.
2900 John St.
Markham, ON L3R 5G3
Canada
Circle 118

Alpha-Based Multiprocessor Board

For those interested in multiprocessor systems that use Digital Equipment Corp.'s Alpha chip, Alta Technology Inc., 12012 Technology Blvd., Austin, TX 78727. **Circle 123**

Upgrades, Enhancements, Additions...

• Version 3.0 of Purify, the software development and AQ tool, is now available from Pure Software. Purify is noted for its ability to detect memory leaks. The new version is easier to use because of a new graphical user interface. **Pure Software Inc.**, 1309 S. Mary Ave., Sunnyvale, CA 94087. **Circle 119**

• Memory maven Kingston Technology has introduced memory upgrade kits for SPARCserver systems. The company is offering upgrades in 32-MB, 64-MB, 128-MB and 256-MB configurations. **Kingston Technology Corp.**, 17600 Newhope St., Fountain Valley, CA 92708. **Circle 120**

• For companies that need to link their SPARCstations and SPARCservers to EISA and ISA bus machines, Rockwell Telecommunications has introduced PC versions of its FDDI adapters. The company, which already has a line of SBus products, now also has the 1265 ISA bus and 1275 EISA bus adapters. Both are priced at under $1,300. **Rockwell Network Systems**, a division of Rockwell International Corp., 7402 Hollister Ave., Santa Barbara, CA 93117-2590. **Circle 121**

• Graphics programmers frequently find themselves migrating from the PHIGS graphics system to the more modern PEX (PHIGS Extension to X). To this end, Template Graphics Software (TGS) has announced Version 5.0 of its Figaro+. The company says the new version of the product supports both PHIGS and X tools, and that this assists developers in moving applications. **Template Graphics Software Inc.**, 9920 Pacific Heights Blvd., Ste. 200, San Diego, CA 92121-4331. **Circle 122**

• Tadpole Technology is generally known in the SPARC world as the vendor of a highly successful laptop. But, long before it built portables, Tadpole was a board vendor, and still is. In August, the company introduced Version 2 of its TP912, an embedded system board featuring the microSPARC processor. The new version features the microSPARC II, running at 70 or 85 MHz, plus four SIMM sites for up to 128 MB of DRAM. **Tadpole**

• For those in need of increased system security, Haystack Laboratories has released Version 1.3 of its Stalker system security and accountability product. The new version incorporates an expanded database of searchable misuses, and is available for SunOS 4.1.x and Solaris 2.x. **Haystack Laboratories Inc.**, 10713 RR 620 North #521, Austin, TX 78726. **Circle 124**

• Loox Software has introduced a new release of its object-oriented graphics development tool for X. Loox, the product, allows developers to rapidly create interactive graphics for UNIX applications. Loox Version 3.0 includes a class of ready-to-use dynamic objects and two new classes of vector objects. **Loox Software Inc.**, 4962 El Camino Real, Ste. 206, Los Altos, CA 94022. **Circle 125**

• Vmark Software has announced that its PICK-inspired uniVerse data management system now has a driver for Uniface. Developers can use Uniface's 4GL and development tools to construct UniVerse applications. **VMark Software Inc.**, 30 Speen St., Framingham, MA 01701-1800. **Circle 126**

•Networking and communications vendor Optical Data Systems has increased the bandwidth of its Infinity line of FDDI hubs. The hubs will now support four dual-attached FDDI rings for a total throughput of 400 Mb/s. In addition, the number of FDDI users per chassis has been increased from 60 to 132. **ODS Inc.**, 1101 E. Arapaho Road, Richardson, TX 75081. **Circle 127**

• FTP Software has announced Version 4.0 of its LANWatch network analyzer. The new release is designed to be easier to install, learn and use, and features, for instance, a mouse-driven interface with pull-down menus. **FTP Software Inc.**, 2 High St., North Andover, MA 01845-2620. **Circle 128**

• Need a new keyboard? Key Source International has introduced the K80-2100 Sun, a Sun-compatible keyboard that can be customized at the factory. Users may specify custom keycap colors, legends and key codes with macros. **Key Source International**, 2391 American Ave., Hayward, CA 94545. **Circle 129**

nology has introduced a line of multiprocessor boards for parallel and embedded systems. The boards will be based on the Alpha 21064, running at 200 MHz; the Alpha 21064A, at 275 MHz; and the Alpha 21066, at 166 MHz.

Alta's first products will be a group of what the company calls personal supercomputers, the PS/Alpha/T-series. These "supercomputers" will support up to 16 processors. An entry-level, two-processor PS/Alpha/T-series development system begins at $38,500.

The company's first board-level product, meanwhile, is the AT/V64, a 6U VME board with a single Alpha 21064A-275MHz processor and 16 MB of cache memory. The device attaches to PCs and Novell Inc. networks, as well as DEC, Sun, Hewlett-Packard Co. and IBM Corp. workstations through EISA, ISA, SCSI, SBus and other interfaces. Pricing begins at $8,900.

Alta Technology Corp.
9500 South 500 W., Ste. 212
Sandy, UT 84070-6655
Circle 130

Mobile Mail Made Easy

Replix Mobile Mail from SoftLinx is a nomadic mail and fax solution for workers on the go. Once SoftLinx is installed, users simply copy their UNIX mail to their laptops before going on the road. They can then read, sort and reply to mail without being connected to their network. Replix Mobile Mail synchronizes mail files and sends replies when the network connection is established, whether locally, over a phone line or via the Internet. SoftLinx's product includes images displayed with Watermark Image Viewer.

Replix Mobile Mail is priced at $149.

SoftLinx Inc.
234 Littleton Road
Westford, MA 01886
Circle 131

Grand Junction Shows Full Duplex

Grand Junction Networks has introduced CollisionFree, a full-duplex capability that can double the bandwidth between Fast Ethernet ports on the company's FastSwitch Ethernet switches. CollisionFree allows the simultaneous transmission and receipt of packets. The company says that the CollisionFree option allows its adapter to support 10-Mb/s switch-to-switch throughput across unshielded twisted-pair wires.

Grand Junction products that support CollisionFree include the company's workstation FastSwitch offerings

and its FastNIC 100 EISA product for EISA-based PCs. Owners of the workstation products may upgrade to CollisionFree for $400, while the EISA product owners can get the same option for $50.

Grand Junction Networks Inc.
47281 Bayside Pkwy.
Fremont, CA 94538
Circle 132

Cray Shares Its Knowledge

Cray Research has made available its CraySoft LibSci Numerical Library of more than 1,200 mathematical and scientific software subroutines for SPARC Solaris-based computer systems. The Library can be used on both single-processor and parallel systems.

Pricing is $1,695 for SPARC systems running Solaris 2.3, and $2,495 for a "performance pack," which includes the CraySoft FORTRAN 90 Programming environment for SPARC workstations and servers.

Cray Research Inc.
655A Lone Oak Drive
Eagan, MN 55121
Circle 133

Windows-to-UNIX Software

The MultiView Desktop, JSB's Windows-to-UNIX integration and terminal-emulation package, has been upgraded and released as Version 4.0.

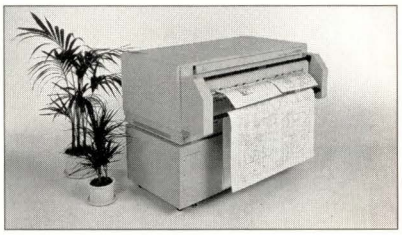
The product's new release resides on a Windows PC and emulates UNIX consoles from AT&T, Interactive UNIX, The Santa Cruz Operation Inc., Solaris, UnixWare and X/Open. It also emulates such text terminals as Digital Equipment Corp.'s VT100, VT220 and VT241, as well as Wyse Technology Inc.'s Wyse 60.

The MultiView supplies its connectivity by supporting TCP/IP, Novell Inc.'s IPX/SPX, DECnet, NetBIOS and general serial and modem links. It also comes with a variety of aids for navigating through connections to remote UNIX hosts. Pricing for a single-user license is $295.

JSB Corp.
108 Whispering Pines Drive
Ste. 115
Scotts Valley, CA 95066-4785
Circle 134

Unattended Folding for Plotter

Japan Digital Laboratory's 4000E Engineering Document Plotter is now compatible with the Printfold Model 3000-CF On-Line Automatic Large



Document Folder. The document folder automatically activates when the plotter outputs a D- or E-size plot. The folder senses the plot size and adjusts itself to fold the plot into an 8½-by-11 inch or 9-by-12 inch packet, then stacks it with the title block out. When the print flow stops, the document folder shuts down and reactivates upon the next plot's output.

The Model 3000-CF Printfold is manufactured by the Printfold Co. and costs $42,500. The JDL 4000E Engineering Document Plotter costs $38,900.

Japan Digital Laboratory Co. Ltd.
4770 Calle Quetzal
Camarillo, CA 93012
Circle 135

Network Storage Controllers

Symmetrical Technologies has introduced SPANControl and SPANStor, two network storage controllers designed to reduce the cost and complexity of adding data storage devices to client/server computing environments. The SPAN product family allows users to expand network storage capacity with magnetic disk, CD-ROM or optical disk devices. The need for software drivers is eliminated and installation time is reportedly as little as 15 minutes.

SPANControl is an embedded board-level controller that includes a high-performance CPU and up to 32

MB of RAM as well as task manager and firmware modules. SPANStor is a stand-alone, plug-and-play storage controller that includes a SPANControl printed circuit board, enclosure and appropriate SCSI devices.

The SPAN family's sophisticated protocol-handling and file-system integration make the extra storage completely transparent even in heterogeneous network environments, including mixed-vendor UNIX platforms. Pricing starts at $2,399, with volume discounts and special configuration prices available.

Symmetrical Technologies Inc.
600 Herndon Pkwy.
Herndon, VA 22070
Circle 136

CORRECTION

The correct price for Source Code Manager (*SunExpert*, September, Page 61) is $795 for a single user, $3,295 for five users and $5,995 for 10. A 50-user CPU license is $25,000; 100-user, $40,000.

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PRODUCT SHOWCASE

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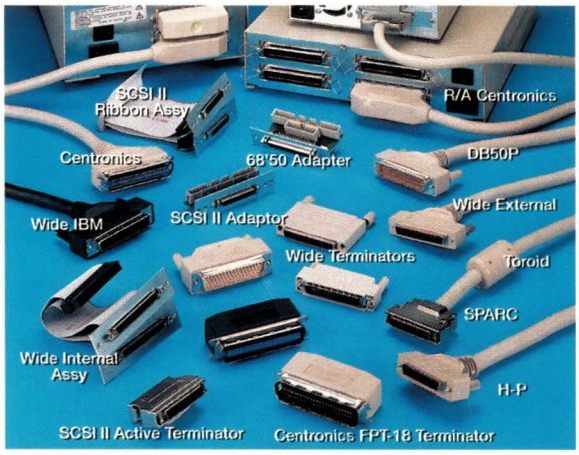

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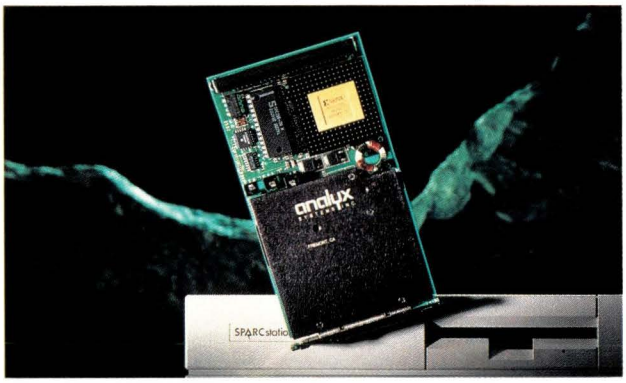

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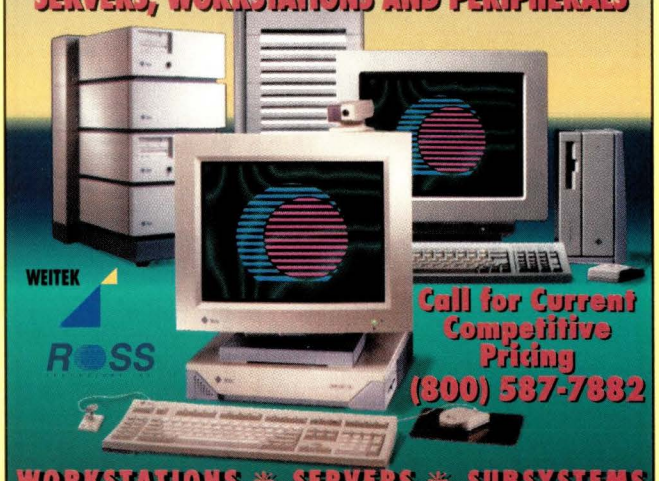

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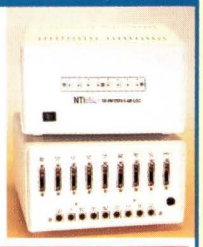

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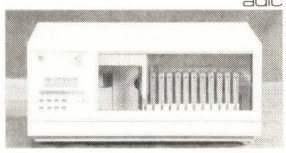

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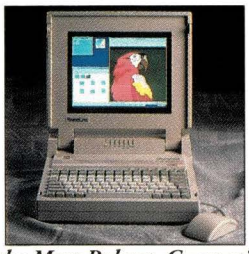

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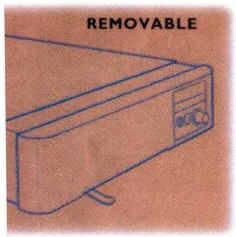

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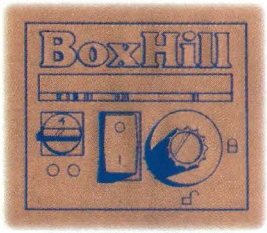

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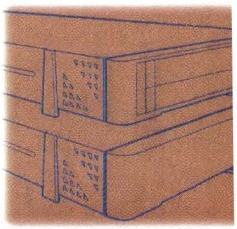

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