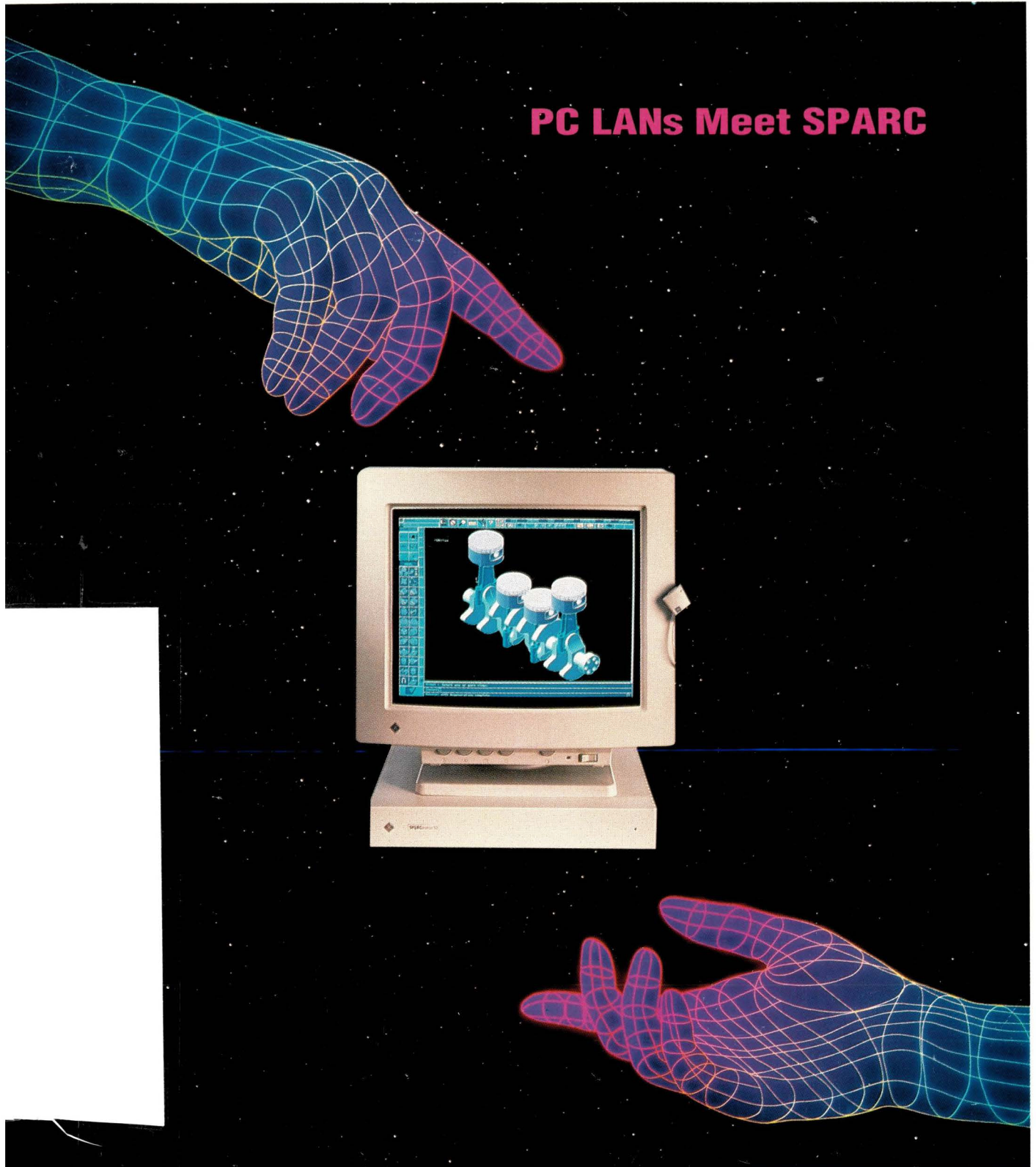


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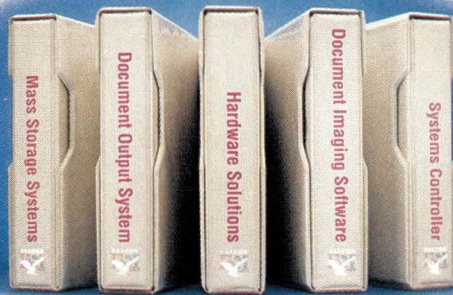
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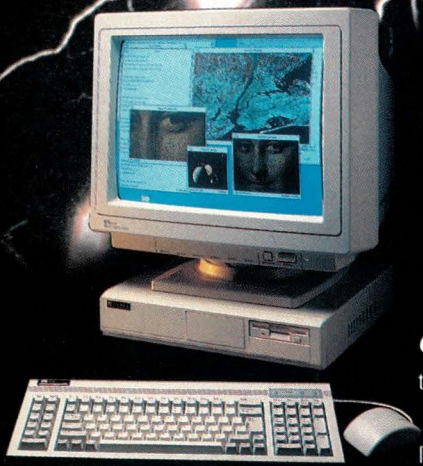


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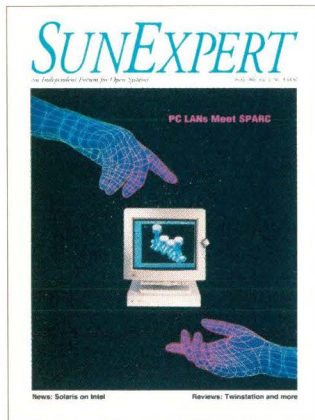
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Courtesy of Uniphoto, New York



Twinstation, Data/Object Manager,
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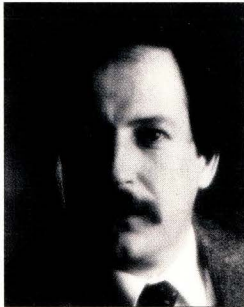
serves the UNIX workstation environment, emphasizing Sun, SPARC and Sun-compatible systems.

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Editorial

Klingons and Federation

"What has that got to do with Sun workstations?" you ask. Well, it's the headline for this month's cover story. The headline is drawn from a conversation between Michael Jay Tucker, executive editor, and Robert



Kidd, senior industry analyst at Dataquest Inc., who says, "They'll join the Federation rather than be a Klingon." Still, no clue?

It means that over the short run, Sun's best shot at capturing a piece of the corporate PC (read commercial) market is to cast workstations in a LAN serving role. Once these users decide to put their LAN in the hands of UNIX, they may debate the merits of implementing a PC operating system (say NetWare or VINES) on the UNIX side or running a version of NFS on the PCs. On the UNIX side, *SunExpert* readers may encounter these alien, single-taskers looking for support, application development, network connections and system administration. And that's why *SunExpert* is writing about the fledgling market for UNIX/PC integration.

Meanwhile, back at SunSoft, the race is on to get Solaris on Intel (the long-haul contender to bring high-end PCs under the Sun banner) ready for first customer shipment sometime between late September and mid-October. For the full story on the software and the supported hardware, see the lead news story, "It's a PC Thang." Unfortunately, the tumult in the 32-bit PC OS market that gives Sun a fighting chance also gives other contenders an opportunity. Among them are some heavyweights. IBM with OS/2 (believe it or not, it's coming back to life), Microsoft with NT, Novell and UNIX Systems Labs (a.k.a. Univel) with UnixWare, and so on. For the rest of the story, see "Desktop UNIXes on Parade," also in the "News" section.

SunSoft, Microsoft and IBM, like the rest of us, will have to wait and see who captures the next generation. Stay tuned!

Doug Pryor

Doug Pryor

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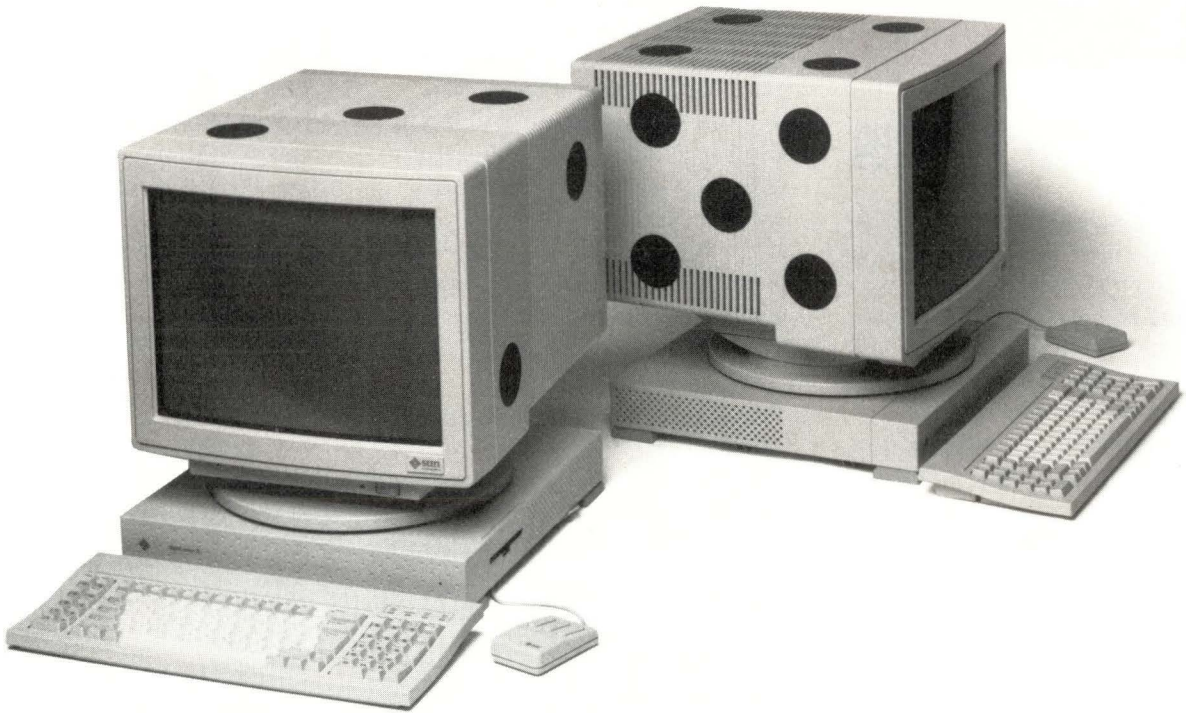
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NEWS

It's a PC Thang

SunSoft is gloating. It can finally say "We told you so" to all of the doubters who had wondered if it would make its promised June first-customer-ship (FCS) target for Solaris 2.0 on SPARC. On June 30, product was out the door. Now, the race is on for Solaris on Intel, or as SunSoft refers to its first PC operating system, Solaris on X86.

SunSoft still expects to make its third-quarter FCS date—sometime between late September and mid-October—for Solaris on X86, according to Michael Zadig, director of technology services. It's likely to be December or January 1993, however, before the operating system begins to get into end users' hands. SunSoft showed a working prototype of the operating system at PC Expo in late June running on PCs from CompuAdd Corp., Dell Computer Corp. and Zenith Data Systems. Intel-based machines were running beta versions of SunPro's SPARCworks development tools and SPARCcompilers. The PCs were also demonstrating Island Graphics Corp.'s IslandWrite, Draw and Paint, which Island says it ported from SPARC to Intel in a matter of days. (Island claims the effort involved was little more than a recompile.) Early-access versions of Solaris on X86 will be made available to other key independent software vendors (ISVs) a couple of months before FCS, as was the case with Solaris on SPARC.

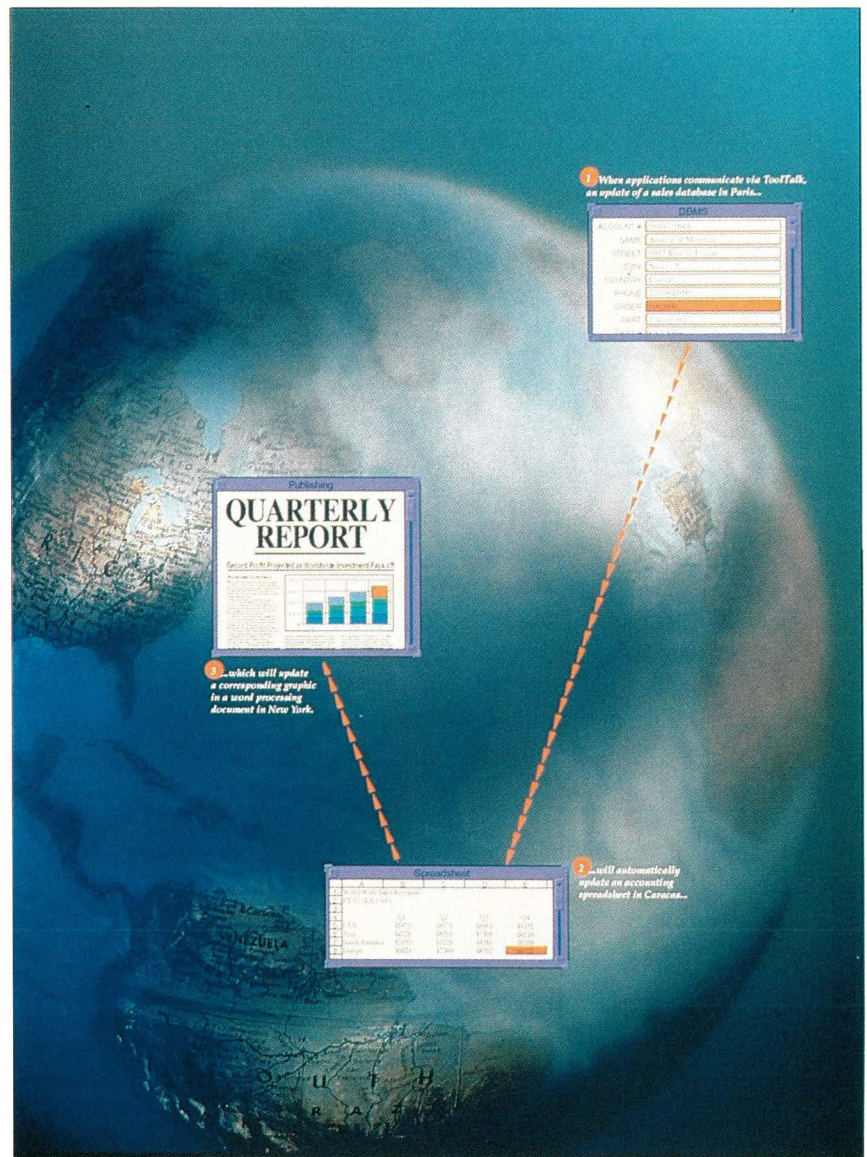
As was also true with Solaris on SPARC, the first release of Solaris on X86 will most likely ship with its symmetric multiprocessing (SMP) capabilities disabled, Zadig says. The Solaris 2.0 on SPARC kernel contained all the code necessary to do SMP, but it

shipped with SMP turned off, he explains. At the same time as it shipped Solaris 2.0 for SPARC, SunSoft shipped a separate disk, the Solaris 2.0 OEM Multiprocessing Kit, to system manufacturers, which allowed them to tune and verify the SMP features of Solaris for their specific hardware implementations. SunSoft says it did this because few users are champing at the bit for SMP, and few SPARC applications available today support or require SMP. Zadig says that SunSoft will begin shipping an SMP-enabled version of Solaris 2.0 in the fall, which will support SMP desktops and servers, including the SPARCstation/server 10 and

SPARCserver 600 MP series. (In the interim, SunSoft is now shipping Solaris 1.1 Version A, which supports SuperSPARC, to its 600MP users.)

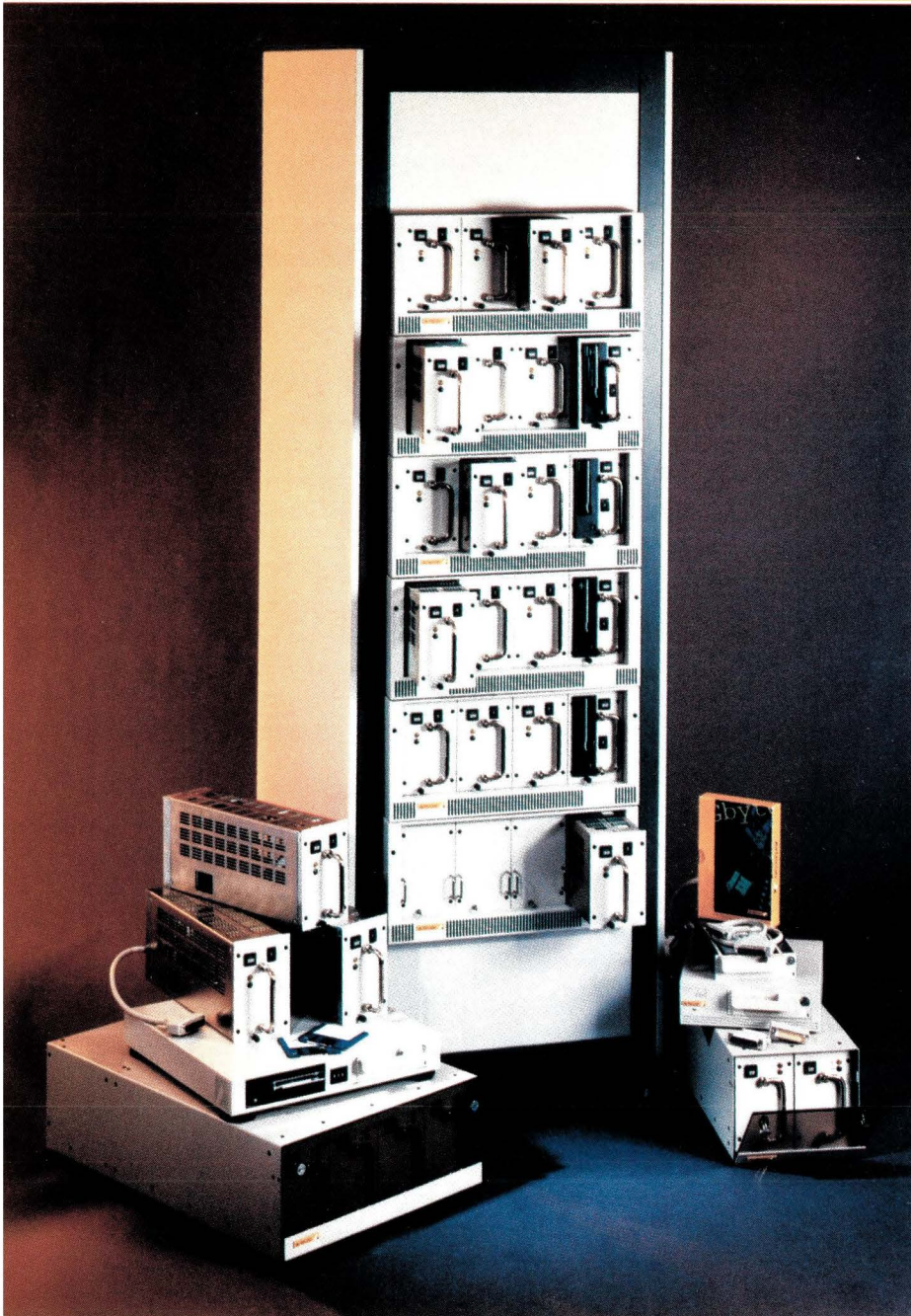
SunSoft continues to build its stable of Solaris on X86 OEMs. In addition to AST Research Inc., CompuAdd, Dell, NetFRAME Systems Inc. and Toshiba Corp., all of which committed last fall to supporting the PC version of Solaris, are several new OEMs: Everex Systems Inc., ICL Inc., NCR Corp., Olivetti and Zenith Data Systems. All of these OEMs are working with SunSoft to certify that their various PCs run alpha versions of Solaris on X86. None of these companies, with the possible exception of

Features like SunSoft's message-broadcast system, ToolTalk, will differentiate Solaris on X86 from other PC UNIXes, Sun Microsystems Inc. says.



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Supported Hardware for Solaris on X86

CPU Types

- 33-MHz 386 with 387 coprocessor
- 25-, 33- or 50-MHz 486DX, 486DX2 or 486SX with 487SX coprocessor

Bus Architectures

- ISA
- EISA
- MCA

Memory

- 8-MB minimum

Distribution Media

- CD-ROM

Disk Controller

- 200-MB hard disk required

SCSI Cards

- Adaptec AHA-1540/42B, ISA 16-bit
- Adaptec AHA-1740/42B, EISA 32-bit
- DPT PM2011/9X (90, 95), ISA 16-bit
- DPT PM 20112A/9X (90, 95), EISA 32-bit
- DPT PM 20112B/9X (90), EISA 32-bit

Video Display and Adapters

- Super VGA or 8514-A-based
- VESA SVPML-compliant
- ATI Graphics Ultra and Orchid Prodesigner II (both 1,024-by-768, 256 colors)

Super VGA Chipsets

- Tseng Labs ET 400
- Western Digital WD90C30

Graphical Input Devices

- Logitech C7/9 Serial/Bus three-button
- Logitech Mouseman Serial/Bus three-button
- Microsoft Serial/Bus two-/three-button
- Microsoft IBM PS/2 mouse compatibles

Network Adapters

- WD80X3, Ethernet or 10BaseT, ISA 8/16-bit
- Installed base 8003E/EB/W, 8013EP/W/EW/EBT
- Currently shipping 800EP/WC, 8013EPC/WC/EWC

Tape

- SCSI tape (¼-inch, 4mm or 8mm) and CD-ROM

Sound

- Soundblaster Pro

Other

- High- and low-density floppy disk (3½-inch, 5¼-inch)
- Up to four parallel ports and up to four serial ports

Source: SunSoft

CompuAdd, plans to support Solaris on X86 as its exclusive PC UNIX. Rather, they will sell users Open Desktop, SVR4.2, UnixWare, NT, OS/2, Solaris or a combination thereof. (See "Desktop UNIXes on Parade," below, for more on these systems.)

With Solaris on X86, SunSoft is going after the high-end, Fortune 200/Fortune 500 PC user, says Zadig. "These people want to run client/server, mission-critical, distributed applications," he points out. Our customers, Zadig says, will be "corporate DOS users who want to graduate." This will pit SunSoft directly against both the Santa Cruz Operation with Open Desktop and Microsoft Corp. with NT, Zadig claims. SunSoft's differentiators will be its built-in, value-added features, such as ToolTalk, integrated object-oriented technology, a fully preemptive kernel, its device drivers and networking installation tools, he says. "We've got experience providing solutions, not just technology," Zadig adds.

Zadig says he sees SVR4.2 and UnixWare going after the lower end PC space, and thus competing less with Solaris on X86. "There's a tremendous amount of SunSoft code in SVR4.2," he claims. At the same time, because SVR4.2 makes use of UUCP and UnixWare of IPX/SPX as their respective networking protocols, Zadig questions the extent to which Solaris and these other SVR4-based operating systems will compete head-to-head.

Cost may prove to be yet another differentiator. At press time, no pricing information was available for Solaris on X86. But a single copy of Solaris 2.0 for SPARC desktop systems retails for \$795.—mjf

Desktop UNIXes on Parade

Solaris 2.0 is far from the only game in town when it comes to desktop UNIXes. Within the past couple of months, UNIX Systems Laboratories Inc. has taken the wraps off UNIX System V, Release 4.2 (known as Destiny before USL ran into trademark problems). And Univel, the USL/Novell Inc. joint venture, announced its early access program for



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UnixWare. If the field is extended to 32-bit Intel-Corp.-based systems, there are also Microsoft Corp.'s NT, the IBM Corp./Apple Computer Inc. joint venture's (a.k.a., Taligent's) Pink, IBM's OS/2 and the Santa Cruz Operation's Open Desktop.

Of these, the most serious contenders from SunSoft's point of view are likely to be the SVR4.2/UnixWare, NT and Open Desktop. Open Desktop has been shipping since 1990. UnixWare is likely to ship in the third quarter of this year, as is Solaris 2.0 for Intel. NT's ship date has slipped to first-quarter '93, according to industry sources. SVR4.2 began shipping to OEMs and software publishers in July.

USL is positioning SVR4.2 as being "at the heart of the 32-bit, networked OS battlefield," the very spot "where upsizing and downsizing meet." At press time, the price for a copy of SVR4.2 was expected to be slightly less than \$500.

USL expects to sell SVR4.2 as the OS for PC LAN servers or low-end database and application servers. For a 386SX portable or desktop, the OS requires a minimum of 4 MB of memory and 60 MB of hard disk. A client system running several applications increases the memory requirement to 6 MB and the disk to 80 to 120 MB minimum. SVR4.2 will run the more than 6,000 documented applications available for SVR4, as well as applications written for previous UNIX System V versions, SunOS (Solaris 1.0), SCO UNIX and Berkeley Software Distribution 4.X. SVR4.2 also currently complies with the Open Software Foundation's Application Environment Specification.

The base SVR4.2 system comprises an optimized SVR4.1 ES base; a GUI layer, based on the MoOLIT toolkit, allowing users to choose Motif or Open Look; extended networking, development tools and driver interfaces; and a USL-designed desktop manager. USL is making available to OEMs and publishers various prepackaged software "sets"—utilities set, multiuser set, administration set, graphics applications set, networking set and software development set—which they can mix and match and customize for

their own customers. USL plans to launch a branding program, under which it will stamp applications software as being SVR4.2-compatible, some time soon, according to company officials.

The first SVR4.2 port is available for Intel-based PCs. USL has said that SPARC, MIPS and Motorola Inc. 88000 ports will be available before year's end. ICL Inc. and Fujitsu Ltd. have undertaken the SPARC port. USL has also publicly stated that SVR4.2 ports for Digital Equipment Corp.'s Alpha, Hewlett-Packard Co.'s Precision Architecture and IBM's RS/6000 could be available as early as 1993. "SCO hasn't committed to reselling SVR4.2—yet," teases Joe Menard, USL vice president of marketing. A multiprocessing version of 4.2, based on UNIX International's Enhanced Security Multiprocessing (ES/MP) version of System V, is also under development, says USL.

UnixWare, which is basically SVR4.2 with built-in IPX/SPX transport protocol (rather than TCP/IP) support, will be packaged as shrink-wrapped UNIX. Novell will distribute the Univel product and support the end-user customers, and will develop a hardware-certification and ISV/IHV program for the system. Confusingly, USL also plans to make a master binary of UnixWare available to customers.

In June, Univel launched its early-access program. More than 50 software vendors announced their support at announcement time. The developer kit that Univel is providing includes

- an early access version of UnixWare, complete with its desktop manager and tightly integrated with NetWare services, protocols and application programming interfaces (APIs);
- development tools, including MoOLIT tools, Motif development tools and libraries, device-driver kits and network APIs, such as the NetWare C Interface for UNIX API, TLI over IPX/SPX and TCP/IP, and TI-RPC over IPX/SPX and TCP/IP;
- documentation for developers, administrators and end users; and
- technical support and customer service plans.

According to Univel, UnixWare will

be compatible with the more than 3,000 UNIX applications that are currently available for the Intel 80X86 platforms. The company is also touting the operating system's capability to provide users with access to the thousands of DOS- and Microsoft Windows-based applications through NetWare.—mjf

Every Programmer's Dream (or Nightmare)

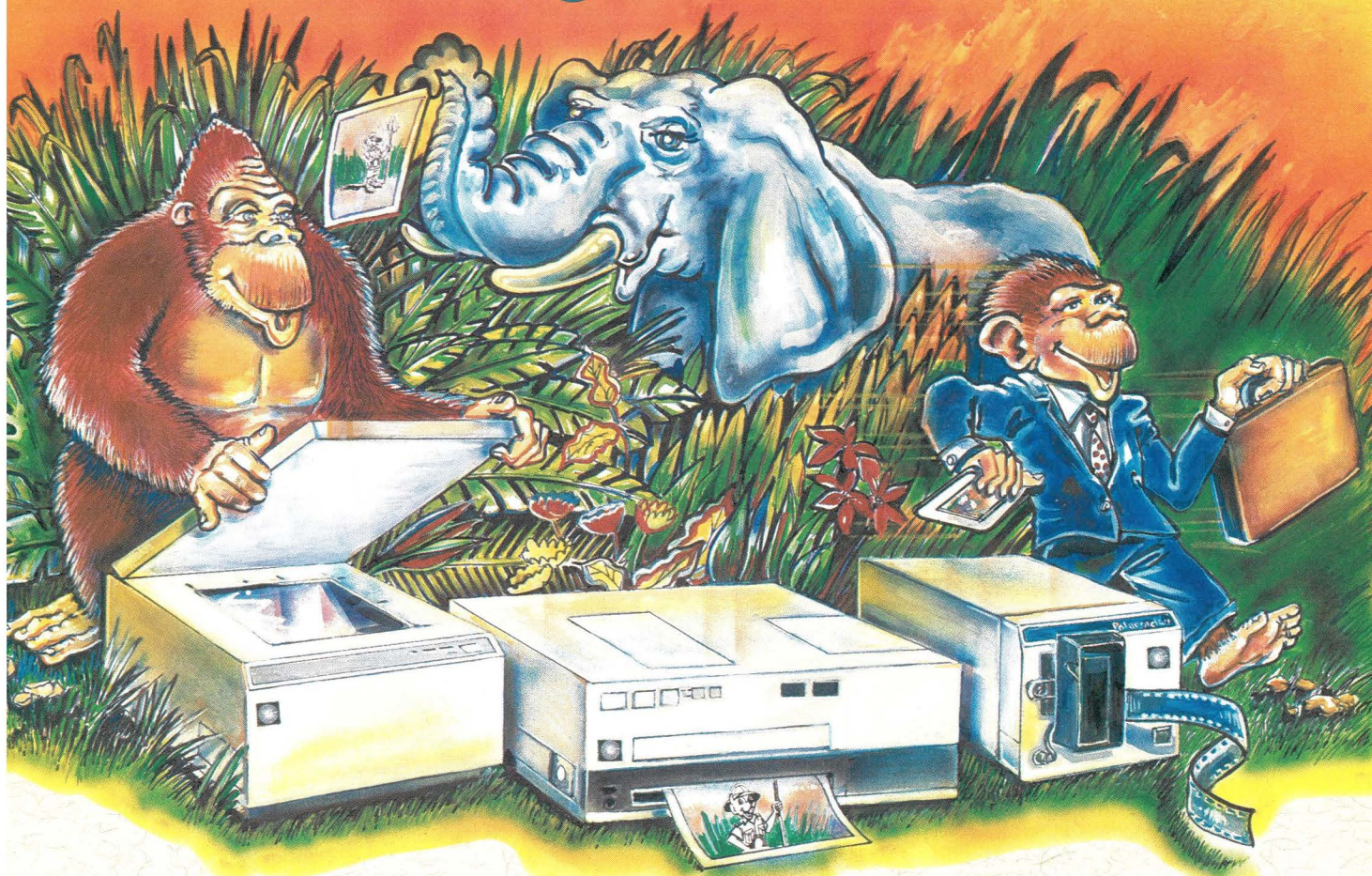
There's been an outburst of activity on the software-development front in the past couple of months, as evidenced by back-to-back announcements from SunPro, Sun Microsystems Computer Corp., CenterLine Software Inc. and Hewlett-Packard Co. The good news is that there is going to be a plethora of development tools for programmers working in the Solaris environment. The bad news is it might be a while—maybe not before Solaris 2.1 is unveiled late this fall—before developers can get their hands on some of them. But judging from the complexity of SunPro's announcement, at least, it could take developers that long to figure out exactly what will be available when.



SunPro, which first revealed plans for SPARCworks almost a year ago, has already shipped Solaris 1.0 and 2.0 versions of this core product to its Master Developer (i.e., early access) customers. SPARCworks Professional consists of any of Sun's SPARCcompiler products (C, C++, FORTRAN and Pascal) coupled with the SPARCworks development tools. The tools—SPARCworks Manager, SourceBrowser (a graphical static analyzer), Debugger, Analyzer, FileMerge and MakeTool—are common across all of the compilers and use ToolTalk as their messaging broadcast system.

SPARCworks Professional for Solaris 2.0 began shipping July 1, one day

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after Solaris 2.0 for SPARC began shipping. But the version for Solaris 1.0/SunOS 4.1.X isn't due to ship until October. SunPro explains this reversal by saying that it needed to focus all of its efforts on readying Solaris 2.0 tools to ship simultaneously with the operating system. "Recognizing that customers want to migrate their applications to Solaris 2.0 using sophisticated development tools on SunOS 4.1.X" as well, SunPro decided to bring the SunOS 4.1.X development environment up to speed, according to the SunPro party line. The biggest difference between SPARCworks Professional on Solaris 2.0 and SunOS 4.1.X will be in the area of the performance analyzer, SunPro claims. "The Analyzer takes advantage of some features in Solaris 2.0 (SVR4) and hence will only be available on Solaris 2.0," notes a recent SunPro posting to the Internet.

Versions of the various compilers that support the Solaris 2.0 environment, including SuperSPARC-optimized ones, also became available on July 1, while those supporting SunOS 4.1.X won't be available until October. SPARCworks Professional and Solaris compilers for Intel 80X86-based platforms should make their debut before the end of the year—possibly as early as when Solaris for Intel ships in the third quarter.

"To ease the transition to Solaris 2.0," in SunPro lingo, SunPro is offering Transition Packs for all of its languages. The Transition Packs package the Solaris 2.0 and SunOS 4.1.X development products on the same CD. With the C Transition Pack, for example, customers receive SPARCworks Professional C for Solaris 2.0, Sun C 1.1 for SunOS 4.1.X and a common SPARCworks Professional development environment for Solaris 2.0 and SunOS 4.1.X. The Transition Packs for Solaris 2.0 began shipping July 1. SunPro has promotionally priced the C Transition Pack at \$995 through September 30, 1992. It also is offering through September the C compiler alone for \$395 to \$495, a \$300 savings.

Because SunPro does not currently sell directly to end-user customers

(even though it does so indirectly through SunExpress and various ISVs and resellers), developers who do not fall into these latter categories will need to go through resellers or Sun Microsystems Computer Corp. to get their hands on the new Sun development tools. This actually ends up being a good thing, since SMCC's pricing is lower than SunPro's. Until September 30, SMCC is selling the SPARCCompiler C 2.0 for \$395 and SPARCworks Professional C for \$895.

SunPro's and SMCC's competitors haven't left the market to Sun, however. Two days after SunPro made its announcements, CenterLine Software (Cambridge, MA) unveiled CodeCenter 4.0 (see *SunExpert*, June, Page 14). CodeCenter 4.0 includes an optimizing ANSI C compiler for Sun workstations, as well as a performance-analysis browser and integration with SunSoft's Solaris 2.0 porting tool, Pipeline Tool, among other new features. CenterLine will even sell developers SunPro's C SPARCcompiler, if they so desire, along with CodeCenter. SunPro says it has not tested—nor does it plan to test—other vendors' compilers to find out whether or not they are compatible with SPARCworks. CenterLine plans to ship CodeCenter 4.0 this fall for SPARC systems and the HP 9000/700. The company plans to port the environment to other UNIX systems next year.

Less than a month later, HP's Fort

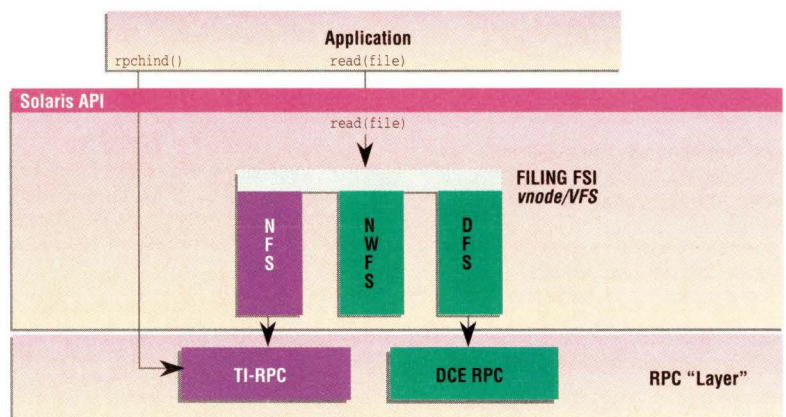
Collins, CO-based Software Engineering Systems Division took the wraps off the next version of SoftBench. The C-based SoftBench 3.0 and its counterpart, C++ SoftBench 3.0, offer several new features, including improved program visualization through three new graphical browsers; reduced application link time; enhanced ability to merge concurrently developed versions of code into a single software release using a new File Compare and Combine tool; integrated support of the vi and emacs editors; and an on-line interactive training option. HP also announced a software change-request process-management environment that is designed to help development teams automate and manage the process of handling software change requests on UNIX systems. HP plans to ship SoftBench 3.0 in October for its own 9000 series, as well as for Sun SPARC systems.—mjf

More Distributed Distributed Computing

SunSoft is working to further distribute its distributed-computing model with its latest series of networking-related announcements. The system-software arm of Sun Microsystems Inc. has made public its plans for ONC+, the next generation of Sun's Open Network Computing product, and Federated Services, a collection of interfaces to various networking protocols and services, of which ONC+ is

Via SunSoft's Federated Services' interfaces, Solaris users will be able to access the DCE RFC, NetWare's file system and other transport-independent RFCs, Sun Microsystems Inc. says.

How Multiple RPCs Can Coexist in Solaris



Source: SunSoft

one. And through Transarc Corp., SunSoft is promising links to the Open Software Foundation's (OSF's) Distributed Computing Environment (DCE).

"We're adding another layer of transparency for users and making distributed computing more tightly integrated with Solaris," claims Natalie Shuttleworth, group marketing manager for distributed computing at SunSoft.

ONC+ features enhanced naming, filing, distributed application and security services. Under the auspices of ONC+, SunSoft is adding capabilities such as multithreading and local disk caching to NFS; increasing the number of nodes (to 10,000) supported by NIS with a new version called NIS+; supporting transport-independent remote procedure call (TI-RPC); beefing up security through support of Kerberos, RSA and DES; and adding TCP features such as auto-host/net configuration, point-to-point-protocol (PPP) and open-shortest-path-first (OSPF) routing. SunSoft will be making these enhancements through 1993, with the first-NFS multithreading,

NIS+, TI-RPC and Kerberos and DES support—becoming available as part of Solaris 2.0.

According to the San Jose, CA-based market researcher Dataquest Inc., the installed base of ONC is 3.1 million nodes, up 42% over 1990's total. The product has been licensed by more than 300 companies and exists in more than 120 implementations.

Meanwhile, SunSoft is starting to roll out its overarching Federated Services products and strategy. Within 2.0 will be available demonstration-technology examples of name switch, vnode interface filing and various authentication schemes. Via the vnode interface, for example, users could access the distributed file system and the DCE RPC. They also will be able to plug into Novell Inc.'s NetWare and/or the ISO's Open Systems Interconnect (OSI) through Federated Services' interfaces, according to SunSoft. In 1993, federated naming, filing and security interfaces will be available as part of Solaris. All of these interfaces will be licensable, SunSoft says.

Simultaneous with these announce-

ments, Pittsburgh, PA-based Transarc announced it was adopting Solaris 2.0 as a reference platform for its Encina family of on-line transaction processing products. Because Encina is based on the DCE, Transarc also announced it will develop a production-quality implementation of DCE for Solaris 2.0, which it expects to ship some time in 1993. Since March 1992, Transarc has been shipping early availability versions of Encina and DCE for Solaris 1.0 and IBM Corp.'s AIX 3.2. Encina will be able to integrate more easily with Solaris thanks to the Federated Services interfaces, according to Transarc.—*mjf*

Tadpole Keeps on Truckin'

SPARCbook, the SPARC-based notebook from Tadpole Technology plc, is showing up everywhere—from software demos to the financial trading floor. Not bad for a company that has only been shipping product since January in the United States and the late spring in Europe.

In fact, Tadpole could easily ship more than 10,000 SPARCbooks this

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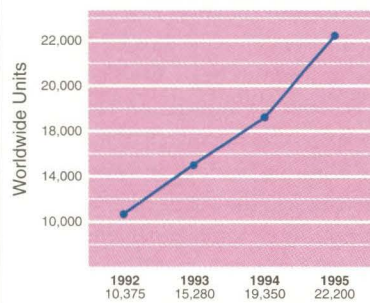
year alone, according to Hampton, NH-based market-research firm Workgroup Technologies Inc. And rather than resting on its laurels, Tadpole continues to enhance its product with options such as a standard VGA color screen (which it began shipping in February) and, most recently, the NOMADIC (Network-Oriented Mobile Adaptation for Distributed Integrated Communications) Computing Environment, or NCE.

NCE is a set of hardware and software enhancements designed to make the SPARCbook more portable and better able to interact remotely with LANs and other network topologies. Tadpole has integrated NCE into the Solaris environment.

NCE comprises Tadpole's Portable System Enhancements and Portable Network Environment. The system enhancements include Save and Resume, which provides an automatic start-and-stop method for applications and eliminates the need to reboot UNIX between user sessions; automatic low battery save; the Power Management System, which allows

users to select from several options to extend battery life; and Portable Power Windows, Tadpole's version of OpenWindows Version 3.0, which includes a variety of screen-resolution options, real-time panning, a virtual 8-bit frame buffer and a color tool, allowing users to select up to 256 colors.

Tadpole Shipments to Climb Steadily



Source: Workgroup Technologies Inc.

The Portable Network Environment consists of several Portable Productivity Tools, namely, Faxtool; a portable mail tool based on Post Office Protocol V 3, a k a POP; a time-zone tool; and the Serial Line Internet Protocol tool (SLIptool), which dials

remote logins and allows users to access remote networks via TCP/IP facilities, just as if the SPARCbook were directly connected via the Ethernet.

The Portable Network Environment also provides users with a base layer of IP communications facilities, which Tadpole is calling the Portable Access Layer, or PAL. Currently, ONC and TCP networking solutions can be layered on top of PAL via SLIP. Tadpole says this layering will be achieved through point-to-point protocol (PPP) in NCE's next release. Future NCE releases will feature Portable Network Technology, which includes an automatic network configurator, enabling users to easily plug and unplug their SPARCbooks from various networks.

Ken Cannizzaro, the new president of Tadpole's Austin, TX-based subsidiary, Tadpole Technology Inc., says that Tadpole is considering licensing NCE to interested parties. All of the SPARClike portable vendors, as well as Sun itself, are possible candidates. If Sun does license NCE, it won't be the first time that it has collaborated with



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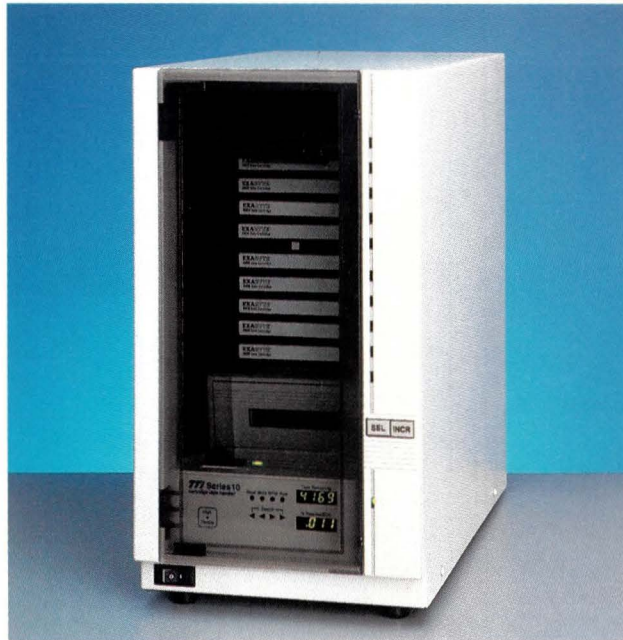
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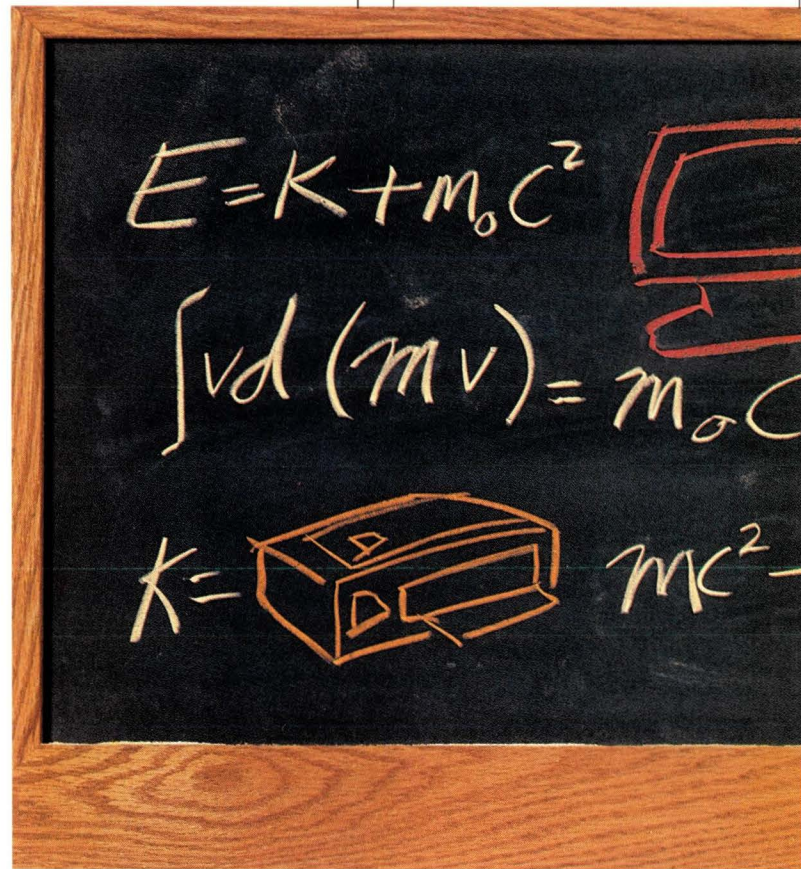
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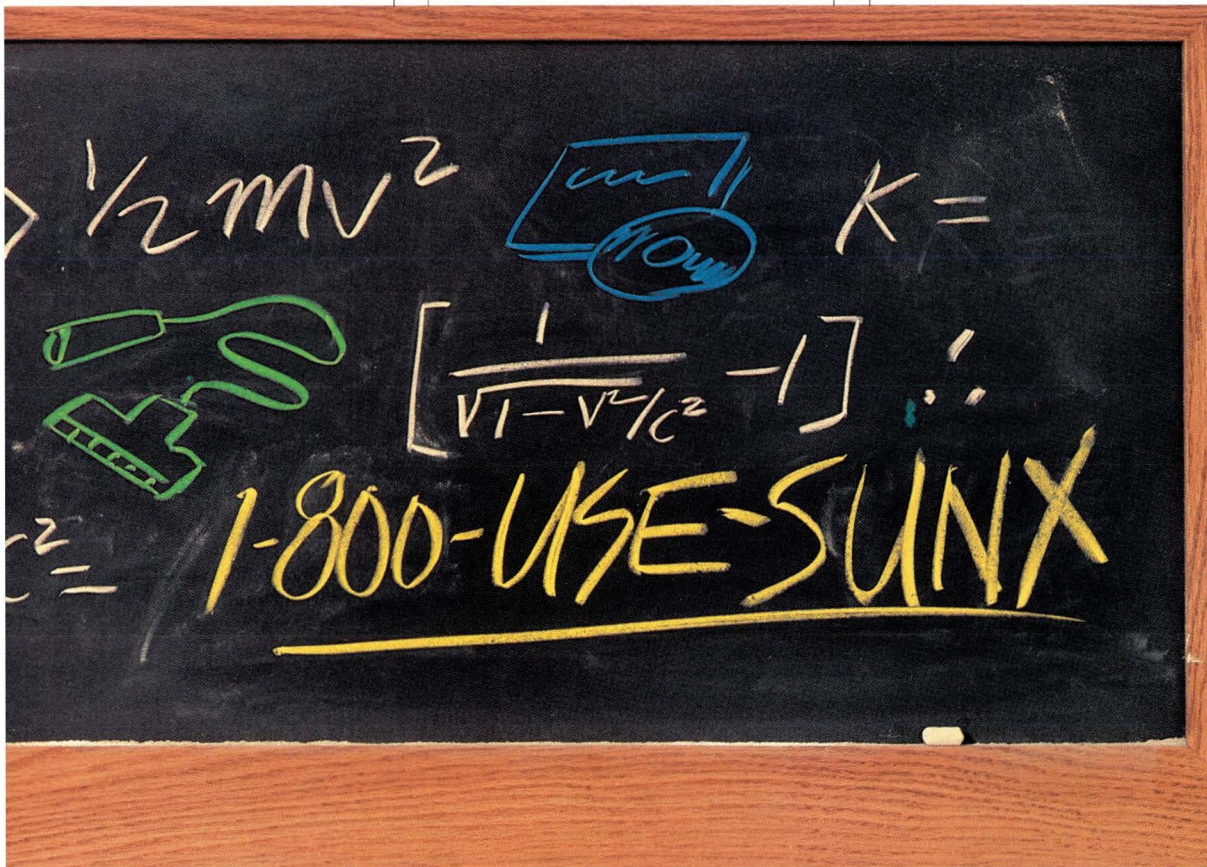
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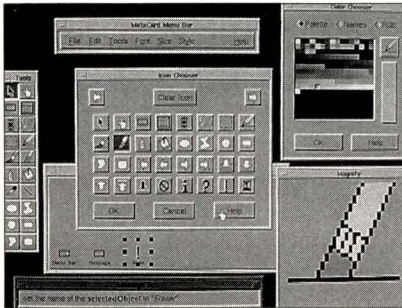
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Tadpole. In May, Tadpole signed an exclusive distribution agreement with SunExpress under which SunExpress is offering the SPARCbook through its telemarketing and catalog sales channels.—mjf

HyperCard on Suns?

Not long after Apple Computer Inc. introduced the HyperCard hypermedia product, HyperCard clones appeared for the PC. Now, similarly compatible hypermedia card products are appearing for Sun workstations. One such is MetaCard from MetaCard Corp., Boulder, CO. It is "both less and more than HyperCard," says company President Scott Raney, less because it isn't HyperCard, with all the force of Apple behind it, and more because it brings HyperCard-like programming to the Sun.



He says that's important because most users need to be able to quickly, and cheaply, produce more of their own low-end applications. "In general, the applications that people need are small. They're small, and they're well defined," says Raney. Rather than trying to do that with, say, Motif or Open Look—"they're horrible production environments. I compare them to assembly language"—the users can quickly generate Stackware.

The product is only now shipping, but its beta sites have been generally positive. "It is syntactically identical to HyperCard, and it has some nice UNIX extensions," says Gever Tulley, director of engineering at Xaos Tools Inc., the San Francisco-based graphics vendor whose products played a role in the development of the animation sequences of the movie *Lawn Mower Man*.

Tulley was a MetaCard beta user. "I used it as a tracking mechanism for

bugs," he says. "It was a fairly simple application, but I threw it together in an hour."

Apple Computer, meanwhile, seems unconcerned with UNIX versions of its HyperCard environment. "They've tolerated the clone market in the PCs," says Raney. "They haven't encouraged it, but they haven't discouraged it either."—mjt

TCP/IP and NFS Make Windows Shine

In a rush that amounts to a stampede, vendors are hurrying to make Microsoft Windows more at home with the de facto and de jure standards of UNIX-oriented networking—TCP/IP and NFS, respectively. This June, a grand coalition of software developers lined up to endorse a common interface for TCP/IP applications running under MS Windows. Called the Windows Sockets API, the spec was announced "on the behalf of the Windows Sockets Committee," by Redmond, WA-based Microsoft Corp.; SunSelect, the Billerica, MA-based division of Sun Microsystems Inc., which deals with PC networking; FTP Software Inc. of Wakefield, MA; and JSB Corp., Scotts Valley, CA.

In theory, the specification will define a standard interface between an MS Windows application and TCP/IP. An application written to the spec is supposed to be able to run unchanged on TCP/IP implementations from almost any vendor. Already, some 20 different software companies have announced support for the specification.

Among those 20, many already offer links between PCs and UNIX (FTP, for instance, has specialized in them for years), and many others are taking the opportunity to introduce MS Windows-based products. Beame & Whiteside Software Ltd., Dundas, Ontario, announced at Spring Interop trade show two products, BC-TCP and BC-NFS, that bring TCP/IP and NFS to Windows.

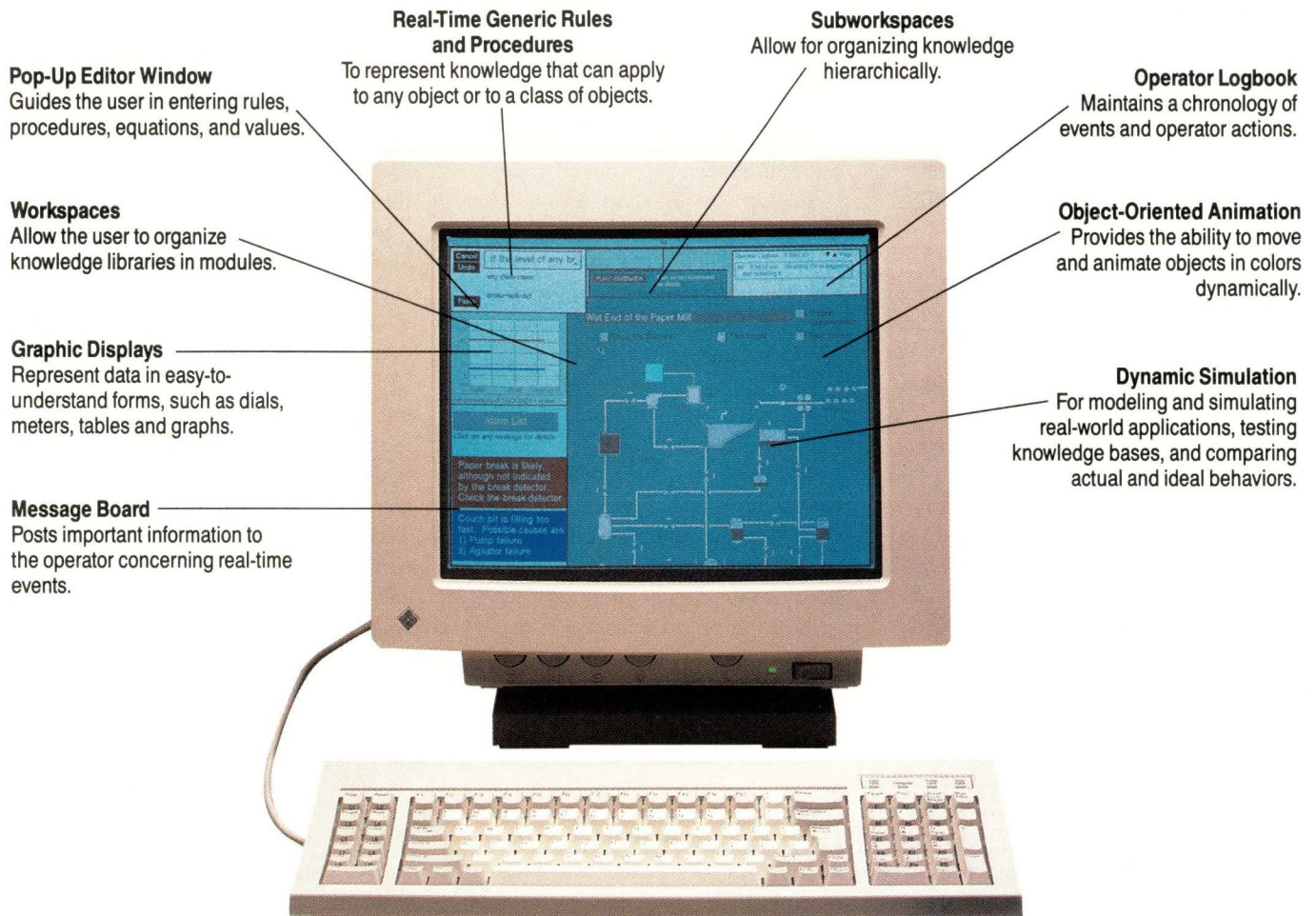
Moreover, a new company, NetManage Inc., Cupertino, CA, announced ChameleonNFS, a PC NFS product that allows PCs running MS Windows to act as both an NFS

International Spotlight

Europe Leads the ISDN Charge

Sun's contention that healthy demand for ISDN services in Europe spurred it to include built-in ISDN with the SPARCstation 10 is apparently not as surprising as it might first appear. Kathy Burrows, analyst for Dataquest Europe's telecom group in Denham, United Kingdom, says there will be "some demand" across Europe, particularly in France and Germany, where ISDN is tarified in such a way as to make it attractive. "France Telecom has spent a lot of money in sorting out [ISDN] applications. It is well marketed," she says. An alternative to ISDN, leased lines, is still quite expensive in Germany as well, she adds. The United Kingdom is behind those two countries, she says; British Telecom has an ISDN service, but it is in only the early stages. In 1991, Dataquest says, the Deutsche Bundespost Telekom sold 60,000 Basic Rate lines, France Telecom sold 20,000 Basic Rate lines, while British Telecom sold only 2,500 such lines. Burrows says Sun's move to put ISDN on a workstation is a good one and one of the first such attempts. Currently, however, users who want ISDN capability are opting for adapters for their existing workstations, which cost between \$1,500 and \$2,000. As the SPARCstation 10 is more expensive, she says, "it won't be sold in vast quantities—yet."—mwj

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client and server, which NetManage says is a first. "Before, everyone who did NFS used a UNIX machine as a server and all the PCs were clients," says company President Dan Geisler. "We've done it the other way around."

Meanwhile, as an added twist, some companies are offering products that combine MS Windows, the X Window System and NFS and TCP/IP. AGE Logic Inc., for instance, announced on June 1 an agreement with Novell Inc.'s San Jose, CA, office, under which AGE would bundle TCP/IP software from Novell with AGE's own X Window server software that allows X Window System applications to run on MS Windows.

Why the sudden boom in Windows-to-UNIX links? "It's a question of business," says Ajit Kapoor, vice president of market-research firm The Meta Group. "There are 14 million to 15 million PCs shipped every year."

In fact, the growth of PCs that are networked either to or by UNIX machines has been so rapid that yet another coalition of industry heavyweights has sprung up to address the problem of just managing them all. In May, Intel Corp.; Microsoft; Novell; SynOptics Communications Inc., Santa Clara, CA; and the SunConnect division of Sun Microsystems announced plans to collaborate on a common, open set of APIs to ease the management of individual PCs on a network.—*mjt*

This Just In...

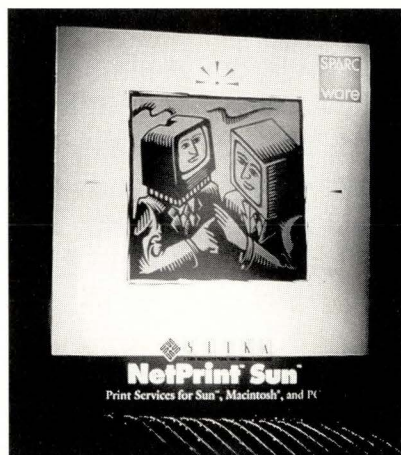
- There's more than one way to build a SPARCstation 10-compatible. Just ask **CompuAdd Corp.** This summer the Austin, TX-based company will announce a plug-in board, codeveloped with **Ross Technology/Cypress Semiconductor Corp.** and using the hyperSPARC chipset, which will turn an existing SPARCstation into an SS10, according to a member of CompuAdd's Advanced Systems Group. Then, in the fall, CompuAdd will unveil its full-fledged SS10-compatible. Advanced Systems is expecting the board-level product to steal the show.

- SPARClike vendor **Mobius Computer Corp.**, Pleasanton, CA, meanwhile, has shored up its product

line with a 40-MHz, SPARCstation 2-compatible, the Mirage Series Model IPS/2. The system is SCD 1.1-compatible. The Mirage IPS/2 delivers 28.5 MIPS, 25 SPECmarks and 4.2 MFLOPS. A diskless system is priced at \$6,990; a diskfull model, preconfigured with a 520-MB hard drive with Solaris 1.0.1, X11R4, Motif, C and ONC, sells for \$8,590.

- **WordPerfect Corp.**, Orem, UT, and **SunSoft** have entered into a "strategic technology-sharing partnership." The pair say the agreement will result in providing WordPerfect customers with better products in a more timely fashion. It also will allow WordPerfect "to effectively utilize SunSoft's development resources." The WordPerfect and WordPerfect Office products will be ported to Solaris 2.0; they both already run on SunSoft's Interactive UNIX product line. Finally, according to the two companies, the plan calls for cooperative development of future versions of WordPerfect products "along with reciprocal participation in marketing programs for current versions of WordPerfect and SunSoft products."

- A Sun Microsystems Inc. subsidiary that hasn't been heard from much lately, **Sitka Corp.**, has taken the wraps off NetPrint Sun, a set of network printing services that provide Sun, Macintosh and PC users with a way to share printing resources. NetPrint Sun allows PC users connected to an Ethernet or LocalTalk network to access Sun printing services. In addition, Sun workstations can print to any Mac or PC PostScript printer on the network, including LaserWriters, LaserJets or color thermals, via



NetPrint Sun. NetPrint Sun resides on a Sun workstation and thus provides all network users access to SunPics' NeWSprint software, if they so desire. The product is compatible with "many" NeWSprint printers, as well as with Adobe Systems Inc. Transcript. Alameda, CA-based Sitka has priced the product at \$495 per copy and is selling through SunExpress and Sitka resellers. A version with NetPrint Sun and NeWSprint bundled is available through SunExpress for \$995.

- More printing news: InterCon Systems Corp. has introduced LPR client software for the Apple Computer Inc. Macintosh. The product, InterPrint (formerly known as LPR/Con), is based on the Berkeley line printer resource/line printer daemon (*lpr/lpd*) UNIX print protocol. It allows Mac users to send output to any UNIX PostScript printer on a TCP/IP network. InterPrint is compatible with Mac V6.0.5 or higher, and MacTCP is included in the package. Pricing starts at \$195 for a single-user package. InterCon is based in Herndon, VA.

- Just when you thought Version 8 was hot, SPARC International announces the next version of the SPARC architecture, Version 9, which represents "the first architectural change to SPARC since it was introduced five years ago," according to David Ditzel, director of the advanced systems group at Sun Microsystems Laboratories and chair of the SPARC Architecture Committee of SI. Version 9 extends the SPARC address space to 64 bits, yet maintains upward binary compatibility with current versions. Version 9 contains new instructions, enhanced UNIX support, foundations for multiprocessing support and superscalar SPARC support. SI says it expects that systems based on Version 8 and Version 9 will coexist through the 1990s and maintain application compatibility through adherence to SCD 2.X. HaL Computer Systems Inc., Campbell, CA, says it is "well under way" with its own implementation of SPARC Version 9 microprocessors. The company is building a family of 64-bit superscalar SPARC systems that are SVR4-compatible. ⇐

Learn the Only Debugger You Will Ever Need Without Turning the Page

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1 Double click on a variable to create a window that displays its value whenever the program stops.

2 Click on a variable to print its value.

3 Click on a green dot to set a breakpoint.

4 Click on the stop sign to clear the breakpoint.

5 The program is currently stopped here.

6 Click on a function name to display its source code.

7 Set a conditional breakpoint at the current line.

8 Click "next" to execute the next line of the program.

9 Click "go" to continue (or start the program).

Click "help" to learn the rest of MULTI.

Click here to see the object this points to.

Double click here to see this array in a new window.

Move the mouse here and type in a new value.

Click "calls" to display a call stack window.

Click "halt" to stop execution of the program.

Click "edit" to edit the current function.

Click "make" to compile and link the program.

The screenshot shows a code editor with the following code:

```

41 struct bar {
42     struct bar *next;
43     enum color {red,orange,yellow,green,blue}color;
44     float d[10];
45     int count;
46 }*Bar;
47
48 struct bar *NewBar(count,color)
49     enum color color;
50     {
51     int i = 0;
52     struct bar *ret;
53
54     if (count == 0)
55         return 0;
56     ret = (struct bar *)malloc(sizeof(struct bar));
57     ret->next = NewBar(count-1,color);
58     ret->color = color;
59     ret->count = count;
60     for (i = 0; i < count; i++)
61         ret->d[i] =i;
62     return ret;
63 }
64
65 main()
66 {
67     Bar = NewBar(10,orange);
68     Rest ();

```

The interface also includes a variable window for `*ret` showing `next: 0x6100`, `color: orange`, `d: {0,1,2,3,4,5,...}`, and `count: 10`. A call stack window shows `0_NewBar(count=10,color=orange(1))` and `1_main()`. The status bar indicates `STOPPED line:61 file: test.c` with `count: 10` and `stopif i==9`. A control panel at the bottom contains buttons for `help`, `go`, `next`, `step`, `calls`, `halt`, `edit`, `stops`, `regs`, `local`, `pop`, `assem`, `make`, and `quit`.

It's worth learning **MULTI** to fix one bug.

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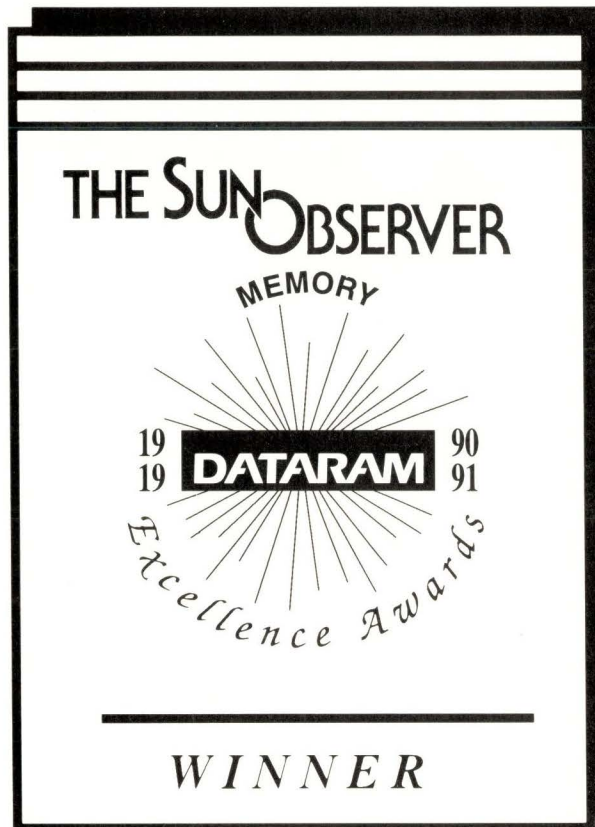


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TOM BARRETT

Move Down! Move Down! No Room! No Room!

by MICHAEL O'BRIEN

"Let us reason together."

—The guy with the sharpest knife

"Since January 1983 when the ARPANET first switched from NCP to TCP/IP, the vendors, managers, wizards and researchers of the Internet have all been laboring mightily to survive their success."

—RFC 1287

"It was only the best butter."

—Author of a failed transition plan

Q: I must confess that I've seen Mr. Protocol do some strange things in my time, but this beats all. Would

you please explain to me why he is attacking that post office with a penknife?

A: This just goes to show that appearances can be deceptive. Mr. Protocol is not doing any such thing. That's not a penknife. That's a fine whittling knife. Mr. Protocol is whittling away at the post office. He is doing so, in fact, as a matter of dire necessity.

Mr. Protocol would like to call your attention to that small dappled pony over there. That is a reminder of the way things used to be, when the mail was carried on horseback. In the Good

Old Glory Days of the Arpanet, about which Mr. Protocol is nauseatingly fond of reminiscing, the host field was designed to be so large as to be effectively infinite in size: The network protocol would never run out of address space for hosts. In this case, "infinite" was chosen to be eight bits, enough room for 256 hosts. The original implementers of the Arpanet were certain that there would never be enough hosts on this small research network to fill up the address space.

By the time the original Arpanet protocol (known simply as the Network Control Protocol, or NCP) was replaced, efforts had been under way for several years to "stretch" the address space. The main effort was to provide some sort of direct access for the various machines on the brand-new, all-singing, all-dancing local-area

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networks that had been installed at many of the major research sites. Here these people had all of their machines tied together at long last, sharing files and mail like there was no tomorrow, and only one machine could talk to the Arpanet. This was extremely frustrating to those who realized that only the narrow host field prevented all of their hosts from communicating with the Arpanet.

Well, actually there were a few other problems. For one thing, the original Arpanet did not allow hosts direct access to the net. Hosts communicated only with an Interface Message Processor (IMP), a special-purpose computer that mediated between the wild variety of machine architectures then in use and the actual network. These IMPs could only support up to four (later eight) hosts each...at an estimated amortized cost of about \$100,000 per year.

However, even though only one or two hosts at each site could communicate directly with the net, the net users saw no reason why those hosts could not act as gateways for other machines at the site, passing traffic back and forth, if only some way could be found to address those subsidiary hosts in some unambiguous fashion.

Consider that people working on such schemes were operating under a number of constraints. In the first place, the host address field in the NCP packet header really was limited to 256 hosts. Other, "extra" addressing

bits would have to be carved out elsewhere in the header. Also, such a scheme would probably succeed only if it could be carried out transparently; that is, hosts whose net control software was "unaware" of the scheme should not be able to detect that any funny business was going on. This resulted in a great deal of discussion about which other bits in the header could be used and how.

In any event, another set of network researchers had a more grand and grandiose scheme in mind. The Internet Protocol (IP) was proposed, and the Internet was under way. The IP was designed from the beginning to accommodate a multiplicity of local networks, communicating through gateway machines. This neatly solved the problem, seemingly permanently.

The IP replaced the eight-bit host address field of NCP with a 32-bit host address field for both source and destination. This, once more, appeared infinite. Given that the protocol can support 4,294,967,296 hosts, or one for every human being on earth, it would seem that this would hold us for a while. However, a new wrinkle was added when IP was instituted.

If the host address field were to be used as an undifferentiated 32-bit number identifying an individual host, then 4,294,967,296 hosts would require 4,294,967,296 routes in the gateways (not to mention that the gateways would have to be 64-bit computers, at least!). Therefore, the IP

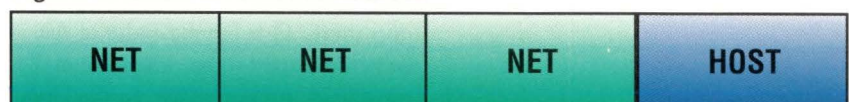
Figure 1. Class A Network Address



Figure 2. Class B Network Address



Figure 3. Class C Network Address



is divided into four sections of eight bits each, and these sections are used to encode the source or destination addresses in various ways.

The address is split into a host portion and a net portion. Gateways throughout the Internet may then route packets based purely on the network portion: Each network advertises itself and the address of a gateway that can reach that net. Three different

Why in the world are we covering ancient history in such detail? Mr. Protocol is glad you asked. The reason is because this arrangement is beginning to break down.

A moment's thought will show that the numbers above are somewhat bogus. If all possible Class A network numbers were allocated to Class A networks, then these networks would chew up all of the possible address

The problem, it would seem, is that the neat division of the IP address into octets built walls in the wrong places.

classes of address are recognized, as shown in Figures 1 through 3. The largest networks are pre-allocated a Class A network number, which is a specific number for the "net" portion of a Class A network address. This leaves 24 bits of host address left, which the Class A net can divide up and allocate to its member hosts as it pleases. During the IP days of the Arpanet, the Arpanet was a Class A network, with net number 10. The host number came in the next eight-bit field ("octet"), the next octet was left as 0, and the final octet held the IMP number (well, by then it was a packet switched node (PSN), number, as the IMPs were renamed to be PSNs, but you get the idea).

Class B addresses are evenly divided between the number of bits in the host field and the number of bits in the net field. The maximum number of hosts on a Class B network is then a little under 65,536 (zero and 255 are unusable), instead of the approximately 16,777,216 that will fit into a Class A network address. The advantage is that there can only be 254 (again no zero or 255) Class A networks, but there can be a little under 16,384 (zero and 255 still unusable) Class B networks.

Finally, the numbers are reversed for the Class C networks. There can be 16,777,216 of these, but each one can have only 256 hosts.

space, since any possible pattern of 32 bits would be a legal Class A address. Part of the Class A address space is reserved; in fact, half of it is. In a Class A address, the leftmost bit (that is, the leftmost bit in the entire 32) must be zero. If that bit is 1, then we are dealing with some other sort of address, either Class B or Class C. Similarly, part of the Class B address space is reserved for Class C addresses.

However, it is still the case that Class A addresses are at a premium, whereas Class C addresses can be given out as party favors. There are probably many large organizations that would like to have a Class A network number, but it would take an act of Congress to get one these days, with only about half of the possible Class A addresses actually allocated. Class C network numbers are still being handed out rather freely. The problem has turned out to be the Class B numbers. There are more than 16,000 organizations who have enough hosts to merit a Class B number, and these organizations are beginning to wake up and smell the scarcity of coffee.

The Internet is designed by committee these days, and that committee is the Internet Engineering Task Force, or IETF. The IETF runs a mailing list, and that list has been more than ordinarily busy lately, thrashing out the problem of what to do about the

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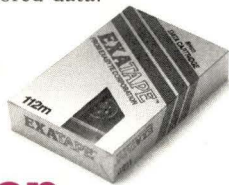
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“exhaustion” of the 32-bit address space of IP.

Actually, the maddening thing is that there is still plenty of address space left in IP. Only Class B net numbers are becoming scarce. Fully half the Class A networks are still available, which is a far larger space than all of Class B. Class C numbers are nowhere near saturated. The problem, it would seem, is that the neat division of the IP address into octets built walls in the wrong places. This could never have been predicted in advance; only experience has shown how many of which sorts of numbers are really needed.

What has delighted Mr. Protocol, and has caused him to jump into the gay art of address-whittling, is the variety of solutions to this problem now being proposed. We'll look at several of them. This is an interesting time, in both the Western and the Chinese senses. It is a rare opportunity to look at how network-architecture decisions are made these days. (In the old days, one or two old-timers would sketch it out on a napkin and then discuss it in smoke-filled back rooms. Well, not really, but there were far fewer people stirring the pot in the days of the NCP-to-IP transition!)

The first solution we consider is the most grandiose. A new RFC has been produced, RFC 1287, “Towards the Future Internet Architecture,” by Clark, Chapin, Cerf, Braden and Hobby. This RFC is like the early work toward IP (and by some of the same people, please note) in that it takes the long view and attempts to list solutions that would actually solve the problem for some little time to come. It also discusses several other problems and their indicated solutions and makes fascinating reading. Mr. Protocol cannot recommend this document to hold up the leg on your kitchen table, as you would be too tempted to pull it out and read it, as opposed to many (possibly most) other RFCs.

The real problem with the IP address space, we now find, is that if it is structured, then the structure will have to be rearranged to meet varying demand for the different classifications. Even if

we were to undergo the pain of rearranging the interpretation of the 32-bit address space now, the same problem would crop up in the future. A structured address is like a hash table: It only works smoothly if it is sparsely populated.

RFC 1287, however, goes further than this. It reports on a meeting of the Internet Activities Board and the Internet Engineering Steering Group, at which the long-term future of the Internet was examined. At this meeting, it was decided that eventually the Internet would have to be able to handle 10^9 (or one trillion) networks.

This will fit into a 32-bit address, but not easily, and certainly not sparsely. Therefore, future solutions to the addressing problem depend on the existence of Autonomous Domains, or ADs, which manage the address space independently, possibly replicating addresses between them. In this way, the problem of overall Internet routing is reduced to a replication of smaller routing problems, with external information used to do inter-AD routing. Some form of source routing, in which the source machine issues its own route to the intended destination in another AD, would be needed.

Another possibility, which does not eliminate the need for ADs, is to increase the address field from 32 to, for example, 64 bits, which would encode a host address as well as an AD identifier. In essence, this would just be a bigger and better address field, unique across the Internet.

Yet another possibility is to increase the length of the address field again to, say, 64 bits, but to make this a simple host identifier, and to carry the AD information at connection setup time. This is really a combination of the first two proposals.

It is evident that all three of these proposals would require some sort of address-rewriting modules (though in the second case it would be trivial). In addition, the second two proposals would change the IP header, requiring changes to all host software everywhere.

This is the crux. In the days of the NCP-to-IP transition, a cutoff day was declared when everyone had to cut

over. Since there were less than 256 hosts on the net, this was feasible, if highly unpleasant. The unpleasantness was magnified by the fact that many more machine architectures and operating systems were represented on the net in those days than now...exactly the opposite of what one might expect. Some machines, in fact, were simply deleted from the net at the cutover time, since there was insufficient money or interest (same thing—depending on whether you can interest someone with the money) to write a TCP/IP implementation for the box. The really bad news now is that there are a great many more than 256 hosts currently on the Internet, and while relatively few operating systems would have to be changed, actually pushing the changes out into the field represents a task of unparalleled proportions.

The net result is that some sort of fix is required now, to tide us over until a more permanent solution can be chosen, tested and deployed.

The simplest solution is called, puckerishly enough, C#. In this scheme, which plans specifically to remedy the scarcity of Class B network numbers, a new network class called C# is created, which steals four bits of address from a Class B network and creates what are in essence batches of 16 Class C networks that act as a single large network, intermediate between Class B and Class C in size. This is based on the observation that those folks who can't get along with Class C networks because they have way too many of them still don't need the full address space of a Class B network. The advantage is not only that hosts ignorant of this scam will continue to operate normally, but that gateways can also be fooled, simply by deploying 16 new Class C routes for every Class C# net allocated. The price paid is that of routing information explosion, but in all other respects this is a "least-cost" alternative.

Another possibility, with somewhat greater impact, is called Classless Internet Domain Routing, or CIDR. This proposes to eliminate classes of networks completely and to aggregate existing (mainly Class C) networks to

the extent possible, by using network masks in the interdomain routing protocols. If the hosts are also made aware of the masking trick, then Class A and Class B networks can be subdivided, making more efficient use of that end of the address space as well. This requires changes to the routing protocols at a minimum, and possibly new host software for everybody, depending on how, and how thoroughly, it is implemented.

Other proposals are in the works. One of them says that since OSI is king of the world, we should let IP choke on its own success and simply start using OSI protocols. Others say a) we've got a lot of money invested here, b) OSI protocols might have the same or similar troubles if they ever were used to this extent, and c) TCP/IP is spreading a lot faster than OSI anyway, so let's fix the one that works.

In fact, the Internet folks now believe that the definition of the Internet will become fuzzy as TCP/IP and OSI protocols come to coexist on the same Internet. Mr. Protocol expects to see this come about, which will certainly give the OSI protocols a workout. In the meantime, he's keeping his packet wrenches handy. The Internet is going to require some major tinkering, and soon. →

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

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

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

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Process State

by PETER COLLINSON,
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KEITH GRAVES

I was browsing a bulletin board in the United Kingdom the other day and came across a frequently asked question: “I wrote a program that changed directory, but when it finished I was still where I was in the tree. What am I doing wrong?” I began to think about this, and those thoughts have prompted this article.

UNIX processes are often called “heavy” because they carry around so much bag and baggage as process state. However, this state is what makes UNIX “UNIX.” One part of this state is a pointer to the current working directory, and this pointer is affected by the `cd` command via the `chdir` system call.

But I am rushing ahead; let’s look at the basic mechanisms. A new process is created by the `fork` system call. When this is executed, the system creates a process that is an exact clone of the caller. The new process is running exactly the same code and has the same data area. The system also duplicates the per-process state, often called the `u`. area (pronounced “u-dot area”) after the name of the C structure that defines its contents.

There does need to be some way of detecting which of the processes is the new one, and `fork` will return zero in the new process (or child) and will return nonzero to the original process (or parent). The nonzero value is useful; it’s the process id (`pid`) of the child.

Usually, the new process is not content to run the same code as its parent and wants to become a new program. This is done by the `exec` system call. When a process calls this, all its program and data areas are thrown away and new ones established from the executable file that is being loaded. However, the `u`. area is simply altered to reflect the new situation; many values remain the same across the `exec` call.

The relationship between the two processes is a feature of UNIX. When a child wants to die, or is forced to die, it will call `exit`. The process will be wiped from memory, and all its open files will be closed. The process will not completely disappear from the system until its parent executes the `wait` system call. The process has entered `zombie` state.

A remnant of the process, one of the walking dead perhaps, is retained by the system to hold the per-process timing statistics. More importantly, it acts as “token” to inform a waiting parent that its child has died and it can proceed with the next task. The timing information is often thrown away, although it is useful sometimes to get execution times and the like.

If the parent dies before the child, then process one (`init`) inherits the responsibility of executing the `wait` call. A common mistake of programmers starting to generate processes is to fail to call `wait` and then wonder why a call to `ps` shows so many processes showing a “z” for the zombie state.

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To quickly summarize: The child is created as an exact copy of the parent. The child's `u.` area is a duplicate of the parent's, and this guarantees that the child will inherit any values that were set in the parent. These values are left alone when the child calls `exec` to create a new process. Information can only be passed directly between parent and child; there is no automatic flow of data in the other direction. Of course, you can use pipes, files or sockets.

All this is central to the way UNIX operates. Let's look at some parts of the system that make use of these facts.

Ownership

Each UNIX process is owned by some user. A user is characterized by a pair of numbers: the user id (`uid`) and the group id (`gid`). This pair of numbers is important because it determines file access permissions. Every file that the process uses has its permissions checked against the number pair (`uid, gid`) stored in the process state.

Each process can find the identity of its owner by getting the number pair using the `getuid` and `getgid` system calls. This just transfers values from the `u.` area into the process address space. A process cannot change its owner unless it is owned by root. This makes sense for security reasons.

We need some way of establishing the ownership of the user's shell when the user logs in. Almost the last job of the `login` program is to call `setuid` and `setgid`, setting the values just before it execs to the shell. It calls `setgid` first; it needs to be running as root to change process ownership. It then calls `setuid`. The `login` program execs to your shell so

that you can get work done. In turn, your shell will fork new children and they will call `exec` to run new programs. This mechanism passes ownership down the process family tree.

For the ownership information, the idea of inheritance is crucial. After logging in, stating a password and having it validated, your identity is simply passed from parent to child gratis, as it were. No further checks are needed; the inheritance of process state guarantees system integrity.

This is all fine until you want a process run by the user to have privileged access to some system object. Perhaps we want to write `df`, telling the user how much free space there is on a disk. The program needs special access to the underlying structure of the file system to find this type of information. We don't want to permit users to have unlimited access to the underlying structure because it would defeat security. I/O devices must be protected from casual inspection but open for controlled access.

Setuid Processes

We give the `df` program privileged access by making it `setuid`. A special bit in the file permission says: "When you exec this file, change the ownership of the process to that of the file." The `setgid` bit does the same, but for groups. When the user types `df`, the shell will first fork to create a new process owned by the user. The new child will exec to `df` but the system will replace its `uid` with that of the owner of the `df` file, say root. The `df` process will run *as* root, and this gives it access to the I/O devices.

This is a little simplistic; it's all a bit more complicated. A

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process has a *real* uid and an *effective* uid. The real uid is set by the `setuid` call and then doesn't alter. The effective uid is the value that is used to check file access permissions. It starts life being equal to the real uid but is loaded on the `exec` system call if the `setuid` bit is present on the file being run.

If we are running as a `setuid` program with an effective uid of root, then consider what happens when we fork and `exec` to a new process. Yes, the new process will inherit the identity information from the parent. The new process will have root privilege. This may be OK. But what if the new process is an editor that in turn can create other processes using the exclamation-point syntax? Then this might become embarrassing. All the processes will inherit the root ownership. Suddenly, you have handed every user the ability to run shells as root and do anything they like.

What you need to do is to make sure that the editor runs with an effective uid set to the original caller. If we extrapolate the need a little, it's probably desirable to allow any process to set its real or effective uid from either of the two possible values. Many systems contain calls that permit this. It's an area where the System V and the BSD views of what should be done have diverged.

Groups

If you look at your system, you will find that I have been stretching the truth somewhat. The `df` command is not `setuid` to root, it's actually `setgid` to the "operator" group. All the devices have permission:

```
drw-r-----
```

showing a block device that is read/write by its owner (root) and also readable by its group (operator). The effect is the same; the `df` program gets read access to the devices but using group permissions limits the overuse of root privilege, and this is a good thing.

The original group mechanism badly restricted the use of groups. Groups should be used to delineate administrative domains, a group of users who need to share files. Directories and files are made readable and writable by the group, so several users can access the same file base. Once you establish this idea, there are always users who need to move from one group to another.

Changing groups in the original scheme is messy. To get into another group, you need to ensure that your shell is running with the new `gid`. The shell must call `setgid` for us; this will set the group in the current process so it may be inherited by all the processes started by the user commands. This implies that we need the `newgrp` command to be a shell built-in command. It will call `setgid` to change the value in the `u.` area.

Trouble is, we cannot get the shell to execute the `setgid` call. We need to execute `setgid` as root for it to be effective and, of course, our shell is not owned by root. The trick is to make the `newgrp` command `exec` to a `setuid` program (perhaps `/etc/newgrp`) to establish the group that the user wants to be in. Notice this eliminates the user's shell. To get back to the shell, the `setgid` program will `exec` the shell binary, having called `setgid` to establish the new group.

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The shell has been "rebooted" into a different group.

Having done all this, you may still find that it is hard to move files between groups. In my experience, the file that you want is always group readable, but only by the other group. The designers of 4.2BSD decided to tackle these problems.

First, they allow you to be "in" several groups at any one time (a maximum of 16 on my Sun). This obviates the need for the `newgrp` command, although you do need to log out and then in again when you are added into a new group by editing the `/etc/group` file. The list of groups that you are permitted to be "in" is passed from parent to child process in the normal manner.

Also, when a file is created in a directory, it takes its group not from the creator but from the group that owns the directory. This allows you to copy files between directories, automatically changing their group ownership. The behavior is enabled on SunOS by setting the otherwise unused `setgid` bit on the directory. Alternatively you can mount the whole file system with this behavior turned on.

The inheritance of state means that ownership and identity are not problems on a UNIX system. Once set by a privileged program like `login`, they are simply passed from parent to child.

Files

It's not too much of a revelation that UNIX passes files from parent to child processes too. When a process calls `fork`, all open files are duplicated in the child. It's not just a matter of copying data, the kernel has to increase reference

counts on internal structures so that it can track file activity correctly. I should emphasize that *all* open files are passed from parent to child.

Usually, we ensure that channels 0, 1 and 2 (standard input, output and error) are passed. We expect this to happen, by common convention. There is nothing to stop you writing a suite of programs that pass an open file around as file descriptor 4. You simply open it and call `fork`.

In some ways, it's too easy to do. These days it's harder to close files than it is to open them. On older systems, the maximum number of possible file descriptors for each process was a constant burned into those tablets that Ken and Dennis brought down from the Death Star. You could close all the open files using some code like:

```
for (i = 3; i < 16; i++)
    close(i);
```

You added this into your code just after the `fork` and just before the `exec`. All unwanted open files were closed.

These days the number of open file descriptors is almost a variable. It varies from system to system and from machine to machine. Unfortunately, there are also a number of different ways of getting the system to tell you what the number is. The 4.2BSD solution was:

```
max = getdtablesize();
for (i = 3; i < max; i++)
    close(i);
```

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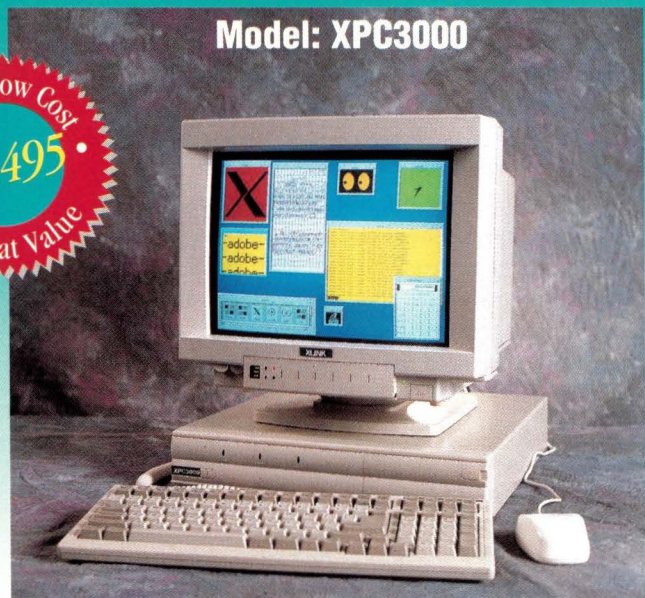
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This is available to you in SunOS but is deprecated. You need to use `getrlimit` to get the value. It is also a little complicated; see the manual page.

Rather than the sledgehammer approach of closing all files, the other way of making sure that processes do not get unwanted open files passed into them is to add a flag to an open file that says "do not pass this file to a process after an exec." This is done by using the `fcntl` system call:

```
fcntl(fd, F_SETFD, 1);
```

This ensures that the file will be closed when the `exec` system call starts a new process.

Why bother with all this? Why don't we just live with the fact that processes may have unwanted open files? Apart from the anti-littering legal eagles, who cares? First, you, the application writer, care because file descriptors are a limited resource and you want to be able to manage your own resources in a predictable way. Second, you, the system administrator, worry because you don't want file descriptors that point to sensitive files to be passed to some program that was written by A. Cracker. Finally, you, the application user, care because you don't want your carefully constructed files trashed by some runaway application that is writing garbage on random I/O channels.

Directories

I am going to end where I started, with the current working directory. Each process has a stored pointer to its current working directory. This is used to interpret file names that don't start with "/." It's not too astounding that the reference is a pointer because that's the handle that the kernel uses to refer to all open files. The directory *is* an open file; the system knows that someone has a valid pointer to it.

The `cd` command has the same basic characteristics as the `newgrp` command described above. We need to change the current directory in the currently running shell process so that all children will inherit the correct directory. We need a built-in command, `cd`, that will call the `chdir` system call to move about the file system. Normal file protection mechanisms are used to control access to sensitive directories.

The `chdir` system call closes the old directory and opens the new one. It stores the pointer to the directory in the `u.` area for the process. The issue here is one of efficiency. If we open the directory and keep it open, then we will have fast access to the location of the disk blocks where the directory is stored. Also, there's a good chance that the directory contents will be found in the disk cache. As a result, file access in the current directory will be faster.

If you considered another implementation where perhaps the current directory path string is stored, then this would involve a full pathname directory search on every open file. It's much better to open the directory once and store its pointer.

This can sometimes be embarrassing. Consider removable media like a disk, a floppy or a CD-ROM. To use it, you mount the file system at some point on the existing tree, making an invisible join. The problems start when you want

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to change the media. You need to unmount it. The kernel will not let you unmount a file system if it is busy, and busy means that someone has a file open on the device.

Directories are files, and a single process with a current working directory sitting on the media will make the system think that the file system is busy. The process does not have to be actively accessing the file system. The mere fact of having done a `cd` onto the removable media is enough to open the directory, add a pointer into the `u.` area of the process and set the file system "busy."

For the poor system administrator, the question is: Which process and who owns it? It's a matter of inspired guesswork, I am afraid. Either that or you need a machine reboot to kill the appropriate process.

It's not just removable media that is a problem; you can get troubles with NFS too. If your current working directory is set to a directory that is on a remote machine linked by NFS, then what happens if the network goes down and you start a command? The process will attempt to access the current directory to find a command name; it depends on your search path. The result is that your process suffers long NFS delays or might hang until the network is revived and things start to get better.

The notion of the current working directory is a crucial part of UNIX: It saves typing; it permits trees of commands and data to be established relative to some position; it makes the tree structured file system bearable to use. I hope you now see why you must put the `chdir` system call into the shell itself for things to work properly. There is no really easy way of making a program force its parent to move directories. If you are determined to be able to do this, then you

can make your program print a command on standard output, say:

```
$ cmd
cd /home/pc/new
$
```

We assume that `cmd` is really doing something else and the output `cd` is a side effect. We can now use the `eval` command in the shell to perform the `cd`:

```
% eval `cmd`
% pwd
/home/pc/new
```

The back-quote operator runs the command `cmd` but picks up the standard output, making it into the arguments for the `eval` command. The `eval` command simply executes the command that is its arguments, paying proper heed to embedded spaces and the like. The result is that the shell executes the `cd` command, moving you to pastures new. Of course, you can now wrap the `eval` construction into an alias if you are a `cs`h user or a function if you use Bourne `sh` or Korn's `ksh`. ➡

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

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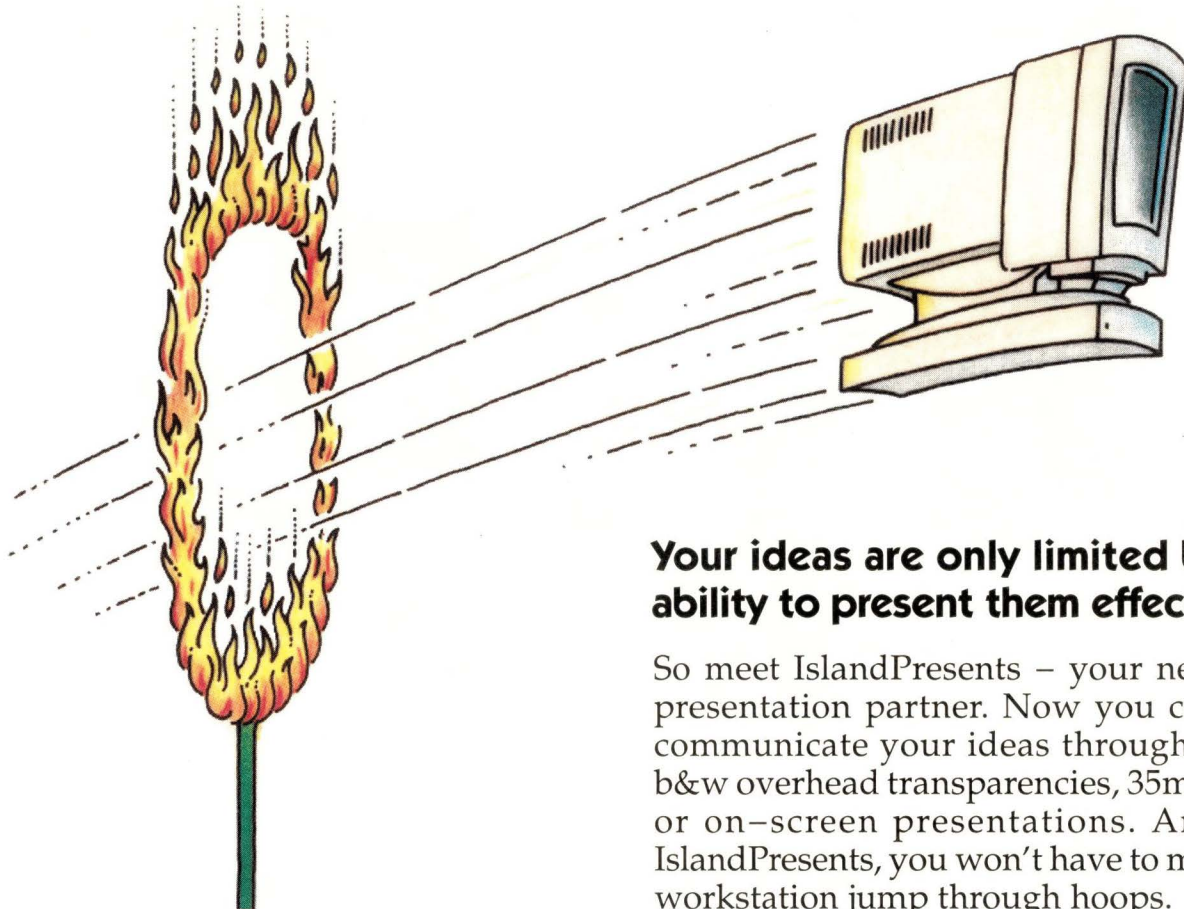
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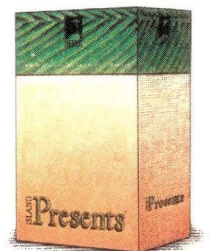
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ROBIN JAREAUX

by **RICHARD MORIN**,
Technical Editor

The Distributed Laboratory

My company name (Canta Forda Computer Laboratory) occasionally causes confusion. I get questions like, "Now that you can afford a computer, don't you need to change the name?" I explain that it is a "Computer Laboratory" (a somewhat nebulous and open-ended affair), rather than a computer, that I can't afford.

I have given some thought to starting a laboratory that I *could* afford. It would be a walk-in facility, open to interested computer enthusiasts on a subscription basis. In brief, it would be the kind of facility that all of us dream about but few of us have—the kind of place we imagine the research laboratories have.

For starters, it would have zillions of toys. Powerful workstations, nifty I/O devices, advanced software, etc. Costs would be held down by the fact that the laboratory would act as a semipublic showcase and sales office.

Try something out for any length of time. If you really like it, buy one to take home.

There would also be a substantial library, meeting rooms, a small auditorium and all that sort of thing. The lab would, of course, be open continuously. Midnight hackers might even get a discount, if usage patterns justified it. Borrowing a trick from the universities, student assistants would keep things under control, receiving part of their compensation in access to toys.

I think such a lab would be a nifty thing to have around, but I doubt that one will ever come together. For one thing, folks like to have their toys close to home. If the lab is more than a half-hour drive away, the toys had better be pretty spectacular. An hour away, and you can forget it.

Security is another consideration. Companies (and many academics) want their research to be private.

Unfortunately, this conflicts with the freewheeling networked environment that the lab should have. I am also unsure about the economics of the venture and would be hard pressed to draw up a convincing business plan. Sigh. On the other hand, I *have* become part of an informal distributed laboratory. You have too, even if you don't recognize the fact.

The Local Lab

There are a lot of UNIX sites in the San Francisco Bay area. As an active UNIXoid, I know about many (though not nearly all) of them. By trading favors over the years, I have gotten to the point where I can use equipment, software and reference materials at a number of sites. It is a casual arrangement, but it serves me (and my friends) quite well.

If you don't have a similar network of associations, it isn't too late to start one. Get involved in your local UNIX

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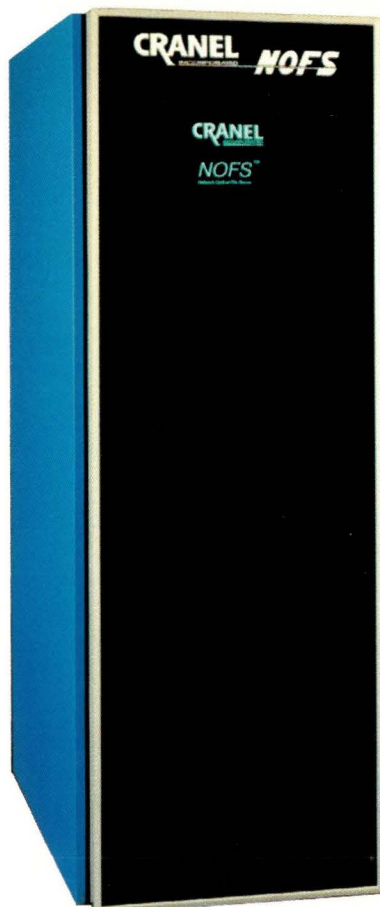
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user groups, regional Usenet news groups, etc. Be open to requests for access to your own facilities. As the saying goes, what goes around, comes around.

The same network can be very useful in getting informal support. After you have Read The Fine Manual, you may still be confused. Alternatively, you may not know which Fine Manual to read. By calling the right person, you may get a hint, a reference or a lecture. Just be ready to help the next caller *you* get, and the system will continue to work.

The Net Lab

The Usenet, along with the plethora of mailing lists, provides a second level of support. Post your questions to the appropriate group, and you may soon have an answer. Then again, you may not. A carefully composed request will usually generate some help, however, so the effort is worthwhile.

On a longer time scale, the Internet serves a similar function. While estimates vary, one source ("Alex-A Global Filesystem," Vincent Cate, *Proceedings of the USENIX File System Workshop*, May 1992) puts the aggregate archives at more than a terabyte. Even after redundancy, dated copies and general garbage are discounted, this is a *lot* of bits.

Specifics? Mr. Cate has indexed more than 3,000 computer science technical reports, with more appearing all the time. The archie server (see below) currently tracks about 130 GB of publicly accessible FTP archives, up 30% in the last year.

Much of the material is experimental and/or practical source code. System administrators write lots of tools, many of which find their way onto FTP archives. Language designers, seeking larger audiences for their efforts, put their interpreters, compilers and sample code out for trial and comment. A slew of window system code has emerged, offering assorted ways to develop interactive applications.

Sometimes the boundaries become fuzzy. The Tk system provides an easy way to write script-based windowing programs, complete with interprocess

communication. Is Tk a window-system tool, a language or an IPC testbed? No matter. It's nifty, free and available over the net.

My personal interests lie in the area of computer languages. Each new language represents (at least potentially) a new way of thinking about the programming process. awk, C, FORTH, Lisp and Prolog can all be used to solve generic programming tasks. The nature of the solutions in each case is likely to be somewhat, perhaps radically, different, however.

Special-purpose, or "little," languages offer even more room for diversity. There are languages for constraint-based programming (Bertrand), parallel execution (PlaNet), text transformation (TXL)—the list goes on and on.

By giving me access to dozens of languages, the Internet archives allow me to expand my notions of programming. Most of the languages are well documented, in papers, books or on-line documentation. If I have problems with them, after reading the literature and trying things out, I can frequently get help from the author(s) or other users. Most languages, in fact, have their own mailing lists or newsgroups.

Finding Things

Archie, an on-line catalog of ftp-able files, is a useful tool for finding packages (see "Wanted: Free Software," in the "Features" section, for more information on archie). Given the exact name of a file, archie will list the sites that have it. If you have only a rough idea of the file name, archie can do searches for partial names or even regular expressions.

If you don't know what the file is called, the archie *whatis* command can be useful. *whatis* does a case-insensitive search of a database of on-line package descriptions, printing any that match. It is pretty brainless; a search on "tar" matches "Military," "start," "Commentary," etc. The *whatis* database also tends to be both limited and dated, due to the amount of manual effort required to enter descriptions. Nonetheless, it may help you to find desired packages.

If you have Internet access, log in to an archie site (as "archie") and look around; the menus will help you get started. "Where's Archie?" lists archie sites as of January 4.

Where's Archie?

Australia

archie.au
139.130.4.6

Canada

archie.mcgill.ca
132.206.2.3

Europe

archie.doc.ic.ac.uk
146.169.11.3
archie.funet.fi
128.214.6.100

United States

New York
archie.ans.net
147.225.1.2
New Jersey
archie.rutgers.edu
128.6.18.15
Maryland
archie.sura.net
128.167.254.179
Northeast
archie.unl.edu
129.93.1.14

For more information on Internet resources, try Jeff Kellem's column "What's Out There?" (*login*., Usenix Association, (510) 528-8649, office@usenix.org). In the May/June issue, Jeff discusses archie, Charlie, WAIS and a host of hosts (-). In future issues, he plans to discuss the gopher, Hyperbole, Prospero and WorldWideWeb information servers, along with Project Gutenberg and the Open Book Initiative.

Futures

Stepping out on a limb, I'd like to discuss a possible set of Internet services and an effort that is under way to initiate them. The first service, a "package registry," would contain standardized registration forms for

freeware (and perhaps other) packages. Based on this information, a set of Certified FTP Mirrors (CFMs) would provide reliable access to registered packages. Other possible spinoffs include Certified UUCP Servers (CUSs) and a package review database.

To register a package, the author (or some other volunteer) would send in a form. Certain items would be required: the formal name of the package, a one-line description, definitive archive site(s) and/or newsgroups, the current version string, a cryptographic checksum, etc. These would allow users to determine whether a given package was indeed the desired one and where to get the most recent version.

Other, optional information would include a one- to three-paragraph description of the package, contact information for the author and/or maintainer, relevant keywords, distribution restrictions, etc.

All submitted forms would be archived; why discard knowledge? For most purposes, however, the moderated collection of forms would be the appropriate place to search. One or more moderators would attempt to keep the collection accurate and current. Note that the moderators would only promise to work with available forms, as opposed to creating new ones. Creation of forms is a staggering task and needs to be spread over the authors, users and maintainers of the packages.

It is quite possible that most users would never look at an actual form. Various user interfaces can make browsing much easier than it would be with, say, `more(1)`. Nonetheless, the form database is the basis for all searches, so its layout must be regular, if not pretty.

Now for the spinoffs. The aforementioned Certified FTP Mirrors would be designated directory trees, maintained and checked by standardized mirroring software. Although CFM operation would be totally voluntary, any CFM that failed to operate reliably would lose its certification. Thus, any packages found in a CFM would be guaranteed to be registered, up-to-date (within

certain constraints) and accurate.

This would be a great improvement on the current state of affairs. Many Internet archives are, to be kind, somewhat casual in their mirroring policies. Packages may not be checked for currency on a regular basis, may be mirrored from nonauthoritative sites, etc. Some sites actually store packages that were (shudder) manually retrieved from other sites. In such a situation, it is easy to see how archie can report files with the same name but wildly varying sizes and time stamps.

Certified UUCP Servers would provide the same clean packages as CFMs. In fact, a CUS would draw its packages from one or more CFMs. The difference would lie in the delivery system. Upon request, a CUS would email the requested package to the requesting site. This isn't much different from current email ftp servers, except for a possible improvement in the quality of the delivered packages.

To reduce modem bandwidth, however, the CUS system could figure out which CUS could most economically deliver the file. Add a bit of caching logic and usage monitoring, and popular packages could migrate automatically among CFPs. Nothing very hard here, but the results could dramatically improve the availability of packages while reducing total network bandwidth and storage loads.

An informal committee is currently drafting the registration form; a draft should be posted to the net in the near future. Assorted collections of package descriptions will then be converted and added to the system. It will take some work, but I (and others) think it needs to be done. Contact registry-request@cfcl.com for more information. ➡

Richard Morin produces Prime Time Freeware, a semi-annual CD-ROM collection of redistributable, UNIX-based source code. Between releases, he consults, writes and teaches on UNIX topics. He may be reached at CFCL, P.O. Box 1488, Pacifica, CA 94044 or by email at rdm@cfcl.com.

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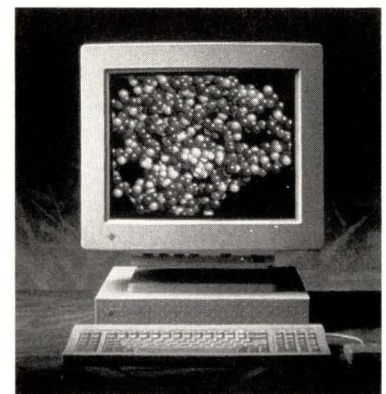
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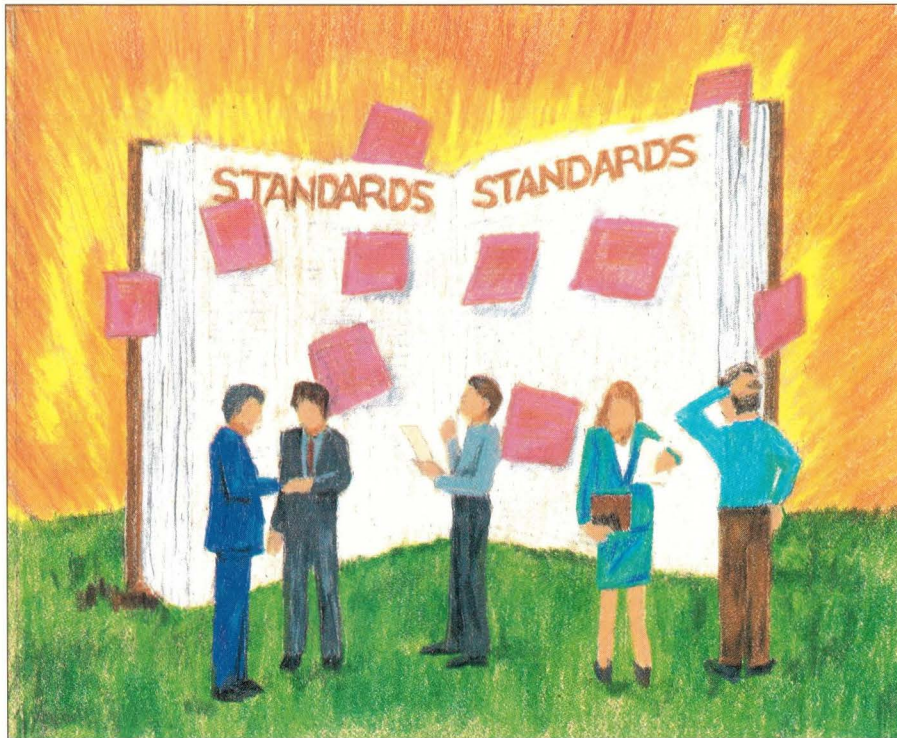


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JOHN W. KELLEY JR.

by PETER H. SALUS

Civilization's Discontents

Back in May, I quoted Arnold Toynbee on standardization and the breakdown of civilizations. This produced several cogent comments from readers. Moreover, at the end of the month, John Gilmore (gnu@cygnus.com)—a near-founder of Sun Microsystems, an early developer of NeWS and one of the co-founders of Cygnus Support, a company that provides commercial support for the GNU C Compiler (as well as producing its own free Solaris 2 compiler)—questioned just what X3J11 (the ANSI C committee) was doing. Doug Gwyn (gwyn@smoke.br1.mil) who serves on X3J11, has responded in a vituperative manner. ANSI C is officially ANS X3.159-1989. Much of what follows is John's. Some is Doug's.

"It seems to me that the ANSI C committee overstepped the bound-

aries of 'prior art,' producing scores of needless incompatibilities. And they plan to do it again soon," wrote Gilmore.

"Somehow the Committee has the idea that if a good idea doesn't make it into the standard, it won't be adopted, and that if a bad idea makes it into the standard, it doesn't matter anyway; it can be changed later.

"I'll tell them what matters. What matters is stability. We have all the turmoil and all the good ideas we need without their help. Standards exist to create stability. I'd be glad to throw the ANSI C committee a retirement party, if they won't ever meet again for the next 10 years. I'm serious.

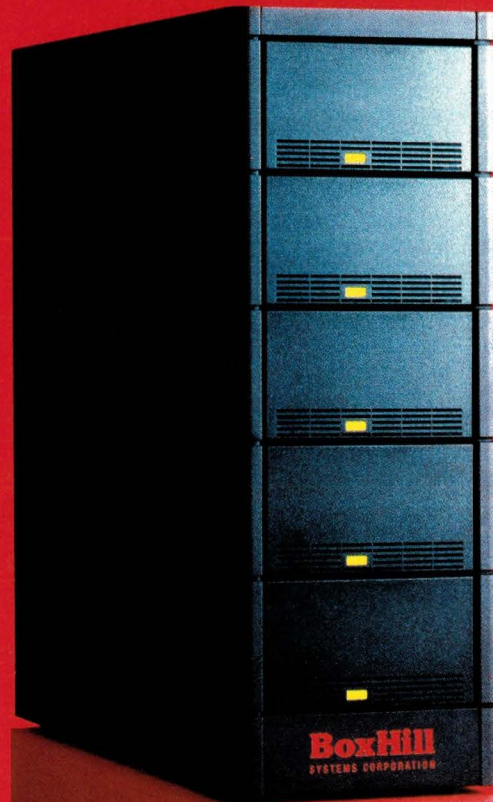
"My company works on a compiler. This compiler runs on a large variety of host systems. It cannot control the include files on those host systems.

The ANSI C 'model' was of a unified compiler and include files and libraries. Unfortunately, the market does not fit that model. We have to interoperate with the host-supplied include files and libraries.

"We now have a 640-line shell script that fixes up the include files on a bunch of these host systems. The problems we run into are utterly trivial... There is no prayer of getting more than a hundred compilers to agree on all these fiddly details. Neither the compiler writer, nor the library author, nor the user cares one whit about this stuff. But because of ANSI C, we are all stuck with trying to make it consistent. Because if we don't, our programs don't compile, due to conflicting declarations.

"It's been possible to write portable programs for a long time. Once ANSI C appeared, it became harder to write

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portable programs. It is infected with the 'I'm the only variant of C in existence' disease even worse than most vendors' C implementations. And the Committee felt free to change all sorts of things without regard for the impact it had on users. Vendors, at least, have to stay compatible with other major vendors; the Sun-1 compiler had to compile almost anything you could throw at a VAX, or Sun wouldn't have survived. The ANSI C committee seems to be more insulated from the results of its decisions. This needs changing.

"In a portable program, how can I declare 'abort'? Old compilers don't have `<stdlib.h>`, so I can't just include that, or I'll get a compile-time error. Some old compilers consider it void; others consider it int. At link time nobody will care, so I could just explicitly declare it either way. But if for some reason `<stdlib.h>` *does* get included, perhaps through a host-dependent `config` file, and you declared it backwards from the way `<stdlib.h>` declared it, your program won't compile. On SunOS 4.1.1, which is a non-ANSI system, `<stdlib.h>` declares `abort` 'extern int abort (*l void l*)'; (Non-ANSI systems are free to do things like this. It doesn't violate any standards.) The solution we adopted is to declare `abort` in the host-dependent configuration file. It is *one more thing* that we have to configure on a host-by-host basis. Our program is more complicated, harder to understand and harder to port. Because of ANSI C.

"The answer 'Just wait till everything is ANSI C' is a symptom of infection with the aforementioned disease. What if we want to write programs now? Also, the ANSI C committee wants to start revising the C standard again. So even if you waited till everything was ANSI C, there would soon be two of them, and you'd be back fiddling with details just to get working programs to compile."

[X3J11 has, indeed, begun changing ANSI C. But it has done so by removing the line numbers and otherwise conforming with the International (as opposed to National) way of doing things. This may be a disadvantage to

a programmer who actually looks at the various parts of Plauger's *The Standard C Library* (Prentice Hall, 1992). The Committee is also throwing away the Rationale in the Standard, apparently because it was difficult for readers to follow the Committee's deliberations. The current draft is full of obscure prescriptions in the third person, which no one (except Doug Gwyn) appears ready to either defend or explain.—*phs*]

Gilmore continues: "Now they want to 'track' what some ISO committee is doing to C. [I assume that John is referring to ISO SC22/WG14 (C Language), the body that will transmogrify the American National Standard to an ISO/IEC standard.—*phs*] We already suffered the first abortion produced thereby—trigraphs. The next plan is to rewrite all the multibyte character functions. We clearly didn't have enough practical experience with them (if they need changing so soon), and they don't belong in the standard anyway. So let's change 'em, and force all the vendors to supply the new ones!"

Gwyn remarks: "Gilmore's practical complaints were aimed at problems that would not occur were he not trying to support *nonstandard* C environments. It is ridiculous, for example, to lay SunOS brain damage at X3J11's feet. When SGI's Irix 4.0 `<assert.h>` triggers lint warnings, is that the fault of X3J11 or of SGI?... There are zillions of vendor stupidities in their header files, both before and after the C standard. Somehow I don't think it's X3J11's fault.

"The proper way to support antique C environments, as Gilmore should know from the GNU C compiler project, is to replace them with standard conforming environments. If one instead tries to straddle the fence between the nonstandard and standard C environments, *of course* he will encounter all kinds of incompatibilities. Vendors who don't know how to implement standard conforming C environments compatibly with their previous dialects are simply not doing their job right; several such vendors have been through this process without major disruption."

Gwyn is also interesting in his view of why X3J11 has acted: "There is *exactly one reason* that X3J11 has proposed that the international C standard (which has *identical* technical content to the existing ANSI standard) be adopted as a replacement for the older American National Standard, and that is *to ensure that X3J11 continues to exert as much technical control as possible over the content of the international standard*. In the modern multinational corporate world, international standards can have great commercial impact even on parochial U.S. customers. Far better to have arranged for the starting IS to match the ANS and to monitor and adjust the evolution of the IS than to diverge into two incompatible standards.

"JTC1/SC22/WG14's U.S. delegation are all X3J11 members, and there is *no commitment* for the American National Standard (after substitution of the text of the IS) to track ISO addenda if and when they occur." It may be that I am misreading, but I think that Gwyn has told us that the ANSI is working to prevent some foreign corporation from playing on a level field, and is giving a U.S. company, which has already been working with an American National Standard, an advantage.

"Use the standard—don't fight it. If you fight it of course it won't help you," says Gwyn.

As most of you would expect, I have a lot of sympathy for Gilmore. It is difficult enough to try to write compilers, without standards committees requiring things that make programs both longer and needlessly complex. It is not just Cygnus that will suffer from this, I expect that there are folks at CenterLine and Multiflow who are less than thrilled with the ANSI committee's activity.

Gwyn was quite belligerent years ago when Geoff Collyer (then at the University of Toronto) criticized the work of X3J11. I still think that Gilmore has a lot going for him.

When the C++ committee (X3J16) was being formed (in 1990), there were members of the ANSI C committee who threatened to sabotage the C++ standard in

balloting if all of the C++ incompatibilities with C were not removed (see article 625 on `comp.std.unix` [3 Oct. 90]). I am not sure that John isn't a bit extreme, but it certainly looks as though ever since the approval of the standard in 1989, X3J11 has been trying to perpetuate itself, rather than merely adjourning until there is something to do. After all, if all that's needed is deletion of the Rationale and the line numbers, you don't have to have a committee.

Incidentally, there is a good summary of "UNIX standardization" in Rich Stevens' new *Advanced Programming in the UNIX Environment* (Addison-Wesley, 1992).

This is a very good book overall, but it is also very large (over 700 pages). I originally thought it was the top for a new coffee table.

Finally, I am informed that the Cygnus Solaris 2.0 compiler will be a full port of the GNU C compiler and tools to Solaris 2.0. The result will be a full set of development tools—ANSI and traditional C compiler, assembler, linker, debugger and binary utilities—freely available to everyone under the GNU General Public License. (Cygnus is trying to get Solaris/GNU cc on the next Sun Catalyst CD.) They will release the tools at the same time as Solaris 2.0. For information, email: solaris-compiler@cygnus.com. ➔

Peter H. Salus is the executive director of the Sun User Group. He has attended both ISO and P1003/P1201 meetings and expects remission of time in purgatory as a result. Email: peter@sug.org.

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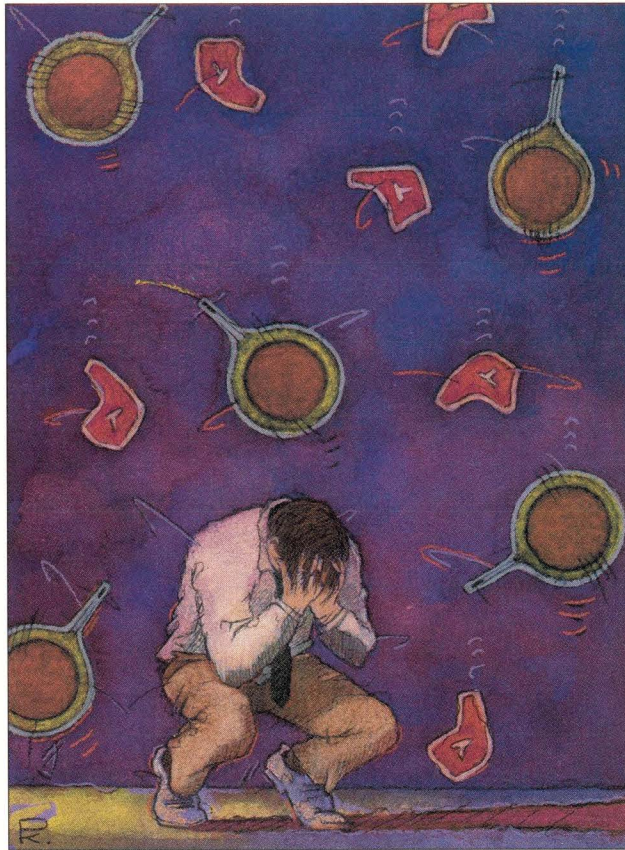
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PETER KALABOKIS

by S. LEE HENRY

Custom-Made Magic

The magic of OpenWindows is in the intuitive tools and operations it provides to users. Drag and drop is a powerful metaphor because it mimics what we do in real life—like dragging steaks from our refrigerators and dropping them into frying pans. Point and click has a similar appeal for all of us with remote controls for our television sets. Seriously, this familiarity and the consistency of operations significantly reduce training requirements and increase users' productivity.

This month we'll look at how some of this magic works and can be customized for your environment. We'll examine how binding files to icons works in OpenWindows Version 3, compare this to OpenWindows Version 2, and offer warnings about Binder that might save you some heartache.

Classing Engines

The icons you see when you open File Manager are the result of entries in the OpenWindows 3 structure known as the Classing Engine Databases (cetables). Classing Engines are new in OpenWindows Version 3. Effected through a

series of these tables, the bindings reflect the character of your files and ensure that selection and print operations work as intended.

Though not ASCII text files, the Classing Engine Databases are easily manipulated through the Binder. Let's walk through the creation of a customized binding and see how it works.

Binder

First, bring up the Binder tool (see Figure 1). Scroll up and down and admire the nice collection of icons that are available. Most of the time, you won't need to develop your own. Notice the three entries under the View menu. These correspond to the three levels of cetables—network, system and private—located in `$OPENWINHOME/lib/cetables/cetables`, `/etc/cetables/cetables` and `$HOME/.cetables/cetables`. File Manager, Binder, Printtool and Mailtool all refer to these databases. Upon installation of OpenWindows Version 3, you will see only the network bindings.



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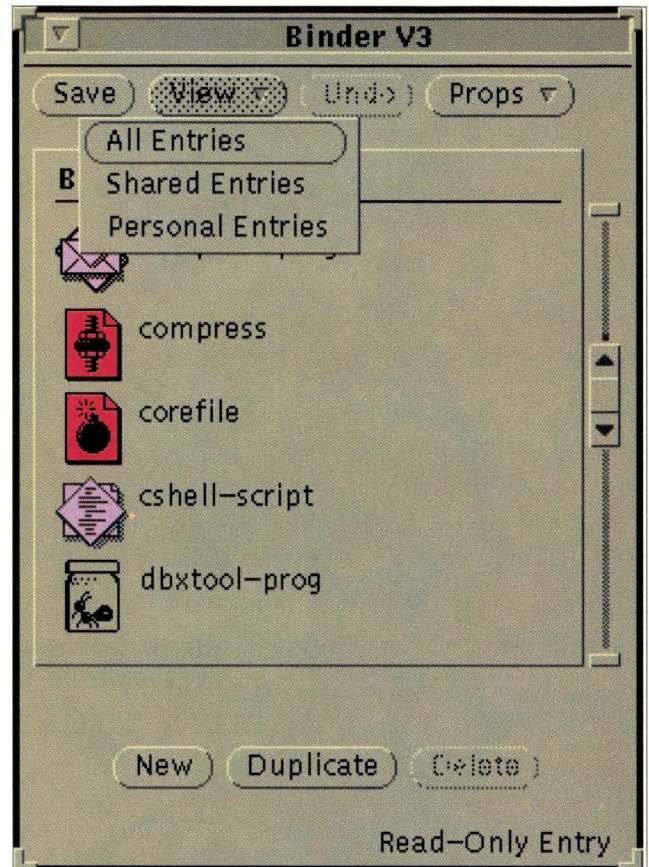


Figure 1: The View

Next, select an entry from Binder and bring up its file-type properties window by selecting "File Types..." from the Props menu (see Figure 2). The readme file is a good example of bind by file name. It has four different entries for the bind by name operation (READ.ME, README, Read.Me and read.me).

The sun-raster entry is a good example of a bind by value. Select sun-raster from the list and bring up "File Types..." again. By selecting the "Content" item from the scrolling list, you will see the bind to the hex value 0x59a66a95 on the right half of the form. By the way, the plus and minus buttons let you extend and collapse this portion of the tool.

Adding a new binding is quite easy, but I strongly caution you to keep a backup of existing cetables files, especially if you are running as root. I've blown Binder out of the water frequently and easily. If you see messages like these when you try to bring up Binder, start fresh:

```
ttsession: Can't init server.  
Warning: ToolTalk not initialized in Binder!
```

To create a new bind entry, click "New" at the bottom of the Binder. Enter a name for your binding, an icon and icon mask, select colors (I suggest that you use the color chooser), apply and then save.

Click on the plus button for application and print method entries. If the bind is for an executable file, simply enter \$FILE for application. This tells the system to execute the

file when someone double-clicks on it in File Manager. If you're dealing with an image or text file, on the other hand, you may want to view the file or invoke text editor. Take a look at the entries for sun-raster and default-doc.

At this point, you've tied together an icon, icon mask and colors with print and application methods. The next thing to do is to bind these values to your file types, either by name or file content.

Select the "File Types" Category from the top of the "Binder: Properties" form. To bind by name, click on "New," enter your pattern in the "Pattern" field (e.g., *.how-to) and hit enter (see Figure 3). Your pattern should appear in the scrollable list. As we saw with the readme-file entry, you can bind on more than one name pattern if you like.

If you are binding by content, select "New," "by Content," "String" (or one of the other Tag Types), and your value. Enter a Tag Offset value if your bind value does not appear at the very beginning of the file. If your value is one of the numeric types, you can specify an optional Tag Mask as well. Enter "Apply" and unpin your window.

Now "Save" your bindings. You'll have to reopen any tools that use the cetables—e.g., File Manager and Mailtool—before the changes will take effect.

Classing Engine Database Files

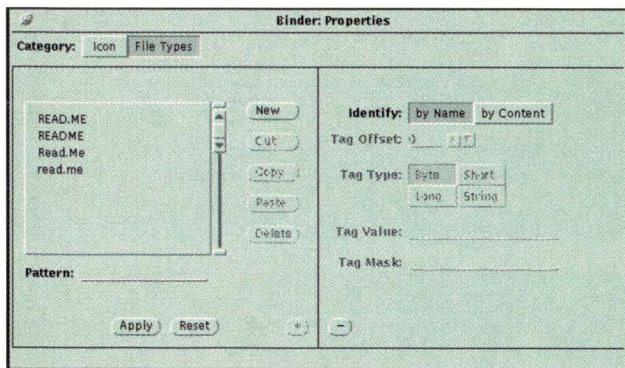
Similar to the filetype file in OpenWindows Version 2, the Classing Engine Database ties together the file type, icon, icon color, open methods and print method. Unlike OpenWindows 2, however, the /etc/magic file is no longer used by the desktop tools, but only by the file command.

In OpenWindows Version 2, bindings were established using the /etc/magic and the /etc/filetype files. Personal entries were effected through the local version of the filetype file (~/.filetype).

Software installation scripts often installed custom icons by copying the icon files and adding lines to your magic and filetype files. This created an identity for the application's files.

In OpenWindows Version 3, things are done differently. Since the Classing Engine Database files are not plain text, there is a system command to add bindings programmatically. The ce_db_build and ce_db_merge commands allow you to recreate your cetables file or add bindings to it from formatted text files like that shown in Figure 4. The

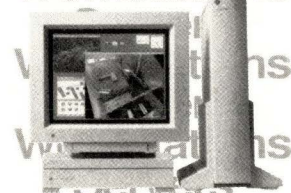
Figure 2: Binding by Name



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ce_db_build command also allows you to dump the cetables file as ASCII text into a file.

At first, this structure appears far more complicated than the filetype file that we knew and loved in OpenWindows Version 2. It is simply more verbose. Instead of comma-separated fields, we have labeled entries. The best part is that you usually don't have to deal with the format of this file since everything you need to do can be done through the binder and icon editor tools.

If you are adding custom bindings via a script, however, you can create a file with the binding values and use the ce_db_merge command to add them to your system at the network, system or user levels. Be sure, however, that you save the file first, so that you can recover if there is a problem.

```
cp bubbles.icon $OPENWINHOME/include/images
cp bubbles.mask.icon $OPENWINHOME/include/images
cp $OPENWINHOME/lib/cetables/cetables /tmp/
  cetables.$$
ce_db_merge network -from_ascii bubbles.binding
```

You could migrate custom bindings from OpenWindows Version 2 to OpenWindows Version 3 with a clever `awk` script that delimits on the comma character, determines the binding type by field position (first field is by name, second is by type), and creates an ASCII file like that shown in Figure 4 for merging into the Classing Engines Database. I don't think it's worth the trouble unless you have a large number of custom bindings to reproduce.

Figure 4: Classing Engine Database ASCII File

```
{
NS_NAME=Types
NS_ATTR=
NS_ENTRIES=( (
(TYPE_NAME,type-id,<fred-file>)
(TYPE_ICON,icon-file,<${OPENWINHOME}/include/images/bubbles.icon>)
(TYPE_ICON_MASK,icon-file,<${OPENWINHOME}/include/images/bubbles.mask.icon>)
(TYPE_BGCOLOR,color,<91 229 126>)
(TYPE_FGCOLOR,color,<0 0 0>)
) (
(TYPE_NAME,type-id,<slee-file>)
(TYPE_ICON,icon-file,<${OPENWINHOME}/include/images/bubbles.icon>)
(TYPE_ICON_MASK,icon-file,<${OPENWINHOME}/include/images/bubbles.mask.icon>)
(TYPE_BGCOLOR,color,<183 229 229>)
(TYPE_FGCOLOR,color,<0 0 0>)
)
)
}
{
NS_NAME=Files
NS_ATTR=
NS_ENTRIES=( (
(FNS_TYPE,ref-to-Types,<fred-file>)
(FNS_MAGIC_OFFSET,str,<0>)
(FNS_MAGIC_MATCH,str,<fred>)
(FNS_MAGIC_TYPE,str,<string>)
) (
(FNS_TYPE,ref-to-Types,<slee-file>)
(FNS_MAGIC_OFFSET,str,<0>)
(FNS_MAGIC_MATCH,str,<slee>)
(FNS_MAGIC_TYPE,str,<string>)
)
)
}
}
```

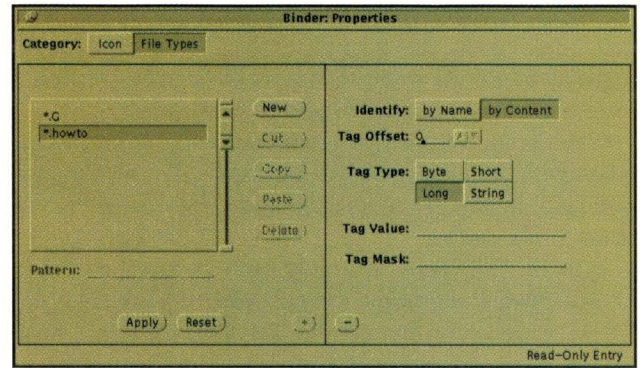


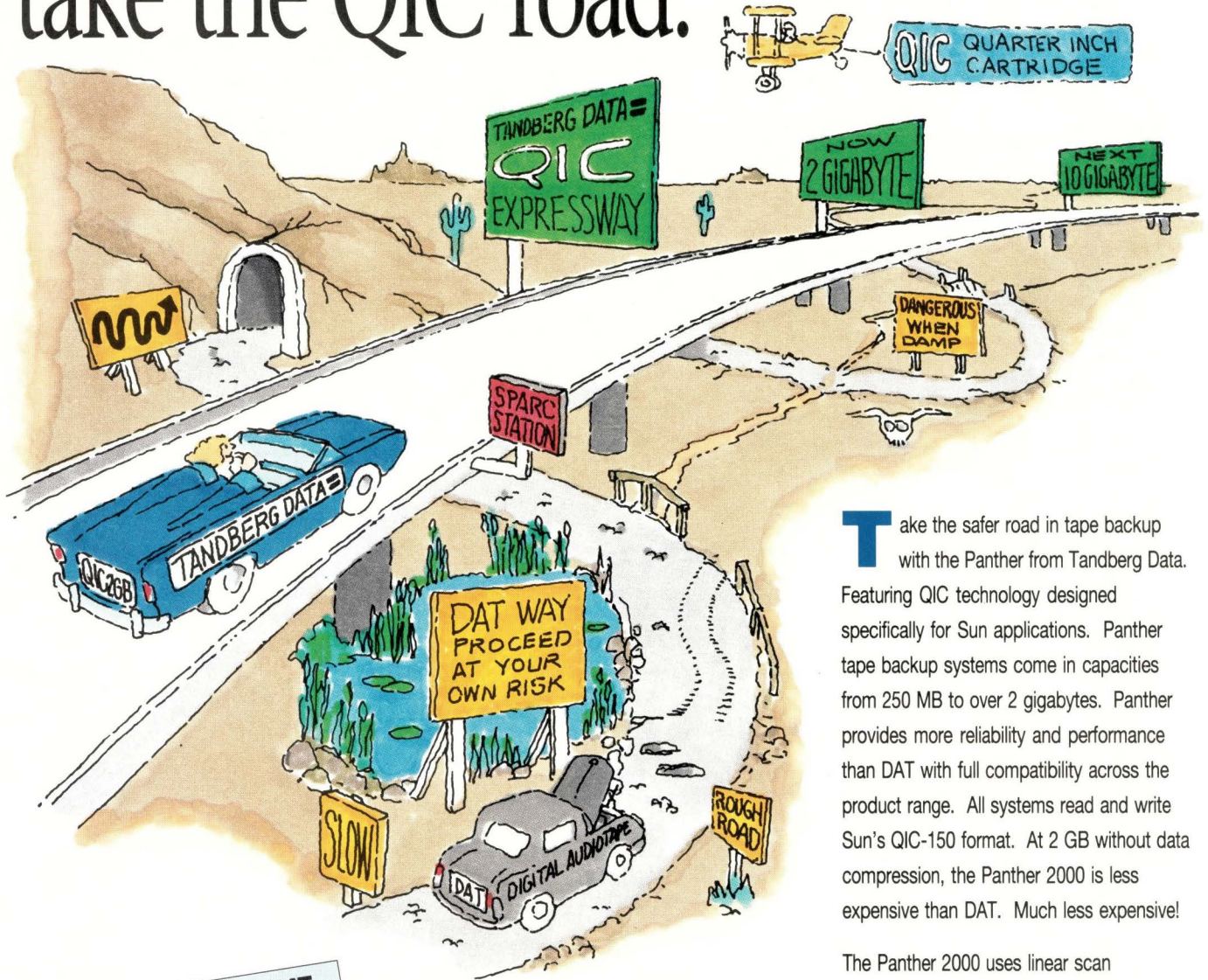
Figure 3: Binding by Value

Conservatism

Binder is a neat tool, and it's fun to create your own bindings, but don't get carried away using icons and colors. Too much variety will begin to work against you. I think it was Steve Jobs who said, "Don't use color unless you mean it." Conservative use of colors and icons to indicate file similarity is a good rule of thumb. ➡

S. Lee Henry is on the board of directors of the Sun User Group and is a systems administrator for a large network of Suns in the federal government. She also heads The Next Page Inc., which specializes in software documentation.

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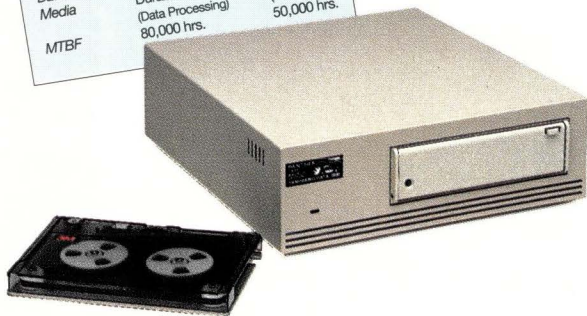


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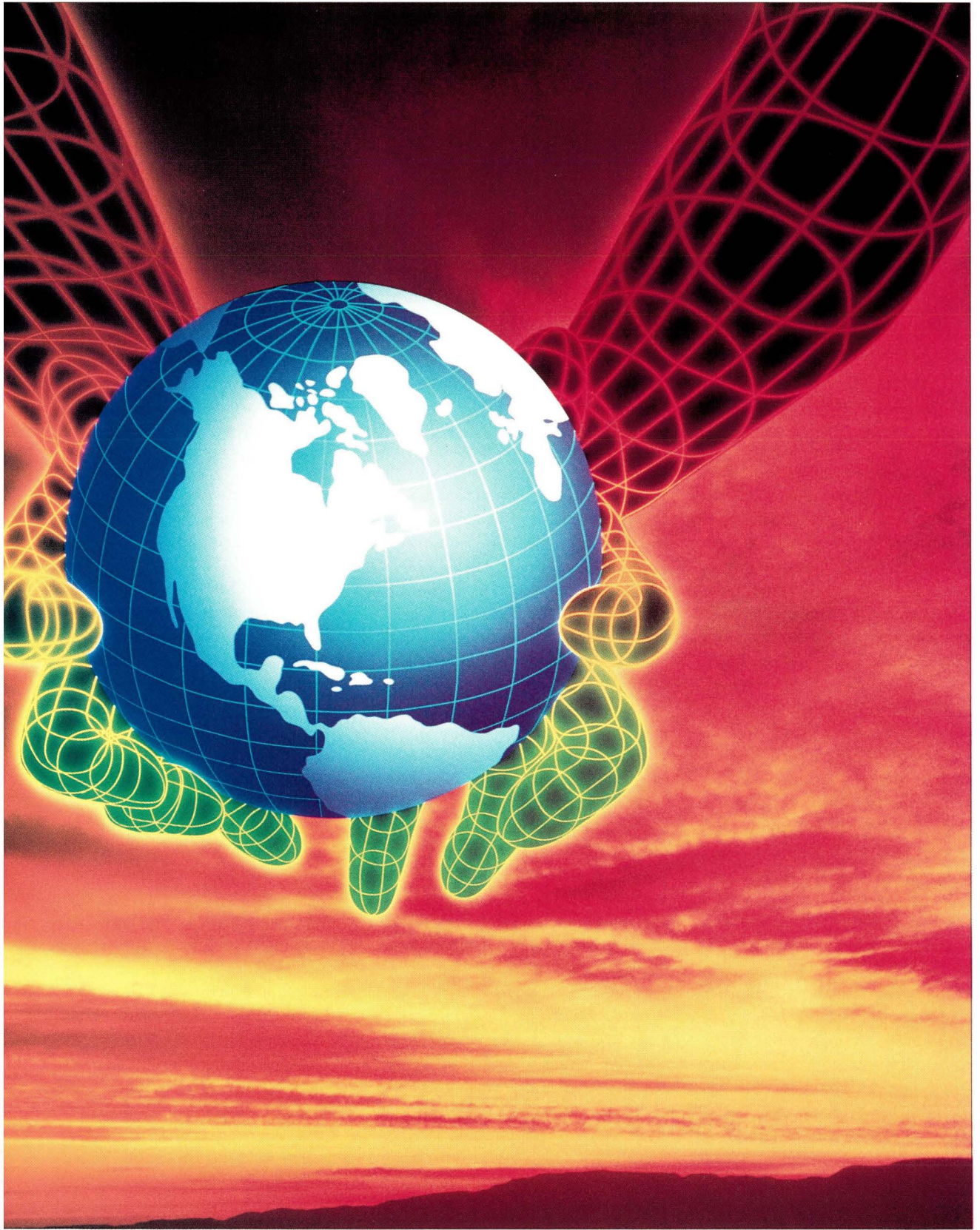
SPARC-based servers, from Sun Microsystems Computer Corp. (SMCC) and others, are hot. Big systems, such as Sun's own 600 MPs and the Solbourne Computer Inc. systems, are now even being eyed as mainframe replacements. Meanwhile, pundits are besotted with "downsizing" and "right-sizing" and other words recently minted by marketing departments in an attempt to make the replacement of Big Iron by Little Silicon sound more dramatic than the common-sense exchange of the expensive for the relatively cheap.

SPARC-based servers are finding a role as the heart and soul of PC LANs.

by **MICHAEL JAY TUCKER**, Executive Editor

UNIPHOTO, NEW YORK





But there's another side to the server story. Users and vendors are considering SPARC-based systems as servers within PC networks. Increasingly, they share a vision of low-cost, high-performance computing in which PCs are linked and amplified by UNIX servers.

In fact, some analysts suggest that this ever-more-popular configuration marks a new stage in Sun's history. At least in the short run, say these analysts, Sun has its best shot at commercial computing not by displacing PCs but by linking them. "They'll join the Federation," says Robert Kidd, senior industry analyst at market research firm Dataquest Inc., "rather than be a Klingon."

But on the trek to the peaceful coexistence of alien beings, there may yet be a few distressing deep-space encounters.

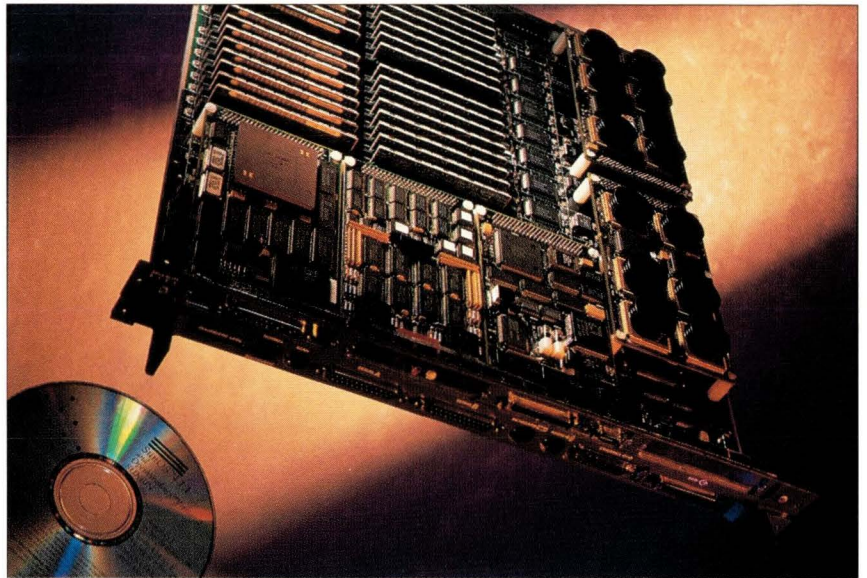
Beam Me Up, Scotty

One thing everyone agrees on is that low-end SPARC-based systems make excellent servers for small groups of PCs. "We think SPARC servers are great," says Bob Davis, director of marketing for Novell Inc.'s connectivity product group. "As application servers, they are second to none."

"With a SPARCserver in the net, you have a multitasking operating system, centralized applications, centralized data," adds Dennis Daudelin, president of Aurora Technologies Inc., which sells, among other things, a token ring card for SBus. "And you have lots of horsepower. You can stick things on it you can't put on a PC... you may not want an Ethernet card on your PC, for instance."

The only real difficulty he sees—even for a small company that has little experience with UNIX—is getting an expert to do the installation. "You have to start thinking about disk drives; you have to think about backup. But really, it is going to be installation effort more than anything else...you've got to make certain that you're working with someone who knows what they're doing."

With a SPARCstation in your PC LAN, says Luiza de Ruijter, product manager for NetWare Sunlink at SunSelect, "You've a powerful development environment...and you've gained connectivity to the wider world [through industry standard TCP/IP].



Sun Microsystems Computer Corp.'s servers range from the tiny to the huge. All have in common the SPARC processor, such as the two or four supported by this SPARCserver 600MP Series board, which can actually challenge a mainframe in some applications.

You can get to the corporate backbone."

And it would be a tremendous database server, adds Phil Rosenzweig, director of engineering for PC networking at SunSelect. He envisions the database running on the SPARC systems, with end-user front ends running on the PCs. "Several of the database vendors have ported their products to NetWare," he says. "But I am not sure that NetWare is all that secure."

He also points out advantages in network management—"Some PC LAN vendors have their own network-management software, but those are proprietary. We're trying to bring them into the open-systems world."—and in software licensing. "The whole concept of software licensing is about to become a major issue for the PC people," he notes. "How do you provide software on a network? They've never dealt with that issue. UNIX already has it worked out. We have that technology in Solaris today. I think the PC industry will come to realize that." He envisions PC license managers running on SPARC-based application servers.

In short, says Herb Hinstorff, server business development manager for SMCC, you want a SPARC-based server when you want it to actually add something to the LAN, rather than just be a shared hard disk with an attitude problem. "You need that kind

of power when you want to do more than just serve files, when you want it to be more than just a LAN."

To Boldly Go

There are dissenters. Some have suggested that the best machine to serve a network of Intel Corp. processor-based machines is another Intel processor-based machine. "The issue is price/performance," says Ajit Kapoor, vice president of market-research company The Meta Group. "You can put a '486 in that role and pay less."

But as far as the Sun community is concerned, the biggest problem with using SPARC-based systems as PC LAN servers may not be competition from alternative systems, but rather deciding which of the many available options to use to provide UNIX-to-DOS connectivity, and then living with the (not always happy) consequences of that choice.

Linking Apple Computer Inc. Macintoshes to Suns is a unique problem, with a unique set of solutions from such companies as Cayman Systems Inc. and Shiva Corp. In fact, mixed Sun and Mac environments are among the most common in the industry. However, most of the industry's attention has been fixed on the Intel-based PCs and compatibles, simply because there are so many of them

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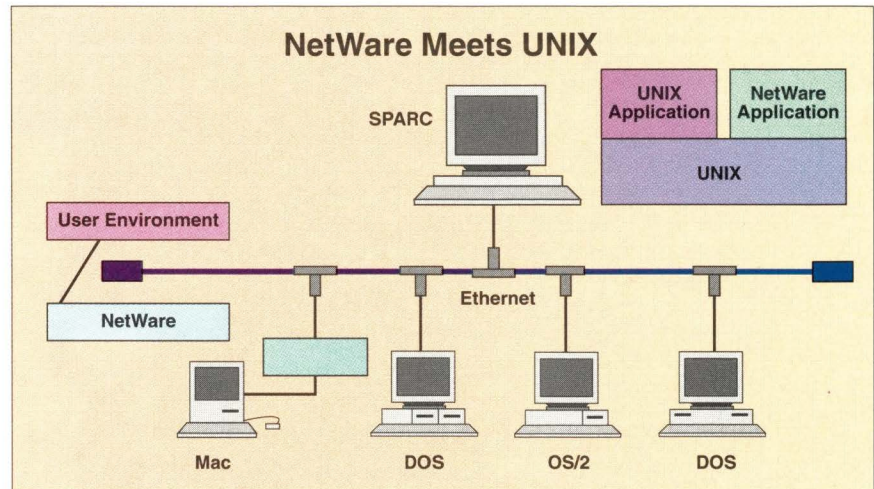
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and they occupy the commercial market that Sun would like to enter. "Hey! Let's face it," says Dataquest's Kidd. "Anyone who wants to play, wants to play with Intel and Mr. Gates."

For those who do want to play with Mr. Gates and all his toys, the choices are many and the way is not straight. Fortunately, the market itself provides certain guides. For those who wish to use SPARC-based systems as servers in PC networks, everything boils down to one question: whether to bring the mountain to the prophet or the prophet to the mountain. In other words, whether it is better to implement some form of a PC network operating system on the UNIX system or to implement NFS on the PCs.

Choosing between these two depends chiefly on whether you've already got a major investment in a PC network operating system in place. If you don't, or if your PCs are few, then PC NFS is the way to go. If you do, then the reverse is true. "You don't require those PC users to change their whole mode of existence," explains John Bush,



SPARC and the dominant PC LAN network operating system, Novell Inc.'s NetWare, can at least cohabit, if not yet exactly merge. NetWare for UNIX in its various forms provides a means to link the SPARC and NetWare environments, though NetWare does not yet run on SPARC in native mode.

senior network product specialist at Prime Service, which offers an implementation for the SPARC of Novell's NetWare for UNIX.

Actually, it gets simpler. If you've decided to implement a PC network operating system on your SPARCserver, then you may have only one choice:

Novell's NetWare for UNIX. That's partly because of Novell's powerful position in the market—"NetWare has 60% of the market," says Tom Kurchavy, president of the Boston-based market research firm Summit Strategies Inc.—and partly because Novell, alone among the vendors of popular PC network operating-system products, seems as interested in UNIX as UNIX has been in it.

Microsoft Corp., with its LAN Manager, is another market leader, but the giant of the Redmonds is really more interested in Windows NT than in SPARC. Other big names, like Banyan Systems Inc. with its VINES, have links into UNIX (Banyan cooperated with FTP Software Inc. to provide such), but it's Novell that put a version of its product on UNIX and then promoted that version heavily. Specifically, Novell announced Portable NetWare, now known as NetWare for UNIX, and made it widely available to OEMs. You can buy it from Sun or from companies like Prime Service, and there is even an emerging class of NetWare clones from independent third parties, such as Puzzle Systems Corp.

But there's good news and bad news. The latter is that none of the NetWare implementations on SPARC really answer all prayers. First, their performance is less than stunning. "People expect it [Netware for UNIX] to be fast," says Ronald Watson, product marketing manager at Prime Service.

Database Servers: UNIX With a Mainframe Face

While low-end SPARC-based systems are courting PCs, high-end systems are looking to muscle in on mainframes. Sun's own 600MP series of machines are being offered as mainframe replacements. And other SPARCserver vendors are following suit.

"Solbourne [Computer Inc.] is focused on servers...and in particular, on the database server market," says Travis White, the company's vice president of marketing. "Approximately 35% of our revenues are coming from the database market...and we expect it to go up to 50%. It is the fastest growing segment of our revenues." In fact, White says that his company has a special relationship with Oracle Corp.—even to the point of tuning the Solbourne operating system to run that database peculiarly well. He calls the resulting system "UNIX with a human face...which also has a mainframe orientation."

Another SPARC system vendor getting in the database back-end business is Opus Systems, which makes SPARC-based add-in cards for PCs. "One of our customers has 16 of our cards plugged into a passive backplane," says John Chun, the company's director of product marketing. "And they're using it as a database server." Chun said that he did not have permission to name the company in question but added that the customer's jury-rigged parallel processor was actually outperforming the company's IBM mainframes.

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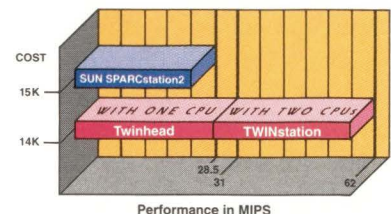


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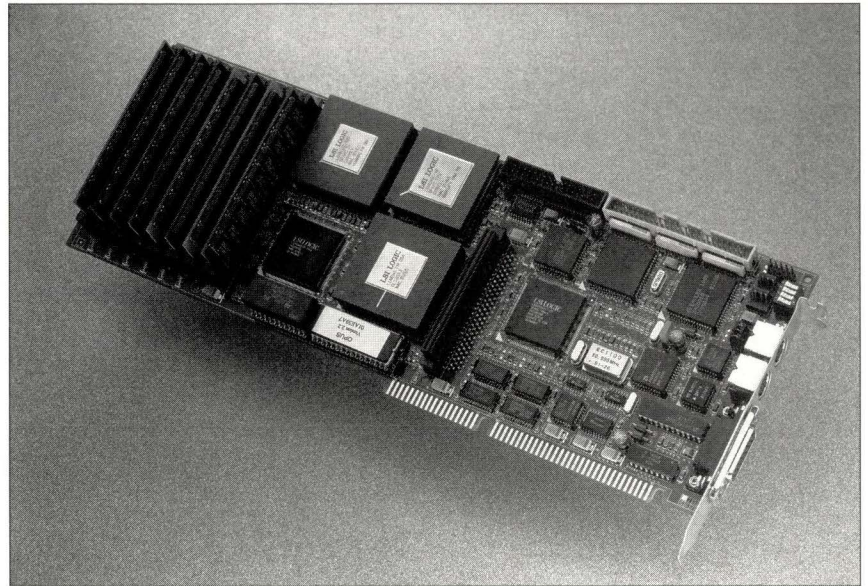
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"We have to back them up. We have to say, 'Remember, it is running across a UNIX shell.'" Second, none of the implementations allow the user to be rid of the NetWare server and use the SPARC system as both a LAN server and a file server. "It is not a server product. It is a connectivity product," says Watson.

The good news is that connectivity is itself a valuable thing and there are lots of places to get NetWare to provide it. Sun, or rather the SunSelect "planet" of Sun, is one such. Sun says that there are several differences between its NetWare, called NetWare Sunlink, and those of its rivals. "One of our focuses has been to integrate NetWare with the ONC environment," says Sun's de Ruijter. "We see a significant need for wide-area connections."

On the other hand, NetWare Sunlink was not yet available to end users as of press time—something that other vendors are quick to point out. "The biggest difference between Sun's product and ours is that ours is available today," says Prime Service's Bush. Prime Service offers a version of NetWare for Suns called Connection NetWare for SPARC. He notes, though, that there are real technical



A PC with a SPARC coprocessor, such as this SPARCcard 2 from Opus Systems, can provide many of the same benefits of a SPARCserver, at a fraction of the cost. Opus suggests a SPARCserver 10 would be "overkill" for a PC LAN server.

differences, most notably the fact that Connection NetWare is based on NetWare 3.01, whereas the Sun product is based on a later version, NetWare 3.11. He says, though, that's actually an advantage for Prime Service, in that the earlier release had greater support for such things as Macintosh connections.

Needless to say, SunSelect distinctly

disagrees. "Connection NetWare is based on the older version," says SunSelect's Phil Rosenzweig, "and there were a lot of bug fixes between the two releases."

Meanwhile, the vendors of Novell-derived NetWare have recently been joined by a new type of being—NetWare compatibles that run on UNIX. Puzzle Systems, for instance, introduced in

Computer Servers: A Survival Thing!

Almost every vendor contacted for this story repeatedly made the argument that mere MIPS are fairly unimportant for server products. They argue that "total system design," including such things as I/O, are actually more fundamental.

However, almost every user contacted for this story disagreed. "Speed," says James Sharp, systems engineer at Lawrence Livermore National Laboratories. "We need faster machines. It seems the workstations are getting faster...and the servers aren't."

Ask a vendor why users want more MIPS on their servers, and you'll get the interesting response that most users don't understand what's really needed on a server. But it is hard to call Sharp a man who doesn't know what he has or what he needs. "We've got about 300 Suns here...both workstations and servers," he notes offhandedly. Also, he's got SGIs, HPs, DECs, a Solbourne ("He's tucked away in one

project. They're doing some animation...and I've got half a dozen X terminals coming out his back")...and, oh yes, "an Epoch [Systems Corp.] jukebox," plus some optical drives from R Squared for long-term data storage.

From one end of this vast and complex net to the other, the need is for speed. "Our biggest concern is network speed," says Sharp. "The servers just have trouble keeping up...We're exploring all sorts of different options. Maybe even building a secondary network for the high-speed machines."

He likes having a certain degree of homogeneity in his network. "Our network is pretty heavily geared toward Sun," he says. "We designed it that way, so that we could find the expertise to maintain it. System administrators are hard to come by," he says. "It is a survival thing."

But much as he might work with Suns, he is beginning to grow concerned. "I'd really like to see some faster Sun servers," he says.

May SoftNet Utilities—NetWare-compatible software that doesn't have a line of Novell code. "The product splits into two halves," says James A. Leslie, director of marketing for Puzzle. "One half is a NetWare emulation...that makes the SPARC systems appear to the PC as just another NetWare server. The other half is a terminal emulator that allows the NetWare PC to log on to UNIX with IPX [the NetWare protocol]...rather than having to lug around two protocols."

The Puzzle product too falls short of being a NetWare replacement. "We say that there has to be one copy of NetWare somewhere in the network," says Leslie, "because it has all the network utilities." But, like Sunlink and Connection NetWare, it does not allow the SPARC system to act as a file server. "We're not trying to displace NetWare. We're just trying to add functionality to the UNIX workstation by allowing it to do double duty. It can be both a workstation and a network file server."

Still other developments are coming. For example, probably no vendor in the world has worked harder at the business of linking PCs to UNIX than Locus Computing Corp. Locus did some of the initial, pioneering work to make UNIX and DOS files more interchangeable in the mid-'80s. In the late 1980s, and now in the 1990s, the company became known for its DOS-to-UNIX products, such as PC-Interface. This year, Locus announced that PC-Interface would also provide links to NetWare.

And in the very long run, all attempts to link NetWare to SPARC could be overshadowed by new events on the operating-system front. In December 1991, Novell and Unix Software Laboratories announced a joint company, Univel, whose purpose is to combine and market USL's System V.4 (originally code-named Destiny) and NetWare. The resulting UNIXware will be available first on Intel platforms, but SPARC could follow.

In fact, British computer giant ICL Inc. has already undertaken the job of porting the Destiny side of the equation to SPARC. But it may be a while before the OS is widely available. "We are pushing to support SVR4 on the desktop...on our PCs," says Peter

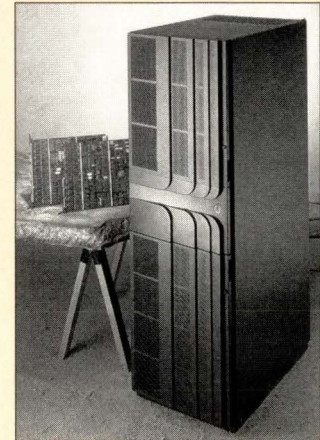
Network Servers: Feed Me!

Sun and other high-performance systems have boosted performance on an almost daily basis since the introduction of RISC. However, that's created almost as many problems as it has cured. "Three or four high-performance workstations can saturate a network," says Dr. Bruce Nelson, chief technologist at Auspex Systems Inc.

As a result, NFS network servers, like Auspex's and the Legato Systems Inc.-developed Prestoserve, have continued to command a market, despite the

protests of systems vendors who argue that their servers don't need any help with NFS. Nelson says that is partly because of, not despite, the fact that the servers are getting bigger and more powerful. They're admittedly better at NFS transactions, but they also have increased requirements. "All this stuff is increasing in MIPS," he explains, "but that means its appetite for data is increasing too."

In the long run, he thinks, the answer will be individual Ethernets. "Ethernet will be like RS-232-C," he says. "Everyone will have their own. They're not going to share."



Stuart, ICL's vice president of business development for midrange systems. But he says the company isn't in any particular rush to get Destiny on the SPARC as well. "We think it is more important for SVR4 to gain market share on Intel first."

The Next Generation

Then there's PC NFS—the other option.

Actually, it isn't the only "other" option. There are many ways of linking PCs and SPARC—witness Locus and Puzzle Systems, which says the terminal-emulator side of its SoftNet Utilities is a PC NFS alternative.

Also, it isn't right to pose PC NFS as a direct analog of or competitor to NetWare for UNIX. PC NFS isn't a network operating system in the same way that NetWare is. And most observers agree that the two are really very different solutions to very difficult problems—with PC NFS being at its best a way to bring PCs that have not already been linked with something else into a UNIX network. "You use PC NFS where you are...buying SPARCs,

and you don't have a PC Network," says Cliff Utstein, product manager for PC networking at SunSelect.

But, rivals or not, the two tend to be paired in the same breath, as though they were companions, if not exactly opposites. "PC NFS is extremely interesting," says John Chun, director of product marketing at Opus Systems, "in that it is emerging as a PC LAN alternative."

And, in that role, it is doing rather well. It is now available on most major PC brands, including Macs. For example, both InterCon Systems Corp. and Wollongong Group Inc. market NFS for the Mac. It is on PCs, though, that PC NFS has garnered the most fame. In fact, Utstein says, "Most people don't realize it, but one out of 10 [networked] PCs are already using PC NFS protocols."

That's easier to believe when you recall that among the leading suppliers of PC NFS for PCs is none other than Novell, which has adopted NFS in more or less the same way that SunSelect has adopted NetWare. Novell's LAN WorkPlace with the NFS Client option

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is nothing less than PC NFS with additions, expansions and modifications. It differs from Sun's version, says Novell's Davis, in that "our strategy has been to provide DOS with the ability to access both NetWare and UNIX."

He says that if you only want to use NFS on your PCs, you'd be better off buying it from Sun. If you want to connect to NetWare somewhere in your network as well as a UNIX server, then he argues for LAN Workplace with the NFS client. He even recounts stories of users who have implemented both NetWare for UNIX on servers, and LAN Workplace on PCs, so that all the machines could link to everything, regardless of what it might be or from whence it came.

Meanwhile, back at SunSelect, PC NFS 4.0 has just appeared. This, says SunSelect (an organization that appeared at almost exactly the same time as 4.0), allows PC users to run under Microsoft Windows and yet access UNIX facilities on a SPARC-server without even noticing that they've left the familiar DOS/Windows environment. "The end user can't tell the difference," says SunSelect's Utstein. "Microsoft has given us a paradigm for executing most of the popular NFS functions without leaving Windows."

But, again, there are dissenters. Some

in the NetWare community aren't sure that building a PC LAN on PC NFS is all that good an idea. "People are seeing the NFS banner held in the sky by Sun and Novell as the path to connectivity," says Prime Service's Watson. "But I think our product is far more transparent."

You can, in fact, find those who seriously wonder if a SPARCserver in a PC LAN isn't a perfectly wretched idea, no matter what kind of network operating system you pick. "A SPARCserver 10 would be overkill," says Opus' Chun. "You don't need those kind of MIPS for a file server."

What Opus suggests instead is its own product, a SPARC-based card that fits into a PC. "The PC with the SPARC could be your server," says Madan Valluri, the company's vice president of research and development. "Or it could be a gateway." He also wonders if the whole issue of SPARC-based servers in PC LANs isn't being looked at improperly. Rather than trying to bring UNIX and SPARC to PCs via servers, he asks if it wouldn't be effective simply to find those PC users that need SPARC applications and give them a SPARC card.

Live Long and Prosper

But for good, bad or indifferent, SPARCservers are pushing hard for

the role of PC LAN server par excellence. That may say interesting things about Sun as a company. "It tells people," says Aurora's Daudelin, "that Sun is serious about the commercial market. Before, they focused on selling one workstation to one engineer."

More recently, Sun has focused on selling one PC-like workstation to one business person. Yet it may be, at least in the short term, that Sun's real success in the commercial market will come not by displacing PCs but by serving them—as PC LAN servers. "There may be major accounts where the servers will come in first," says Steve Zocchi, Sun Microsystems Inc.'s product line manager for servers.

He says that Sun doesn't find that thought particularly distressing. "Do we believe that there should be workstations on every desktop instead of PCs? Sure. But are we aware that there are millions of PCs out there? Certainly." Sun, he adds, would be delighted to supply servers to them.

And that role, the server around which everything else revolves, could make all the difference in the world. "In the long run," says market analyst Kurcharvy, "the survival of UNIX will come in defending the server turf...rather than going after the client." —♦

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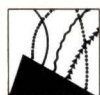
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i860-based Accelerators: *The Chassis*

No one would claim the SPARC processor is a *perfect* chip. It is not going to win any prizes for high-speed, super-computer-style number crunching. Fortunately, though, SPARC has developed a host of almost symbiotic relationships with specialized processors—chief among these, perhaps, being the Intel Corp. 80860 (i860). There is already an entire industry devoted to the production of i860 accelerator boards for numerically intensive applications ranging from graphics to modeling.

The bad news, though, was that until very recently the i860 hadn't been an option for most SPARCstation and SPARClike users.

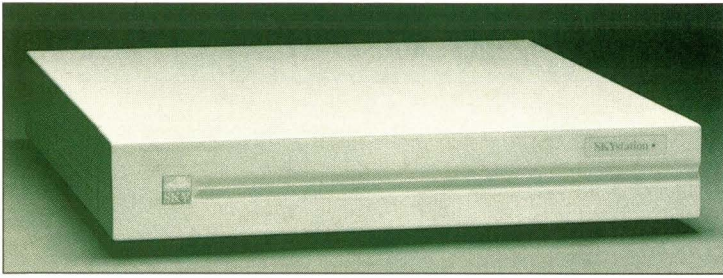
The i860 is a big chip, and fitting it onto an SBus card is difficult. Most i860 accelerators for workstations have been VME solutions—with all the attendant problems of drivers and installation.

The good news is that all that's starting to change.

The Intel chip and SPARC are teaming up in niche applications.

by **MICHAEL JAY TUCKER**,
Executive Editor

S. H. LEE



Among the first i860-based chassis for Sun workstations was the Skystation from Sky Computers Inc. The Skystation links to the workstation via the SCSI port.

A number of companies have introduced chassis-based i860 devices that link directly to low-end workstations. For the first time, the i860 is becoming available to the end user directly.

The Sky's the Limit

It is difficult to say why SPARC and the i860 have developed the partner-

ship they have. It may be mostly a matter of being complementary. Both are standard parts, relatively inexpensive, and yet they have very different strengths, with SPARC boasting software availability and the i860 having sheer matrix muscle.

Regardless of the reason, the i860 add-in board business has long been

strong in the Sun Microsystems Inc. market. Users have been able to select from a larger variety of boards from an equally healthy supply of vendors—such as Mercury Computer Systems Inc., Sky Computers Inc., CSP Inc. and so on. The buyers of VME have traditionally been systems integrators or other VME sophisticates who needed both standard platforms and high performance. “Our users need a lot of processing power,” explains Liisa Walsh, technical program manager at Mercury. “But they want to buy it off the shelf.”

The i860 has also shown up in powerful servers, such as the multiprocessor Torque box from Torque Systems Inc., and it has long had a role in Sun graphics. When Sun introduced a graphics and imaging processing peripheral, the GT tower, it was based on the Intel i860—the same tower is now marketed by Vicom Visual Computing.

Only in the past two years, though, have general-purpose, chassis-based i860 accelerators started to come on line. The first of them may have been Sky's Skystation. Sky took its VME i860 board (which is also noted for having an Intel i960 as a controller) and placed it in a pizza box-style enclosure that could fit directly under or above the Sun SPARCstation. The Skystation then links to the Sun via the workstation's SCSI connector.

Initially, the company saw the Skystation as a general-purpose accelerator for virtually any Sun user. However, its market has gradually shifted. “We were surprised,” says Doug Wilmarth, manager of product marketing at Sky. “We've been most successful with small software companies that were looking for something that they could bundle in as a high-performance version of their product.”

GETTING FRISCY

The i860 isn't the only high-performance coprocessor option out there. Another is the floating-point RISC (FRISC) processor from FRISC Inc., a recently formed subsidiary of Boise-based Micron Technology Inc. The FRISC processor is an 80-MHz, 64-bit, superscalar processor optimized for floating-point operations. “It really looks like a cross between a DSP and a supercomputer,” says FRISC President James Hesson, “except that it is more civilized. It can support an OS, for instance.”

The FRISC processor is not yet available for any add-in boards or chassis products for workstations—but it is present in working silicon, something that a lot of other high-performance, widely hyped hot chips can't say. The company says that it has already been shown running at a peak performance of 160 MFLOPS (32 bit) and 80 MFLOPS (64 bit), and, that in sustained performance, it offers 38 to 42 MFLOPS double precision and 75 to 80 MFLOPs single precision.

Hesson says that the product combines characteristics of digital-signal processors, graphics accelerators and traditional RISC processors. He also says that FRISC itself will introduce FRISC-based products for the Sun market soon: “Our first products are a 3D graphics card for the Sun [Microsystems Inc.] and an accelerator on a dual SBus card.” He also says that there will shortly be a signal processing card based on the FRISC.

Hesson has no illusions about the crowded CPU market. He says that his company will build systems based on FRISC, but he doesn't expect to challenge any of the established merchant CPUs anytime soon: “We'd be idiots to think we could unseat SPARC.” But he's not sure that he needs a vast industry of FRISC-based workstations to do well. “For us to be successful, we don't need that,” he says. “There are so many board-level applications out there, particularly in communications, that we can do just fine without it.”

One such company is MicroSignal Corp. "What we have developed is a product that processes the raw data from Magnetic Resonance Imaging (MRI) machines," explains Jeffrey Taft, the company's president. MicroSignal's software takes data from an MRI scan of a patient, then reconstructs it quickly, even when the amount of information to be processed is vast. "We can show much more detailed images than are normally available," says Taft. "So we can get the patient off the magnet more quickly"—a significant advantage when time on an MRI machine can be expensive.

Another user is WSE Associates. "We're doing various kinds of modeling," explains company President David Wight, "all of which is extremely numerically intensive." Specifically, the company markets GeoTools, software for analyzing subsurface geology. "It isn't seismic," he says. "What we're looking at is electromagnetic fields...it is called magneto-tellurics." The technique looks at variations in the earth's electromagnetic field to determine what lies below the surface of the earth.

The company's customers are mostly

in the oil and gas business, although Wight says the systems would work just as well for people looking for geothermal hot spots or anything else. The company went with the Skystation simply because of the complexity of its calculations. "Really, we just needed to get the performance," says Wight. "We had customers who were paying for Cray time...[With the Skystation], we can give them a fourth of a Cray's performance."

Card Shark

CSPI also has an i860 chassis—the SuperCard-S. "We sell mostly VME boards," says Jeffrey Cohler, the company's director of product marketing. "We wanted to get onto the SPARCstation...but the technology is just not going to fit on a SBus card."

The company therefore brought out the SuperCard-S. It is basically the company's SuperCard VME technology but contained in a chassis that links to the SPARCstation via an SBus connector. This gives it significantly faster

Another i860-based chassis is the SuperCard-S from CSP Inc. Based on a 40-MHz i860, the product links to the workstation via an SBus connector.

The Intel Corp. 80860 (i860) has emerged as one of the most popular coprocessors for the SPARC. A 64-bit device, the chip is optimized for numerically intensive and graphics operations.

I/O than the SCSI-based Skystation. (Sky customers say they don't care particularly. Most of them claim not to need high-speed data transfer. They're more interested in transferring relatively small amounts of data to the i860, where relatively huge operations are performed on it.)

Like Sky, CSPI does not call its product a general-purpose accelerator. "Most people who buy from us," says Cohler, "want to do vector processing.



They don't want a general-purpose machine." And, like Sky, CSPI's customers tend to be companies with numerically intensive applications.

One such customer is Dynamic Digital Displays Inc. "We have a medical application that calculates the radiation dosage for the treatment of cancer patients," says Colin Sims, the company's director of radiation therapy systems. His company's product is a workstation-based application that calculates the amount of radiation necessary to, for example, destroy a malevolent tumor without damaging healthy tissue.

But, says Sims, "it turns out that traditional therapy is an extremely demanding application." It isn't easy to determine where a benevolent dosage leaves off and a destructive one begins. The calculations are hard, and it is these that the company farms out to the i860. "We could run the application without the i860," says Sims, "but it would have a performance factor of 10 or more slower."

Another SuperCard-S user is Landmark/ITA, which has a seismic processing application that runs on a variety of workstations. "It is used primarily by the oil and gas industry," says company Vice President Kerry Stinson. "But it is also applicable to earth studies, mining and so forth."

Landmark/ITA makes the SuperCard-S available as a option with its product. The same functionality might be had from other hardware—say, a DSP board. But Stinson says he is quite comfortable with the company's choice of an i860-based solution. "There's a fairly large company behind the i860," he says, meaning Intel, and he thinks that tools for and upgrades to the part will continue to come down at a comfortable pace. "We expect a steady development stream," he explains.

Pixelated

A relatively new entry in the chassis-based i860 game is Dupont Pixel Systems. Dupont has had board-level i860 products for some time, but in spring of 1992 it planned to introduce a series of chassis as well. The chassis

will combine the company's i860 technology with software that implements a version of Silicon Graphic Inc.'s (SGI) GL graphics library. "The products will allow you to put together a SPARCstation that will match up with a SGI Personal IRIS," says Dupont's marketing manager Mike King.

The company conceives of the typical customer as an organization that has a number of SGI machines, but many more Suns, and which now longs to extend SGI-style processing to the less-expensive SPARC-based platforms. "Rather than buy more SGIs," says King, "they can make the Suns SGI-compatible."

Thus it is that i860-based chassis products have taken on a distinct function in the Sun and SPARClike markets. They aren't generally end-user, general-purpose accelerators, but rather attached processors meant to customize a workstation for one or, at most, two applications within a specific market niche.

But what about the future? There has been some concern in the industry about the long-term viability of the i860 itself. Some observers have speculated that, in the end, the i860 might be incorporated into some future version of Intel's 80X86 product line. Intel acknowledges that is possible. "Certainly, their technology is there to do all sorts of things," says R. Victor Varney, product marketing manager in Intel's multimedia and supercomputing components group. But he also says that i860 will remain an independent processor.

In fact, he sees the i860 as a sort of free R&D for the X86: "What you may see is technologies demonstrated on the i860 first, and then later on the X86 line." In addition, he says, the i860 plays an important, long-term role in Intel's own supercomputer effort.

What could significantly alter the i860's relations with workstations, though, is PCs. Intel hopes that i860 chassis, and later boards, will soon be widely marketed for PCs. "We think we're demonstrating something in the workstation market that the PC people will pick up later," says Varney. ➔

Companies Mentioned in this Article

CSP Inc.
40 Linnel Circle
Billerica, MA 01821
Circle 174

Dupont Pixel Systems
2000 Edmund Halley Drive
Suite 590
Reston, VA 22091-3436
Circle 175

Dynamic Digital Displays Inc.
St. Davids Center
130 Radnor-Cester Road
St. Davids, PA 19087
Circle 176

FRISC Inc.
2805 East Columbia Road
MS 366
Boise, ID 83706-9698
Circle 177

Intel Corp.
Multimedia and Supercomputing
Components Group
SC4-40
2625 Walsh Ave.
Santa Clara, CA 95052
Circle 178

Landmark/ITA
425 First St. SW
Suite 1101
Calgary, Alberta
T2P 3L8, Canada
Circle 179

Mercury Computer Systems Inc.
Wannalancit Technology Center
600 Suffolk St.
Lowell, MA 01854
Circle 180

MicroSignal Corp.
106 So. Main, Suite 502
Butler, PA 16001
Circle 181

Sky Computers Inc.
27 Industrial Ave.
Chelmsford, MA 01824
Circle 182

Torque Systems Inc.
700 High St.
Palo Alto, CA 94301
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46107 Landing Parkway
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An Avant-Garde Workstation, a Data Manager Secret and a Well-Stuffed GatorBox

by BARRY SHEIN, Technical Editor



This month we look at a parallel desktop workstation, a database applications development system and a product to integrate Macintosh and UNIX TCP/IP networks.

Two Heads Are Better than One!

Recently Sun Microsystems Computer Corp. committed to parallel processing on the desktop with its SPARCstation 10 announcement. But these systems won't be available from Sun for a few months. Rather than wait, we took a look at a dual-SPARC workstation made by Twinhead Corp. that promises to be a harbinger of things to come.

Parallel processing is a natural evolutionary step of multiprocessing. A system that can run more than one program simultaneously is a candidate for more than one CPU to help speed up performance. Anyone who has tried to do interactive-intensive processing, such as using a sophisticated WYSIWYG program while a large compile was going on, knows the limitations of time-sharing a single CPU. Fortunately, it looks like those days of waiting are finally coming to an end and we'll add CPUs to our systems much as we now add memory or disk.

The Twinhead Tinstation we

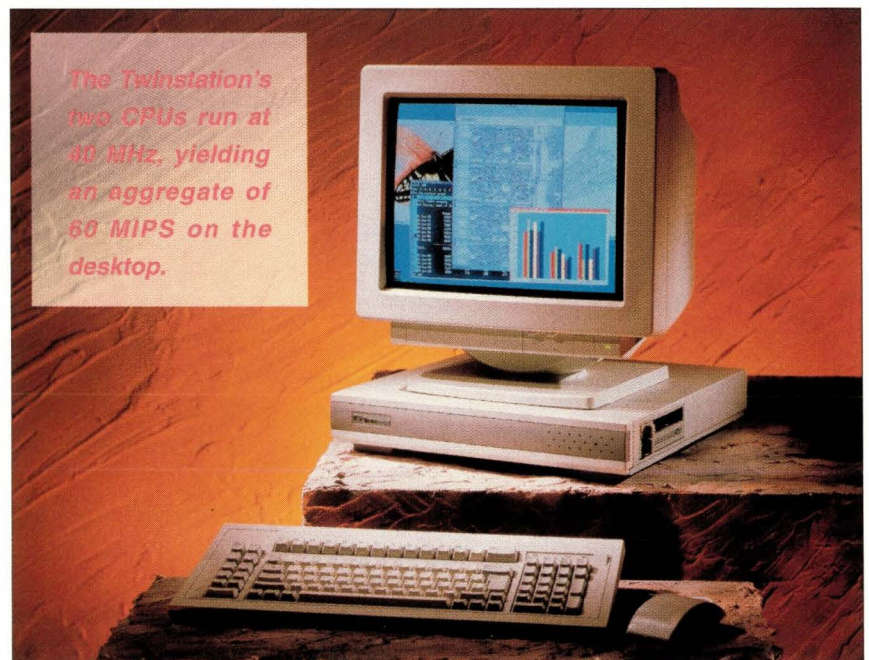
received came equipped with 64 MB of memory, a 500-MB disk, cgsix color frame buffer and 1,152-by-900 color monitor, and two SPARC CPUs running at 40 MHz.

The system box is a little larger than the familiar Sun pizza box, but not by much. This two-CPU system

with a 500-MB disk, color and 16 MB of memory costs less than \$12,000, a very impressive bargain for this much power.

Performance

Dhrystone Version 2.1 yielded 46,729 Dhrystones, or a little over 30 MIPS, somewhat faster than our SPARCstation 2 (Twinhead claims 31 MIPS, close enough). Dhrystone only measures single-processor speed, so we can assume there's an aggregate of more than 60 MIPS in the box



between the two CPUs.

As an informal measure of parallelism I ran GNU's `make` utility, which can optionally use multiple processes to rebuild software. The software I rebuilt was the `make` utility itself. Using the built-in `time` command, the build time dropped about 30% using two or more processes in parallel, versus telling GNU `make` to use only one process at a time.

You can upgrade the Twinhead to a total of two internal 3½-inch hard drives plus a floppy or cartridge tape, 128 MB of memory (eight SIMM slots) and anything else you can hang off the external SCSI and two SBus slots (one of which will be taken up by any graphics accelerator). In the back are the familiar external SCSI connector, two serial ports, thick Ethernet, audio, keyboard and space for SBus cabling.

The system runs SunOS Release 4.1.2 with minor internal modifications by Twinhead. Basically, the Twinhead is running the same version of SunOS as Sun's own 690 multiprocessor. This means that parallelism is currently asymmetric: One CPU handles all the I/O, while either can be used for processor-intensive tasks. According to T. J. Lin, product mar-

keting manager for the Twinhead, a SuperSPARC version is in the works and will only require swapping the MBus CPU module to upgrade. He adds that when Solaris 2.0 arrives with symmetric multiprocessing, Twinhead will offer this software upgrade to its customers also.

Twinhead is based in Taipei, Taiwan, with U.S. offices in Milpitas, CA, as well as Germany, the United Kingdom and France. Twinhead started in 1984 as a manufacturer of DOS hardware products and is currently a \$160 million company with 1,000 employees.

On all counts—price, performance, packaging—the Twinhead is a very interesting SPARClike, an avant-garde workstation portending a technical path Sun has already committed to: desktop multiprocessing.

C Data Run

Raima Corp.'s Data Manager database product is one of the more laudably unusual database systems I have ever seen. The system is entirely designed for C or C++ programmers: `Db_VISTA` is delivered as libraries of subroutines, `include` files and so forth, with a few sample applications (including source code) and utilities meant to be used primarily by the application developer. Interestingly, the entire base system is supplied in source at no extra charge, and sources are available for other options for a reasonable price.

Data Manager is aimed at the developer who needs to generate his or her own embedded database applications from scratch. The libraries are very sophisticated and cover a broad range of database application issues. For example, Data Manager supports networked, hierarchical or relational data organization models, although the underlying representation is a networked model. Utilities for concurrency control, database initialization, low-level editing, dumping, key reorganization, recovery and many other essentials are all there.

The software library is high-level enough that you don't feel like you are building the database system yourself; this isn't rock soup by any means. In a

way, it's reminiscent of UNIX itself: Provide the parts and let the applications developer put them together however he or she wants. I know from developing database applications myself that it's often very frustrating to interface front-end code to a database. Many database systems are provided first as interactive applications and only secondarily as application development environments. As a result, you develop applications within a vendor's 4GL.

This package is definitely not for the novice applications developer. It took me a few hours just to get a simple application working, even after studying Raima's fairly good manuals (both a User and Reference manual). I did, however, feel like I had a lot of generality and power at my disposal.

Object-oriented programming and databases seem to be a natural fit, and Raima has also provided a complete C++ environment along with the more traditional C environment with its Object Manager product. In addition to compatibility with the Data Manager product, Object Manager provides VLF (Variable Length Field) and BLOB (Binary Large Object) support.

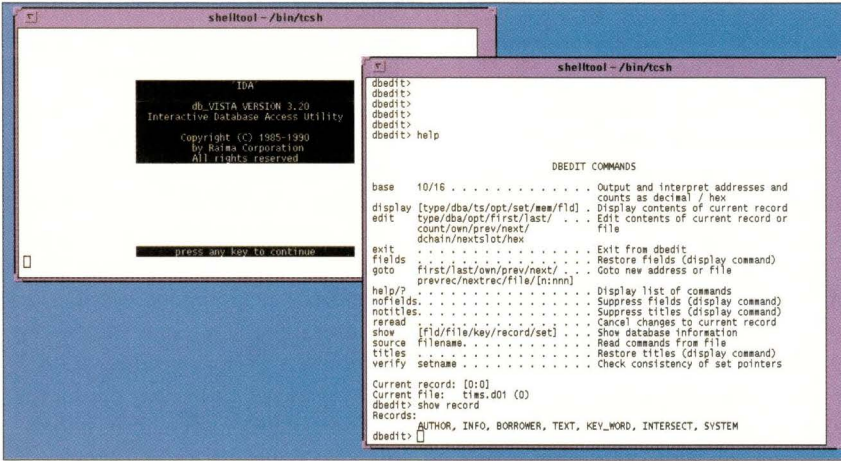
Both Data Manager and Object Manager support maximum record sizes up to 32,757 bytes, more than 16 million records per file, 256 files per database and more than 4 billion records per database. The maximum number of simultaneously open databases is limited only by your computer's memory size. All C data types are supported (integer, long, float, etc.) as well as an additional database address type that holds the location of another object elsewhere in a database.

Raima also sells two add-on SQL (Structured Query Language, a database industry standard) packages, `db_QUERY` and `db_REVERSE`. `db_QUERY` is for read-only access to Raima's database system, and `db_REVERSE` adds in update and other functionality. These packages support queries across multiple as well as single databases.

The entire system is available on UNIX (many variants), MS-DOS, OS/2, MS-Windows and VMS; each platform has its own price schedule.

Applications developed using

Twinstation	
Company	Twinhead Corp.
U.S. Address	1537 Center Pointe Drive Milpitas, CA 95035
Phone	(408) 945-0808
Fax	(408) 945-1080
Best Feature	Dual SPARC processors in an attractive, economical desktop package.
Worst Feature	Nothing that I could find
Price	\$14,995
Circle 120	



Raima Corp.'s db_VISTA is a library of subroutines tailor-made for C and C++ programmers.

Raima's products are royalty-free: You can embed the database into your own commercial application and sell it without further interaction with Raima. Many organizations have already taken advantage of this, including one company, APT, which has layered its own 4GL front end for MS-Windows onto Raima's product. Other applications using Data Manager include Wheelbase, an on-line magazine, and SPARTANS, a database for tracking compliance with the Strategic Arms Reduction Talks by the U.S. Navy.

Data/Object Manager

Company
Raima Corp.

Address
3245 146th Place SE
Suite 230
Bellevue, WA 98007

Phone
(800) 327-2462

Fax
(206) 747-1991

Best Feature
Excellent platform for embedded database application development.

Worst Feature
Requires a fair amount of sophistication to get started.

Price
Begins at \$1,995

Circle 121

One of Data Manager's strongest features is its performance. Raima claims this is due to the internal networked data representation model. Another nice touch is Raima's on-line bulletin board service, which you can use via modem to pick up product information and leave questions.

So why haven't you heard of Raima in a field of superstars like Ingres, Oracle and Sybase? Primarily because its product usually ends up being embedded in other applications and not seen by end users. What you are getting in this review might be labeled "Secrets of the Applications Wizards." Well, the beans are spilled.

Network Gator Aid

The GatorBox CS is an intelligent network gateway in a nifty little package: an upright box measuring 11 by 11 by 1.5 inches with a small stand underneath. Despite its unobtrusiveness, there are a lot of features packed into the box: TCP/IP-to-AppleTalk gateway, AppleTalk routing, UNIX-to-LocalTalk printing and AppleShare-to-NFS file-sharing. Externally, the GatorBox (the hardware portion) has Ethernet (both thick and thin), AppleTalk and serial ports. The software is installed on a Macintosh from three floppy disks included with the manual and hardware.

To play around with the GatorBox CS, we have a Macintosh-IIx with a Cayman GatorCard Ethernet board and a LaserWriter that we plugged into the GatorBox's AppleTalk port. The

LaserWriter was easy to set up and appears to be an lpd printer to UNIX while simultaneously appearing to be a local AppleTalk printer to the Mac; both systems seem 100% satisfied with the arrangement.

To try out the AppleShare/NFS gateway, I decided to mount a large, public filesystem from our Sun server. Although I was eventually successful, I did run into a few small problems, which wasted some time. You set up the GatorBox from the Macintosh with a typical (and well-done) point-and-click interface. You will need to be comfortable with various aspects of network configuration such as host, network and broadcast addresses, NFS setup on the server (you need to make standard entries for NFS access) and other bits and pieces of administrivia. You will also need root access to the server, which is a reasonable requirement.

The first problem I ran into is basically summed up in the acronym RTFM (Read The Fine Manual). You really want to follow Cayman's instructions scrupulously because the order in which the steps are taken to set up NFS is sometimes critical.

At one point in the setup, you need to choose how the software will verify you from the server, that is, how it will check your login and password in order to simulate an AppleShare login later from the Chooser. The three choices are NIS (see Yellow Pages), Files or via PCNFSD (part of Sun's PC/NFS package). We don't run NIS or PCSNFSD, so I chose Files. This means that it should verify your login and password by looking in the files specified in the dialogue: `/etc/passwd` and `/etc/group` by default. This is done by NFS mounting the `/etc` directory to read these files, so besides whichever NFS filesystem you are interested in mounting, you also need to export the `/` or `/etc` directory to the GatorBox. This all went fine.

The problem arose when I went to the Chooser on the Mac to actually mount the NFS volume from the server. The Chooser asked me for my login and password, and no matter how carefully I typed it in, the software claimed it couldn't verify me. After much head-scratching and uttering of



The GatorBox CS from Cayman Systems Inc. is an intelligent network gateway in a very small package.

strange, loud sounds, the problem occurred to me: We run some of the Sun C2 security features on our Sun. This means that password encryptions are not in the `/etc/passwd` file at all, so the GatorBox software was confused and unable to verify my password. After creating a dummy account and placing a password string directly into the `/etc/passwd` file (which you can do even with C2 features enabled), all went well and I was able to mount my filesystem on the Macintosh. I would consider this a real problem for sites that use C2 features (specifically, shadow password files), although little is lost if you create dummy accounts for this purpose other than perhaps a modicum of security.

Once the file was mounted, I opened the device that corresponds to my NFS directory and was greeted with a standard Apple file folder on my Mac desktop.

To get a feel for the performance, I fired up Adobe Photoshop and opened up a directory containing GIF images of some Soviet documents I had just transferred over the Internet from the Library of Congress. The directories in this particular file system are fairly large, although not huge, and it did take a noticeable pause to open each one and display it from a file chooser. Reading in the GIF via NFS took several seconds and I was done, all

worked completely transparently to Photoshop. I can't rave about the NFS performance, but it was certainly adequate and it's hard to tell where the bottleneck occurred. I am going over Ethernet for this entire path, so it's not an AppleTalk bottleneck.

Overall I would say that the GatorBox CS proved itself to be a good, solid product with generally high-quality software that solves some very basic problems with mixing Macintoshes and Suns. Note that your Macs do not need Ethernet boards, as ours had. One of the major features of the GatorBox CS is to gateway between an AppleTalk network and TCP/IP Ethernet. It's unfortunate I ran into that small glitch with password verification, but I'll guess that a workaround from the company isn't hard, and many Sun network sites use NIS so you probably wouldn't run into this problem in the first place.

In summary, if you need to integrate Macintoshes, Macintosh AppleTalk networks and UNIX systems on Ethernet TCP/IP networks, the GatorBox products from Cayman are well worth considering. In fact, I don't know too many other ways to do quite what this neat little box accomplishes. ➔

GatorBox CS

Company

Cayman Systems Inc.

Address

26 Landsdowne St.
Cambridge, MA 02139

Phone

(617) 494-1999
(800) 873-4776

Best Feature

Solves a broad range of Mac/UNIX network integration problems in one small package.

Worst Feature

NFS performance was less than stellar, although adequate for routine file access.

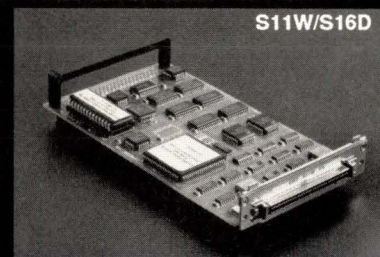
Price

\$2,795-\$3,095

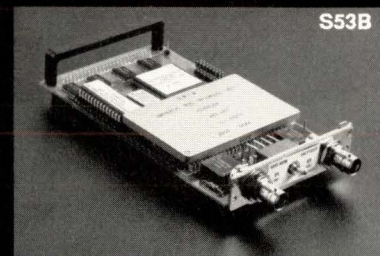
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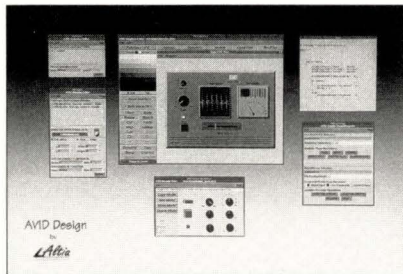
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Beaverton, OR 97006
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FAX (503) 690-1243

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 at the end of the magazine.

Prototype Simulation

Altia has introduced AVID Design, human interface design software for instrument and system developers. It is



a full-fledged instrument design and simulation system that allows developers to prototype designs using a graphical editor to create and assemble components. This object-based editor makes it possible to treat complex elements as a single structure, and Altia provides a library of prebuilt components. The software also includes a suite of animation features so that buttons, meters, dials, as well as custom components, can mimic their real-world counterparts.

Designers control input stimulus by defining input areas, triggers and actions. They can also use a code-connection feature to link external software for data feeds and modeling component behavior. A runtime module can be incorporated into actual instruments or systems.

Single-user price is \$4,900. Site licensing and OEM pricing are also available.

Altia Inc.
7240 Fleetwood Court
Colorado Springs, CO 80919
Circle 124

Network Backup

GT Backup, a network-based backup, restore and tape management sys-



Next-Generation Color Printer

The second generation of the Phaser III PXi plain-paper color PostScript printer is now available from Tektronix. The product employs phase-change ink-jet technology, including Tektronix' proprietary TekColor Finepoint technology—developed in conjunction with Adobe Systems—which allows for fine-detail printing. TekColor also allows users to match their printer output of a commercial printing press via new, built-in TekColor PS color adjustments, such as a Specifications Web Offset Publications (SWOP) option. The TekColor Previewer (which also is built into the Apple Macintosh and Microsoft Windows drivers provided by Tektronix) enables users to preview their output before printing it.

Tektronix is also shipping new color ink sticks for use with the Phaser III PXi that have been reformulated to adhere to a broader range of media and produce more durable prints. The company has introduced a media laminator for producing overhead transparencies. It sells for \$995. And it has come out with a paper tray that can handle 12- by 18-inch media.

Existing Phaser III PXi owners can upgrade their systems for TekColor for \$495. The complete Phaser III PXi retails for \$9,995.

Tektronix
Wilsonville Industrial Park
P.O. Box 1000
Wilsonville, OR 97070-1000
Circle 123

tem, is now available from Alida. GT Backup can perform multiple backup jobs and write to multiple tape drives without permanent .rhost and export permissions. The flexible software allows any computer on the network to back up to any device on the net and permits failed automatic backups to be attempted as part of another run. It includes full-

screen, character-based interfaces and standard UNIX tape formats.

Security is built in to the program: GT Backup's master/daemon method encrypts and verifies source and permissions for each command, and every menu item can be restricted to allow access to specified individuals to perform selected functions.

Pricing for GT Backup on a single workstation is \$395. Multiple-workstation discounts are available.

Alida Inc.
27 McDermott Place
Bergenfield, NJ 07621
Circle 125

Large-Format Scanners

Ideal Scanners & Copiers has introduced a new line of large-format scanners with SCSI interfaces. The line includes the FSS 3000 MP, a single-camera, 25- to 300-dpi device; the FSS 5000 MP, a dual-camera, 25- to 500-dpi scanner; and the FSS 8000 MP, a triple-camera, 25- to 800-dpi scanner. All are E-size and support 256 gray-shade output.

A CADImage/SCAN Interface Kit (sold separately) provides a tool box of scanning facilities including automatic exposure correction and on-line alignment and despeckling features. The software supports 28 different raster formats used by raster-based software. It also supports, for output, Versatec, Océ-Graphics, JDL, Atlantek, Graphtec and Colcomp devices.

Pricing for the hardware line begins at \$9,900; the software starts at \$995.

Ideal Scanners & Copiers
11810 Parklawn Drive
Rockville, MD 20852
Circle 126

DSP Language

A graphical development environment for digital signal processing applications has been released.

DataFlo allows developers to construct a DSP or image-processing application by selecting icons, connecting lines and completing fill-in-the-blank-style forms. The product uses a methodology developed by the U.S. Navy for its own high-performance signal applications. The company says this methodology causes instructions to execute when data queues, which precede instruction nodes, reach predetermined threshold levels rather than at predetermined times established by system clock cycles.

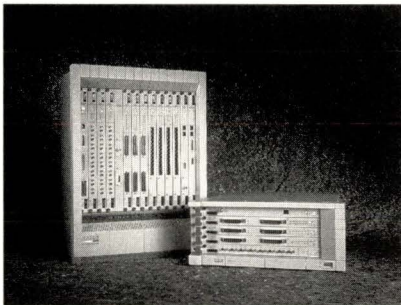
The resulting DSP applications can execute on the workstation itself—Dataflow's premier platform is the Sun SPARCstation—or it may execute on an

Intel Corp. i860-based accelerator from CSP Inc. of Billerica, MA. Pricing varies, beginning at \$4,800.

Dynetics Inc.
800 Hingham St.
Rockland, MA 02370
Circle 127

Networking Hubs Galore

Hughes LAN Systems rolled out four high-performance models of its Enterprise Hub family, including what the company claims is the industry's first RISC-based terminal-server mod-



ule. The other products include an Intel i960 RISC-based multiport Ethernet bridge, a hub-management module, a broadband-to-Ethernet bridge module and a five-slot enterprise hub. All of the modules are intelligent, incorporating a network-management processor and Simple Network Management Protocol (SNMP) agent for remote monitoring, diagnostics and control.

The terminal server, also based on the i960, is a 16-port server that can connect asynchronous devices to hosts through the Hughes LAN Systems' Enterprise Hub. It can support devices at speeds up to 38.4 Kb/s. Available in two configurations, an RJ45 and TP50, the terminal server is priced at \$3,895.

The local multiport Ethernet bridge module provides multiple Ethernet connections on a single-slot card. The product connects all three internal Ethernet LAN segments on the Enterprise Hub backplane, plus a fourth external Ethernet connection using AUI, FOIRL, 10BaseT or Thinnnet. Pricing is \$4,759.

The hub-management module option provides chassis-management functions for the Enterprise Hub. It provides physical system management and an out-of-band management path to other hub modules. It monitors the

operating status of power supplies, fans and chassis temperature. The option lists for \$995.

The broadband-to-Ethernet bridge provides connectivity between Enterprise Hubs using 10-Mb/s 802.4 token bus broadband networks. It can connect hubs as far apart as 24 miles, or link devices on a token bus network to hosts and resources connected to the Enterprise Hub. The product provides a migration path for customers who have investments in coax cable broadband backbone networks yet plan to move to twisted-pair wiring. Any one of the product's three channels can be used, providing a maximum configuration capability of 30 Mb/s of backbone bandwidth. The bridge costs \$5,995.

Finally, Hughes LAN Systems has added a five-slot, small-footprint model to its 2-Gb Enterprise Hub family. The new Model 1100 makes use of the same backplane architecture provided by the company's first 14-slot model. The new model merges wiring concentration, terminal servers, internetworking technologies and high-speed, fast-packet bus technology into a single system. The backplane contains multiple buses for Ethernet, token-ring and FDDI, an 800-Mb/s async bus for bridging and routing, an 800-Mb/s synchronous bus for synchronous and multimedia transport using Asynchronous Transfer Mode (ATM) technology and a 1-Mb/s administration bus for out-of-band management of hub modules. Together, these buses deliver more than 2 Gb/s total bandwidth. The hub is priced at \$1,995.

Hughes LAN Systems
1225 Charleston Road
Mountain View, CA 94043
Circle 128

Faster VME Data Rates

Chi Systems has developed a 6U (Eurocard form factor) HIPPI-VME 32/VME 64 interface board that speeds data-transfer rates among VME-based Sun, Motorola Inc. and Silicon Graphics Inc. workstations and supercomputers. The product's sustained block-transfer rates are projected at 25 (VME 32) to 55 (VME 64) MB/s. The product features a 32-bit-wide, 100-MB/s auxiliary port bus, facilitating

development of custom HIPPI interfaces. VME master/ slave/syscon operations and VME block transfers are supported, eliminating the need for a separate DMA engine on the VMEbus.

Sun- and SGI-compatible drivers ship with the interface. Upper-level protocol-development services are available from Chi. The board, including the drivers, lists for \$12,300.

Chi Systems Inc.

5860 West Las Positas Blvd.
Suite 25
Pleasanton, CA 94588
Circle 129

Interface Does AlphaWindows

Structured Software Solutions' FacetTerm multisession interface now includes support for AlphaWindow terminals, the new class of alphanumeric terminals that provide character-based applications with a point-and-click interface. FacetTerm allows character terminals and PCs to run up to 10 simultaneous UNIX sessions. It enables users to perform screen print operations, cut and paste between applications and allows an attached printer to become a print-spooler device.

List price for FacetTerm begins at \$495.

Structured Software Solutions Inc.

4031 W. Plano Parkway
Suite 205
Plano, TX 75093
Circle 130

FDDI Interface for ICL

ICL's DRS 6000 UNIX servers now support FDDI networking, making them among the first, if not the first, UNIX System V Release 4.0-based systems to feature the FDDI option. The optional FDDI controller is based on the Supernet 1 chipset and 29000 RISC processor from Advanced Micro Devices Inc. DRS 6000 FDDI conforms to ISO 9314 standards. The controller supports single-attached station (SAS), dual-attached station (DAS) and dual-homing mode. Protocols supported include TCP/IP and OSI; GOSIP, X.400, FTAM and VTP support is planned for future releases.

The FDDI networking option is available on new or existing systems.

U.S. list pricing for the controller is less than \$10,000.

ICL Inc.

9801 Muirlands Blvd.
Irvine, CA 92713-95993
Circle 131

Move Over, DeskSet

IXI has launched a rival to Sun's DeskSet suite of desktop applications. IXI's offering, Deskworks, includes a text editor, time manager/calendar, front end to UNIX mail, reminder facility, calculator, world time, secure screen lock, phone book and chess game. The product works with IXI's X.desktop and Motif-based window manager. IXI says Deskworks "will provide, for the first time, a comprehensive Motif user environment on Sun." Deskworks will work with standard Open Windows X11/NeWS server or any other X11 server for Sun.

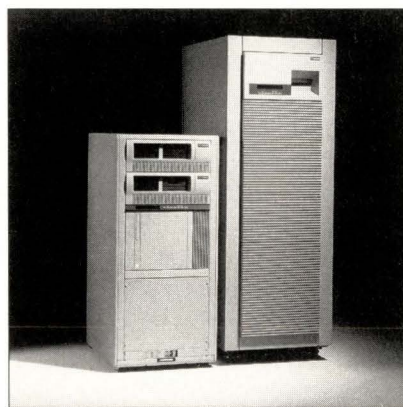
List price for Deskworks ranges from \$75 to \$195, depending on the number of users.

IXI Corp.

One Annabel Lane
San Ramon, CA 94583
Circle 132

SS-2-Based Network Server

An enhanced version of the Epoch-1 InfiniteStorage Server, called the Epoch-2 Data Server, is now available from Epoch Systems. The Epoch-2 incorporates the Sun Microsystems Computer Corp. SPARCstation 2 platform. The



server combines magnetic disks with high-density optical disk and tape robots or jukeboxes. Epoch says it provides "virtually infinite on-line disk space" by staging inactive files from its

magnetic disks to secondary storage such as optical jukeboxes. The Epoch-2 also is able to stage in files by part, so that a portion of a file can be recovered, rather than the entire file.

Additionally, the company announced EpochBackup, a software backup package that runs on local workstations and servers, allowing them to back up to the Epoch-2. EpochBackup is available on Sun, IBM Corp., Digital Equipment Corp., Silicon Graphics Inc. and Hewlett-Packard Co. platforms.

Another new product, Epoch-Migration, migrates inactive data from magnetic disks to the Epoch-2. It runs on local workstations and servers from Sun and DEC.

The Epoch-2 is configurable from 20 GB and up, with a choice of high-capacity or high-performance options. The Epoch-2 starts at \$93,900. An upgrade package (from Epoch-1 to Epoch-2) is available for \$18,000.

Epoch Systems Inc.

8 Technology Drive
Westboro, MA 01581
Circle 133

SunNet Manager Add-Ons

Two add-on packages for SunNet Manager are available from DeskTalk Systems. DataPipe, a relational database management interface, enables systems administrators to better handle performance tracking and network troubleshooting. DataPipe's SQL interface allows users to feed data into DBMS products from Informix, Oracle Corp. and Sybase Inc. It also allows systems administrators to use spreadsheets like Wingz or Lotus 1-2-3 to retrieve information from the database and create graphical data presentations and reports. And DataPipe includes a SQL scripting and query building tool for generating ad hoc queries. The program is self-configuring and automatically creates the necessary tables based on the SunNet Manager setup procedure, as well as controls database sizing.

The Remote Monitoring Services Manager (RSM) provides Novell Inc. LANtern Services Manager functionality on Sun platforms. RSM collects, records and interprets data gathered from LANtern network monitors. In

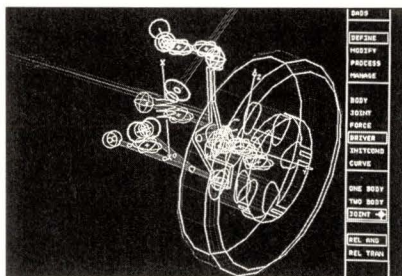
the event that a LANtern monitor detects a problem, RSM provides automatic, real-time alerts on the SunNet Manager console. The package features a network map for managing LANtern and other devices from a single screen, as well as real-time graphing of LANtern counters and gauges. RSM generates station statistics and historical, trend analysis, configuration monitoring and fault-detection data.

RSM pricing begins at \$1,995. DataPipe is offered in a basic package for \$995 or bundled with a full Sybase SQL Server runtime database for \$1,495.

DeskTalk Systems Inc.
19401 S. Vermont Avenue
Torrance, CA 90502
Circle 134

CATIA-to-DADS Link

Providing an interface between Dassault Systemes' CATIA and the Dynamic Analysis and Design System (DADS) from Computer Aided Design Software Inc. (CADSI) is a



new software module from CADSI called CATDADS. CATDADS will allow CATIA customers to perform integrated dynamic analysis and simulation of their designs. The product provides the look and feel of the CATIA environment. DADS results, such as velocity, acceleration and forces, can be linked with CATIA geometry for review as photorealistic animation in the DADS graphic environment.

The product runs on SPARCstations and sells for between \$5,000 and \$10,000.

**Computer Aided
Design Software Inc.**
P.O. Box 203
Oakdale, IA 52319
Circle 135

More Secure Bridge-Routers

Network Systems' Vitalink Communications division has made several network-security enhancements to its 6000 Series of RISC-based bridge-routers. Among the new features are network control facilities software, providing advanced access control, usage monitoring and policy-based TCP/IP routing; TEMPEST-compliant versions of the 6600; and DNSIX-compliant upgrades for the 6400 and 6800.

There are two modules of network control facilities: the packet control facility, which allows network managers to set filters in their TCP/IP router networks, and the bridge control facility, which allows a network to be logically divided into closed user groups.

On the TEMPEST front, Vitalink partnered with North Atlantic Industries Inc. to build a TEMPEST-compliant 6600 bridge-router. And the 6400 and 6800 lines now support the Defense Intelligence Agency's DoDIIS Network Security Information Exchange (DNSIX) standard. Network

Systems claims that its products, unlike its competitors', can run data-intensive DNSIX-compliant applications without significant system-performance degradation. DNSIX Version 2.1 will be available some time in the fourth quarter.

Network Systems Corp.
Vitalink Communications
Corp. division
7600 Boone Avenue North
Minneapolis, MN 55428
Circle 136

Stopping Memory Leaks

Pure Software has released Version 1.1 of its Purify software testing and development tool. Purify is designed to help programmers detect and eliminate memory leaks and memory-access errors. With the newest version, developers can set memory SmartPoints (Pure Software's customized watch-points) to identify logic and other programming errors. Version 1.1 also works with user-defined memory allocation functions and provides more flexible customization features.

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Purify is available as a floating-network license. A single unit, with service support and upgrades for a year, sells for \$2,750. The product is available for C and C++ developers working with SunOS 4.1.X and CC, cc, acc, g++ 1.X, gnu 1.X, CenterLine Software and Object Design's ObjectStore compilers.

Pure Software Inc.
2111 Grant Road
Los Altos, CA 94024
Circle 137

DECnet, LAT Support for Suns

Thursby Software Systems has unveiled Version 2.2 of its TSSnet for Sun Microsystems Computer Corp. platforms. The new release of the company's flagship connectivity software includes a complete implementation of Digital Equipment Corp.'s Network Information and Control Exchange (NICE) protocol suite, making TSSnet for Sun fully compatible with DEC's NMCC/DECnet Monitor and NMCC/VAX ETHERnim. The new release also supports DEC's MOP protocols, allowing users to remotely load their LAT terminal servers from their Suns.

Thursby is also shipping a version of TSSnet for AIX, which runs on IBM Corp.'s RS/6000 platform.

TSSnet for Sun lists for \$2,295.

Thursby Software Systems Inc.
5840 W. Interstate 20
Suite 115
Arlington, TX 76017
Circle 138

MIPS-Based X Terminals

Three-dimensional graphics users now have an X terminal that can meet their demands, according to Japan Computer, the manufacturer of the GlobalX series of MIPS R3000A-based X terminals. The series consists of monochrome and PEX color X terminals. They support Motif as their local window manager and Motif and Open Look as their host-based managers. The machines also support X11R5, the latest release of X.

GlobalX terminals come bundled with JCC's optimized X server, NFS and SNMP. Remote configuration is supported. Standard configuration

includes a monitor, a base unit with thin and thick Ethernet serial interfaces, 4 MB of RAM (expandable to 32 MB), a keyboard and a mouse. Touch-screen capability is offered as an option.

The GlobalXM, a monochrome model, is based on a 25-MHz R3000A. Supported monitors include 17-, 19- and 21-inch, all with 1,280-by-1,024 resolution and 74-Hz refresh rate. The system is designed to perform at 120,000 xstones. The GlobalPEX is based on a 40-MHz R3000A. It includes an integrated 40-MHz floating-point processor. It comes with a specially tuned Trinitron monitor, and is available in 17- and 20-inch configurations, supporting 1,280-by-1,024 resolution and a 74-Hz refresh rate.

U.S. list prices are \$2,995 for the standardly configured GlobalXM-17; \$3,395 for the GlobalXM-19. Pricing on GlobalPEX was not available at press time.

Japan Computer International
1 Bridge Plaza, Suite 400
Fort Lee, NJ 07024
Circle 139

Turn Your Mac Into an X Terminal

Mach^{Ten} X Client and X Server software from Tenon Intersystems allows users to turn their Macintosh hardware into X terminals. The X Server software, Release 1.4.0, links Mach^{Ten} users to X Window System applications. The package, which conforms to X11/R4, runs in conjunction with Mach^{Ten} (a Berkeley 4.3BSD UNIX built on a Carnegie Mellon Mach foundation) and Mac OS. The Server software has a built-in window manager that supports up to six X screens. The software is 8-bit-color-compatible and includes a built-in color database and an editor to enable customized color definitions, allowing clients to display up to 256 colors simultaneously. Support is also available for 8-bit gray-scale monitors and monochrome monitors.

The Mach^{Ten} X Window Client, Release 1.5.0, is based on X11/R5. It can be used in conjunction with Mach^{Ten} and the Mach^{Ten} Development System. Included in the package are X programming libraries, Athena widgets and utilities, configuration files and docu-

mentation, as well as sources for a sampler of X client applications. Motif programming libraries are available as options.

The Mach^{Ten} Kernel lists for \$595 for a workstation and \$835 for a server. The X Window Client software sells for \$75 and the X Window Server software for \$200.

Tenon Intersystems
1123 Chapala St.
Santa Barbara, CA 93101
Circle 140

Low-End Terminal Server

A low-end UNIX terminal server, the Micro Annex ELS, has been introduced by Xylogics. The product is available with eight or 16 ports. Xylogics says the Micro Annex ELS offers "all the functionality of a multi-protocol asynchronous terminal server."

Features of the product include the following: the ability to access any TCP/IP or LAT network host; SNMP support; full modem controls to support the latest high-speed modems on selected ports; rotaries and modem pools; port password security; and macros for customizing user interfaces. The product includes a "UNIX-style" interface, full Telnet and rlogin implementations, RIP routing protocol and UNIX host-based software.

The eight-port version lists for \$1,895 and the 16-port for \$2,495.

Xylogics Inc.
53 Third Ave.
Burlington, MA 01803
Circle 141

Fax Software for Suns

GNP Computers' new XpressFax software allows users to compose, examine, transmit, receive and edit any fax document at their desktops. XpressFax, which runs on any computer with an X11 graphical interface, is fully integrated with standard UNIX mail and printer facilities, allowing any UNIX application to transparently fax output. The product provides an audit trail for authenticating transmission, time, date, duration, sender and receiver of any fax. The software also allows users to queue faxes.

XpressFax can be used from the UNIX command line and has

import/export filters for TIFF, GIF, PBM, PostScript and ASCII. On the Sun platform, the price is \$1,000 for a single-server module, \$1,500 for a five-user license or \$2,000 for a 10-user license.

GNP Computers

1254 E. Colorado Blvd.
Pasadena, CA 91106
Circle 142

...And More Souped-Up X Terminals

C. Itoh has unveiled hardware and software enhancements to its line of X terminals. The new CIT-XE+ family of products is based on a combination of C. Itoh's own graphics ASICS and the TMS340X-40, a new, X Window System-specific RISC chip from Texas Instruments Inc. The enhanced products benchmark at 80,000 xstones for the 1,280-by-1,024 monochrome product, and 60,000 xstones for the 1,280-by-1,024, 8-bit color model.

Like other X terminals, the CIT-XE+ products support SNMP. But the terminals also incorporate a mini-executive, referred to as Monitor-OS, that

allows up to 32 simultaneous remote Telnet connections. The C. Itoh products also support NFS for downloading fonts, as well as TFTP. A local window manager, Clwm, supplements the five currently supported local clients. And an auto-dial enhancement makes it easier for users to establish a serial connection through a modem. C. Itoh offers a touch-panel option.

The CIT-XE+ series consists of two monochrome models (17- and 19-inch), three color models (17-, 19- and 21-inch) and one 16-inch plasma flat-panel model. Prices range from \$2,995 for the 17-inch monochrome, to \$5,795 for the 21-inch, 8-bit color one.

C. Itoh Technology Inc.

2515 McCabe Way
P.O. Box 19657
Irvine, CA 92713-9657
Circle 143

'World's Fastest' Optical Drive

Pinnacle Micro is shipping what it claims is the "world's fastest optical

drive." The PMO-650 is a 650-MB rewritable drive that utilizes Pinnacle's custom-developed Optical Hard Drive Mechanism. This OHD technology combines magneto-optical technology with speeds faster than most Winchester drives, according to the company. It relies on an advanced split-optic design resulting in an "ultra light optic head." The reduced weight allows the drive to achieve faster seek times.

Pinnacle has also implemented a direct seek method, which eliminates one step in the data seeking process. The drive employs a 20-MHz 80188 CPU that allows for strategic data mapping and data queuing on reads and writes, making for greater throughput.

The PMO-650 retails for \$3,995 for Sun systems, Apple Computer Inc. Macintoshes and Silicon Graphics Inc. platforms, and \$4,195 for IBM Corp. platforms.

Pinnacle Micro
19 Technology
Irvine, CA 92718
Circle 144

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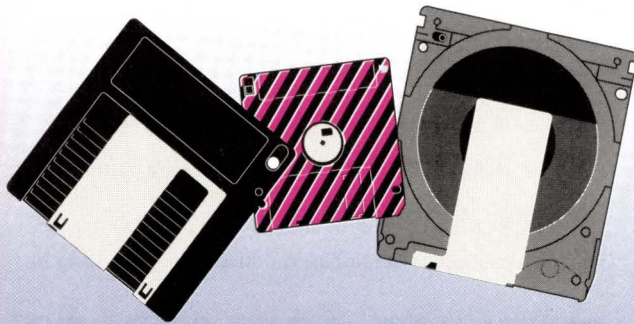
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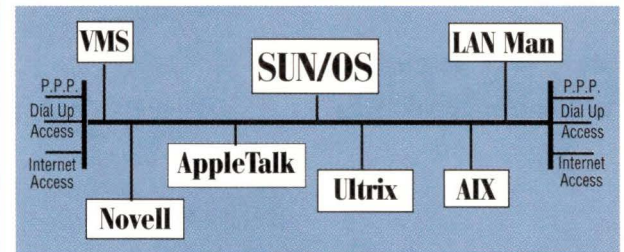
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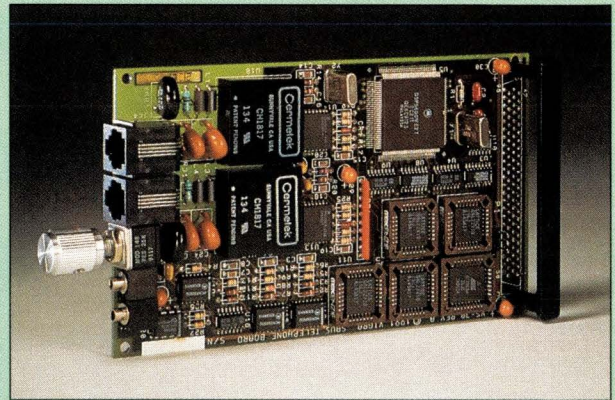
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VIGRA

VIGRA, Inc
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San Diego, CA 92117
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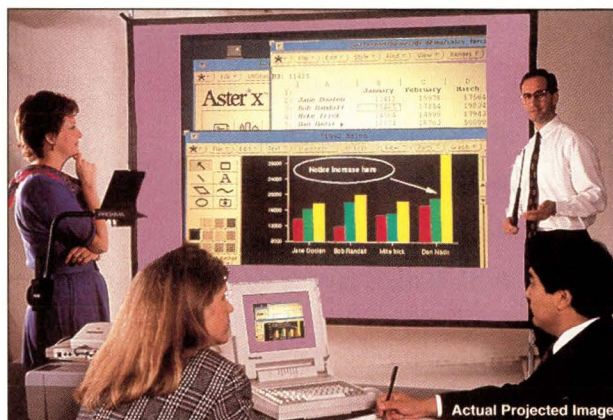
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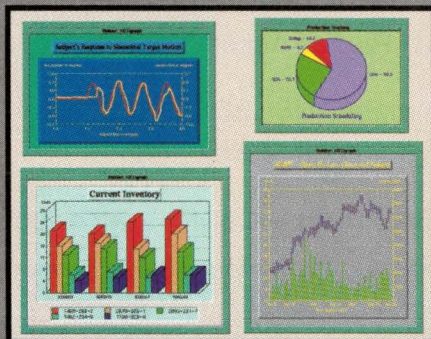
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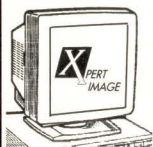


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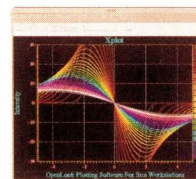
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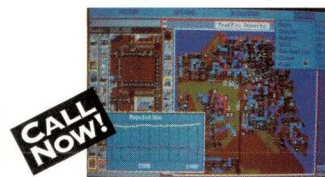


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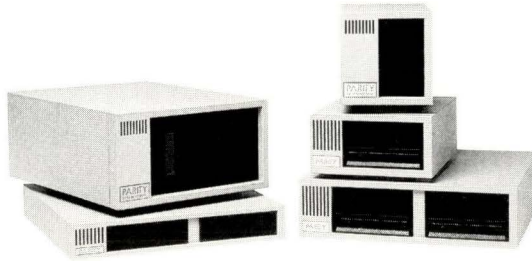
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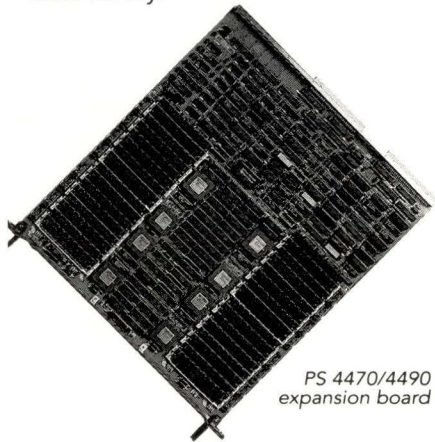
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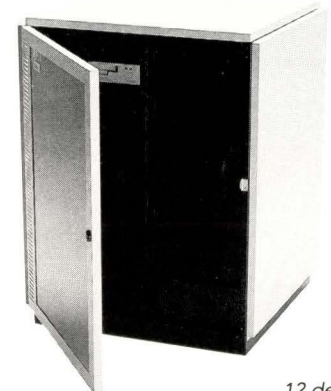


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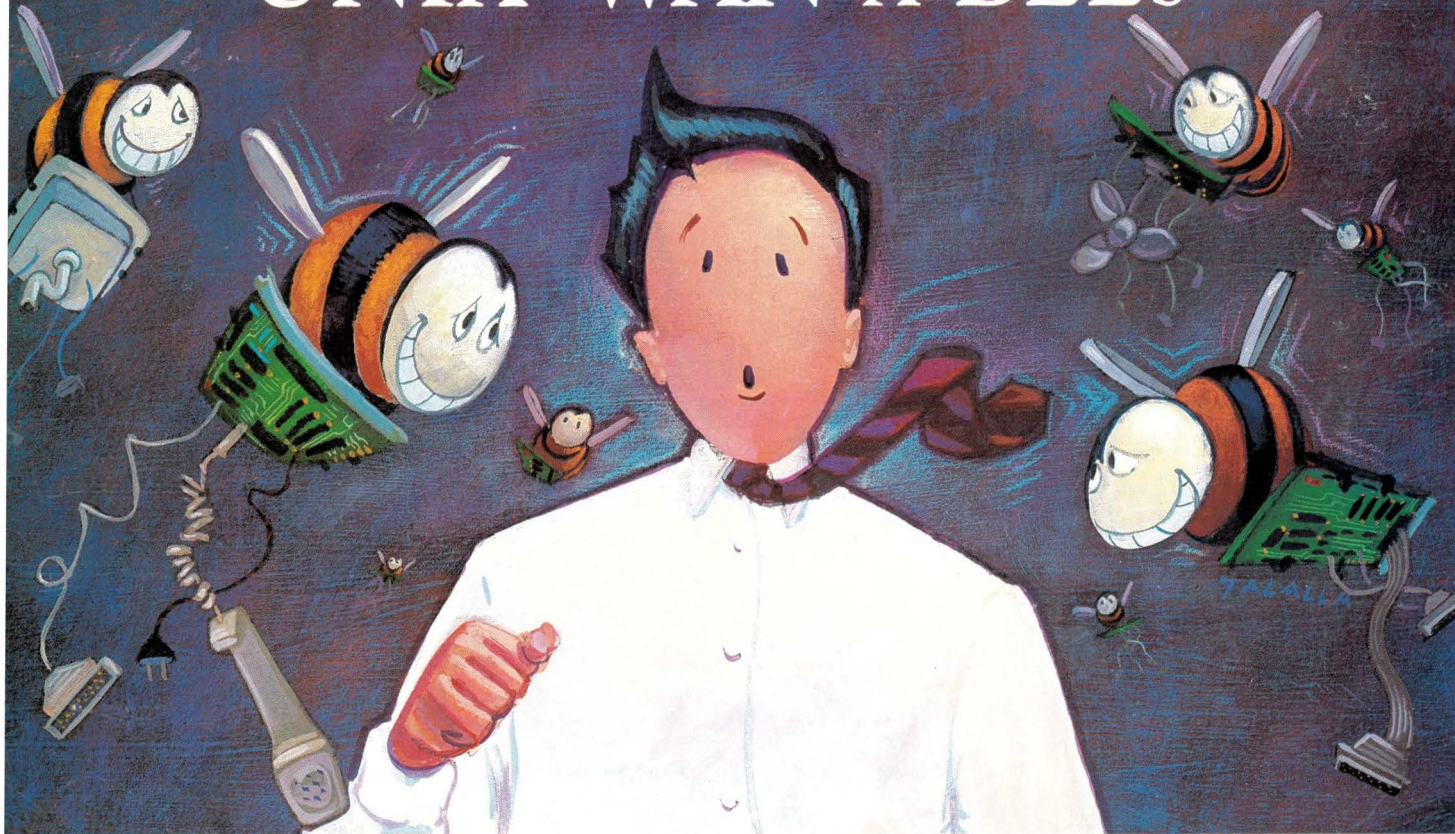


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