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News: Sun Clusters

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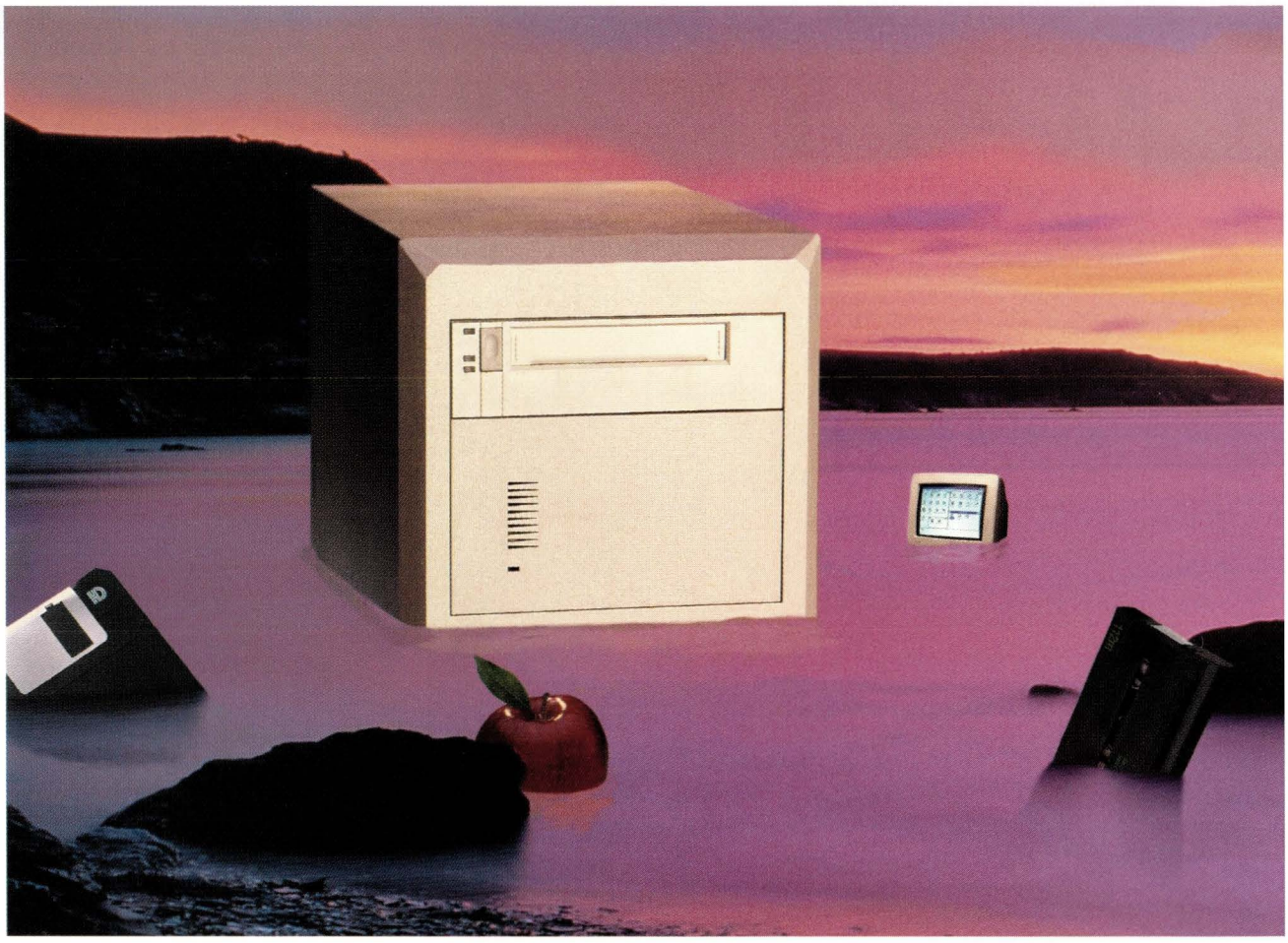

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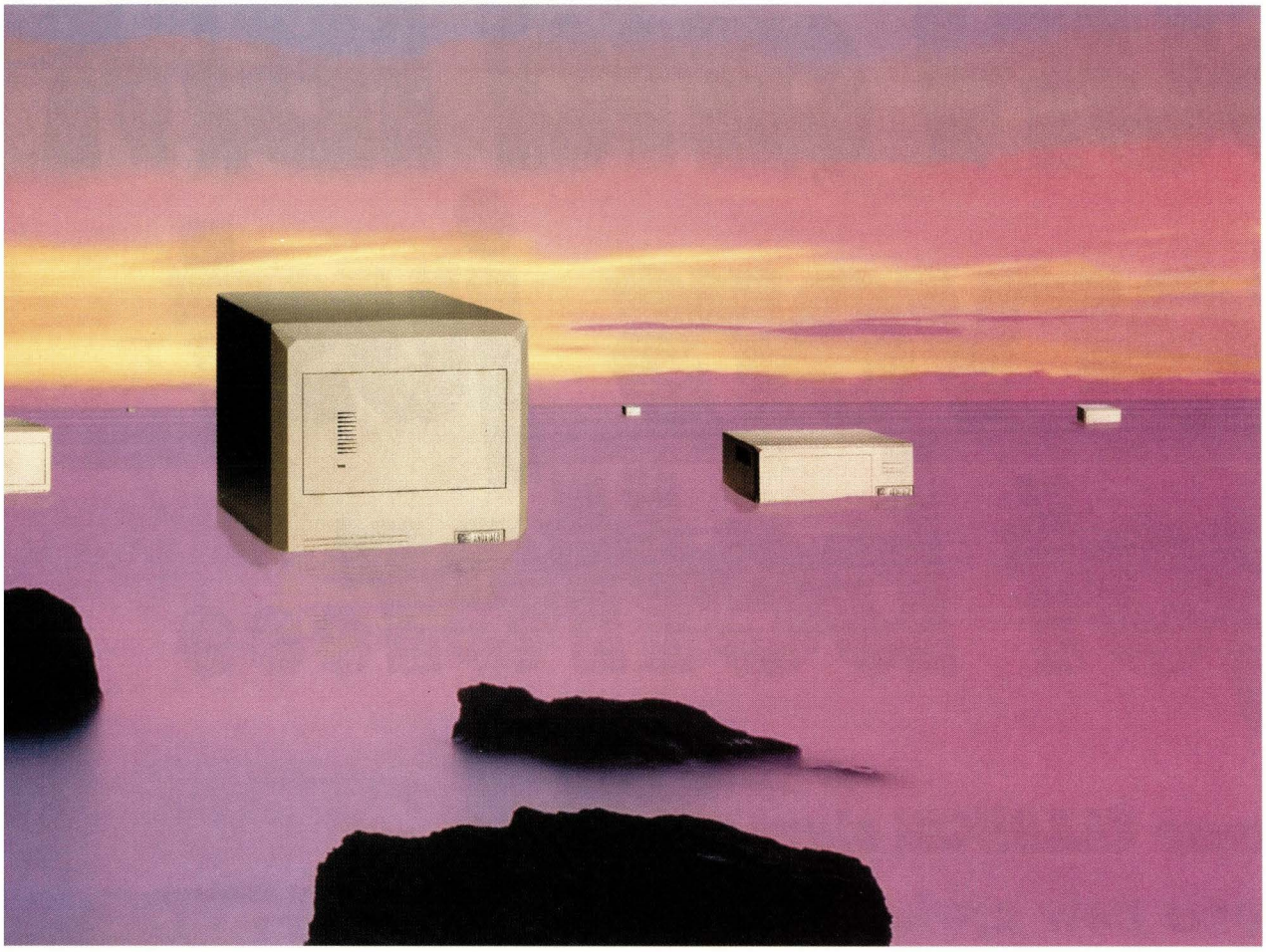

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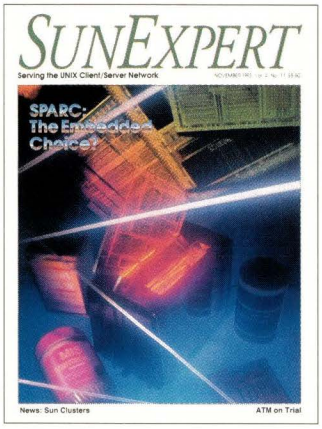

Cover by Ralph Mercer

NEWS

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DEPARTMENTS

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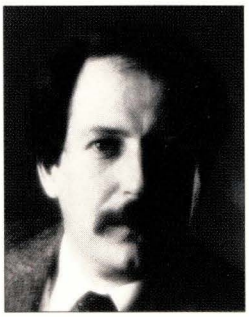
Editorial

It's the Software, Stupid

Graphics accelerators, color laser printers, X terminals, telecom switching equipment: These are just a few of the systems that are often talked about under the general term "embedded applications."



Much to the surprise of many industry pundits, the SPARC processor has accumulated an impressive list of design wins in this sector. I can think of three reasons for SPARC's success in this market: The chips are cheap, the development environment is rich with tools, and every vendor or OEM seems to be in search of off-the-shelf solutions.

But you can read all about embedded systems in Michael Jay Tucker's story "Stealing Sockets." The point I want to make is that Sun Microsystems should examine its penetration of the embedded market and take to heart a few lessons. Lessons one, two and three: It's the software, stupid.

Sun has done an astounding job of retooling itself over the last couple of years. Two years ago, when anyone said Sun hardware could be a contender for the hearts and minds of MIS, most of us chortled and rightly so. Now after the overhaul, Sun should be a force from the desktop, with its X terminal, to the data center, with its SPARCcenter and SPARCcluster configurations. So what happened?

As you Sun veterans know, many of us bought Sun systems because of the OS. It was stable, predictable and robust (it came as a ready-to-use development environment). So what's the problem?

The compiler disappeared, OpenWindoze became Sun's Bay of Pigs debacle and System V Release 4 is on its way to becoming Sun's Gulf of Tonkin Resolution. So what's the solution?

That's the essential question. Mull it over. Keep in mind that Sun intends to migrate to System V Release 4 come what may. If you conjure up ideas that will help you or others deal with Solaris 2.0, email or fax your strategy to *SunExpert*: `solar@expert.com` or call (617) 739-7003. We will compile the "empowering" (as they say in Mountain View) not the embittered ideas in a future Letters to the Editor section.

Doug Pryor

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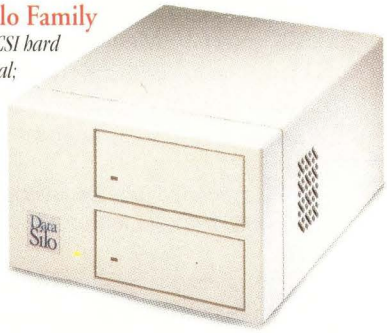

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NEWS

Sun Does Clusters

In a move sure to raise speculation about future mainframe replacements, Sun Microsystems Inc. has announced plans for a cluster product. Called the SPARCcluster 1, the device is a chassis containing as many as 16 SuperSPARC+ processors. Initially, it will be strictly a file server, but in the long term the company suggests the machine's successors will be compute and database servers as well.

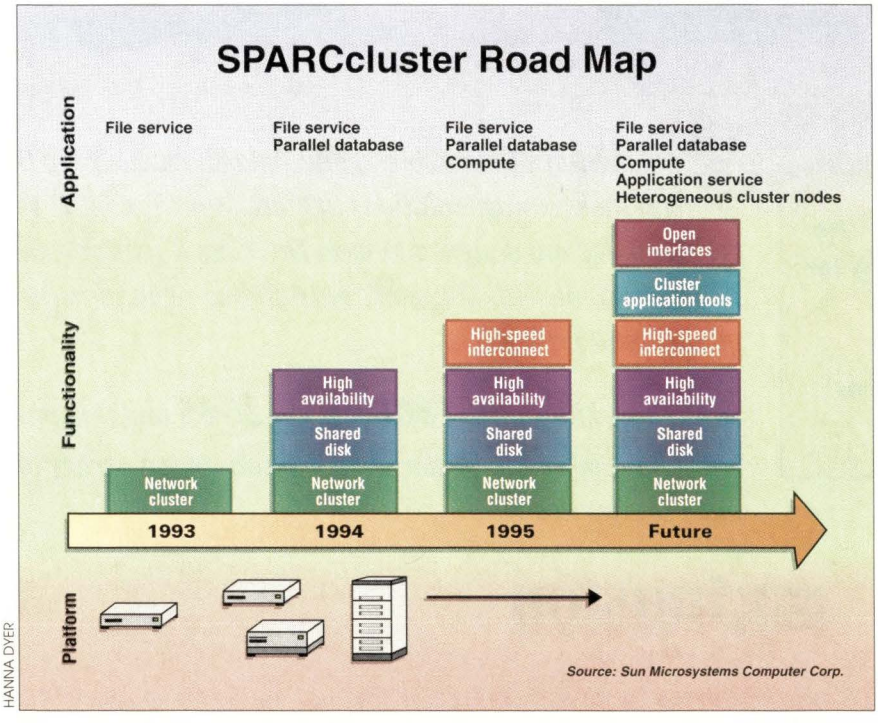
There are two entry-level clusters. The first is the SPARCcluster Model 2, at $85,000. This device has two SPARCserver 10 Model 40 boards in its chassis, along with two disk trays, a tape tray, an Ethernet switch with six network expansion cards, and SPARCcluster software. The second is the SPARCcluster Model 4 with four SPARCserver 10 Model 40 CPU boards, four disk trays, a tape tray, an Ethernet switch with 12 network expansion cards and software.

The products are based on the SPARCserver 10. However, Sun says that it is only a beginning. In the long run, there will be clusters based on all manner of Sun servers, up to and including the SPARCserver 2000.

Sun says the SPARCcluster is meant to be a dedicated network file server. As such, it provides nodes in one or several networks with file service and accelerates NFS operations (Sun says that the machines will offer 240 to 2,500 NFS operations per second). However, Sun has shown a road map for its cluster technology. By 1994, the clusters are scheduled to provide high availability of files and database functions. By 1995, they will be compute engines as well. By 1996, they are supposed to be supporting additional applications.

Clusters have a long history in commercial computing. Digital Equipment Corp. offered VAXclusters in the 1980s as alternatives to mainframes, particularly for database transactions.

SPARCcluster machines will begin as network file services. Sun Microsystems Inc.'s plan, though, is to make them database and compute servers in the near future.



HANNA DYER

More Dinosaurs (er, Protomammals)

It lived 240 million years ago. It was about the size of a good-sized cat, or perhaps a small dog–though it probably looked more like a large lizard. It ate insects, probably. It was not a dinosaur. It was, however, directly (if distantly) related to dogs, cats, whales, rats, opossums and people. Its name was Thrinaxodon.

And, it has a Sun Microsystems Inc. connection.

It seems that Sun workstations and paleontologists are bound to get together. In the February issue of *SunExpert*, we reported on an effort to use medical CAT scanners to look inside dinosaur eggs and other fossils. In a joint venture, Glenn Daleo of the Children's Hospital of San Diego, Peter and Sylvia Berens of Apunix Computer Services, the Natural History Museum of San Diego, and a small army of other volunteers and companies banded together to use hospital CAT scanners and Sun workstations to see inside fossils that would otherwise be impossible to analyze.

Meanwhile, though, other researchers are using industrial CAT scanners to do something similar–and once again, Sun workstations are playing a role.

Timothy Rowe is an associate professor of geology at the University of Texas at Austin. He's also an associate curator of vertebrate paleontology at the Texas Research Museum. He says he's always been interested in the origins of mammals, as well as of birds, and of early dinosaurs. The problem is the study of such creatures can be difficult. "You want to get inside the brain [of the fossils]," he says. "And that's difficult with conventional techniques, which amount to little more than a hammer and chisel."

Many early fossils are too rare to be taken apart by such destructive techniques. Even if there are enough fossils to go around, getting them into pieces can be a painstaking process requiring literally years of work. All of which led Rowe to X-ray machines as the best substitute for hammers and saws.

But, where Glenn Daleo used a medical CAT scanner, Rowe went with an industrial scanner. "It's very good for

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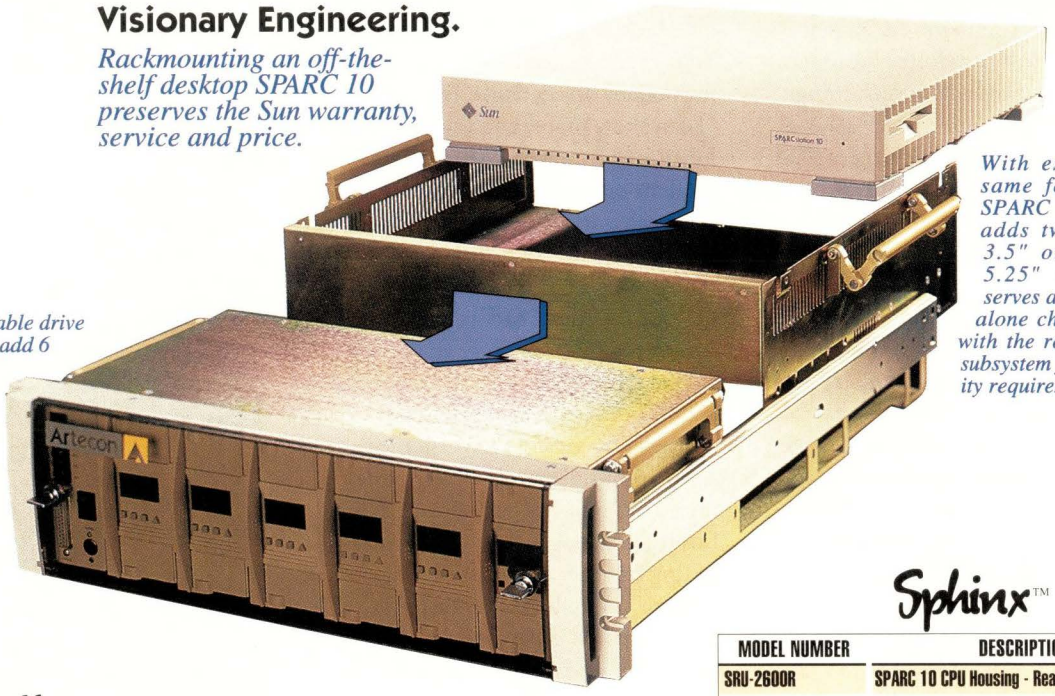

With essentially the same footprint as a SPARC 10, the Sphinx adds two additional 3.5" or half height 5.25" devices, and serves as either a stand alone chassis or mates with the removable drive subsystem for high capacity requirements.

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MODEL NUMBER	DESCRIPTION
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RDU3-DSK-S-2.1GB	2.1GB 3.5" 7200 RPM Removable Disk Module
RDU3-4mm-S-2.06GB	2-8GB Removable 4mm DAT Module
RDU3-4mm-S-4.0GB	4-16GB Removable 4mm DAT Module
RDU3-FLP-S-1.4MB	3.5" Removable Floppy Module

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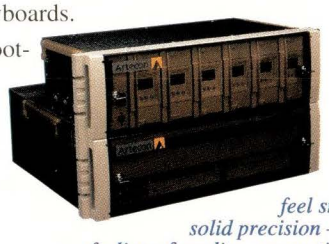

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small fossils," he explains. "And if you look around, you'll see that most animals are small." And certainly most early mammals, birds and dinosaurs were small.

He also needed very high-resolution pictures. That ruled out medical scanners, which have to use relatively low power so as not to harm the patient. That's not true for industrial scanners, which are used to look at such things as turbine blades and sealed machines. "The goal here is not to have a patient get up and walk away afterwards," explains Row. "So they [industrial scanners] can use much higher voltages."

At the suggestion of a colleague, geologist William Carlson, who was using industrial scanners to look inside minerals, Rowe turned to Scientific Measurement Systems of Austin. "We have the largest installed base of CAT scanners in the industry," says John Steude, director of scanner services at SMS. "And we also offer scanning as a service."

SMS' machines used to incorporate a Digital Equipment Corp. MicroVAX workstation as their embedded computer. Its new line of products, Smartscan, uses SPARC-based workstations instead. The top-of-the-line models feature a Sun SPARCstation 10. "It is 20 to 50 times faster than with a MicroVAX," says Steude.

Rowe then turned this combination of scanning and compute power to Thrinaxodon. "It was an animal about the size of a small dachshund," he says. "And it had about the same proportions. It had short legs and a long body."

Thrinaxodon may not have been particularly impressive to look at, but it is in the direct line of beings from which all mammals are descended. In fact, when Rowe scanned Thrinaxodon skulls and compared them to the skull of the modern opossum–"admittedly, a pretty primitive mammal"–he was startled to find they had many features in common. "I thought this would never work. There's 240 million years between them," he says. "But it did."

He has also been able to demonstrate that Thrinaxodon was relatively big-brained for its time and place. Paleontologists had thought that brain growth happened very late in the development of mammals. But, says Rowe, "we've been able to show the expansion of the brain right at the origin."

On the other hand, he's also been able to show there were fundamental differences between Thrinaxodon and its modern descendants. For example, "I can show that it had tiny olfactory lobes–it had a terrible sense of smell; modern mammals have huge lobes. Primates, with our funny flat faces, are the exception." Like a lizard, a dinosaur or a bird, Thrinaxodon relied on its eyes rather than its nose.

Moreover, modern mammals have several adaptations for warm-bloodedness. They have large brain stems, for example, to control their complex metabolisms. They also have "radiators," says Rowe. That is, mammalian breathing passages are complex mazes of tiny passages designed to heat and treat air before it gets to the lungs, where it could otherwise change the temperature of a warm-blooded animal.

By looking inside its skull, Rowe can show that Thrinaxodon had neither of those characteristics. It was probably not warm-blooded. "So, I can point to Thrinaxodon and say that it has taken a big step to being a mammal," says Rowe. "But it isn't there yet."

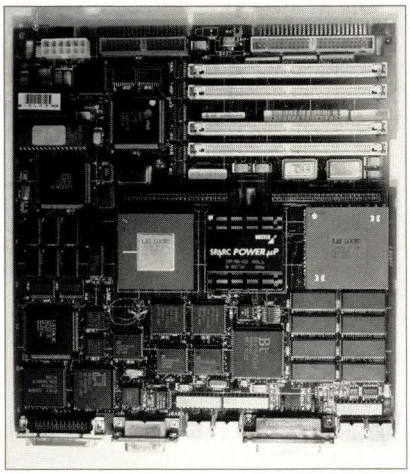
However, Rowe is most elated by the new technology's use in teaching. While it can be difficult for a student to get his or her hands on actual fossils, now they can get images of those fossils in easily accessible TIFF files. Rowe's CAT images of the Thrinaxodon are, in fact, being published by the University of Texas Press as a CD under the title *Thrinaxodon: Digital Atlas of the Skull.*

Now anyone with a CD-ROM drive attached to a PC or a Mac, including any of Rowe's students, can look inside the head of our most ancient relations. "If there's a 10-year-old out there who's obsessed with dinosaurs, and who has access to a Mac or PC with a CD-ROM drive," says Rowe, "now they can see fossils in excruciating detail."–*mjt*

Pinnacle Powers Up on Weitek

Chip maker Weitek Corp. recently introduced SPARC Power µP, a $1,500 CPU that can replace the native processor of a SPARCstation 2 or IPX and boost its performance. Now, a Weitek OEM, Pinnacle Data Systems Inc., Columbus, Ohio, has brought out a board, called TurboSPARC, to bring the same product to SPARCstation 1 and 1+ machines.

"You send us your 1 or 1+ board," says Neil Olson, Pinnacle's international director of sales and marketing, "and we'll send you back a board with the Weitek on it."

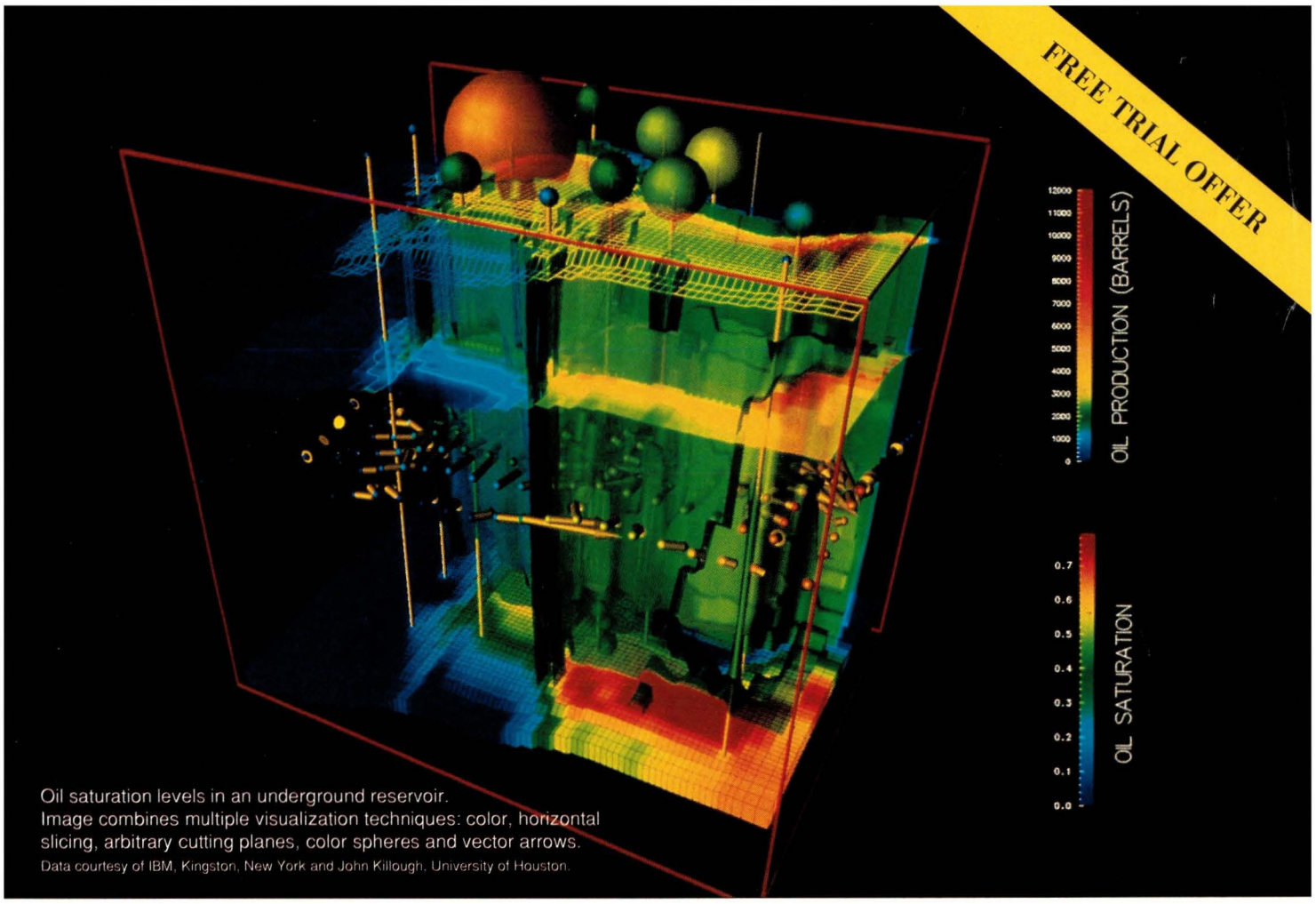


The TurboSPARC allows SPARCstation 1 and 1+ machines to use the Weitek Corp. Power µP CPU.

The customer simply removes the old workstation motherboard, extracts and keeps the memory, and then mails the board to Pinnacle. A new board is sent back with the Weitek already in place. That means the user doesn't have to take responsibility for changing out the processor–something that makes the service attractive even to owners of SPARCstation 2s, who could, if they wished, deal directly with Weitek. "Occasionally," says Olson, "those SPARCstation 2 users may have a little problem putting CPUs on their motherboards."

Pricing ranges from $1,995 for upgrading a SPARC 1 to $3,395 for upgrading an SLC. The product comes with a one-year warranty.

The product targets individuals who might want to upgrade to a complete



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SPARCstation 10 but can't afford one in a recession-plagued age. "If you look at the economy right now," says Olson, "and at the cost of buying a new system, you'll see that it makes good sense to do an upgrade."

Traditionally, the fortunes of computer upgrade vendors have exactly paralleled those of makers of car parts. In times of general prosperity, they don't do badly. In bad times, however, they do very well indeed. Explains Olson, "The customers are saying, 'For 2,000 bucks, I can get a complete doubling of everything. The bean counters will love it.' You might even be able to slip it in as an expense rather than a capital expenditure."

Mobius Does Have Two Sides

A Mobius strip is a construction that, in theory, has only one side. Mobius Computer Corp., however, has two sides. On the one hand, it makes and sells a SPARCalike, a Sun workstation-compatible based on the SPARC processor. On the other, it has an Intel Corp. 80X86-based line of machines that run Solaris X86.

The two sides raise an interesting question. Which of the two approaches, SPARC-based or Intel-based, will really deliver the inexpensive, low-end, Sun-compatible computing promised by the original SPARCalike concept?

Mobius has been selling SPARC-based systems for about two years. "They're sort of an anomaly for us," says Craig Stouffer, director of product marketing for Mobius. "Our primary business is in Intel-based systems."

But it is an anomaly that has served the company well. "SPARC is between 15% and 18% of our business," says Stouffer. This makes Mobius' SPARC-alikes among the most successful around. Relatively few of the SPARC-alikes introduced in the past three years have lasted more than a few months.

The SPARC side of Mobius' products include the recently introduced Mirage Series of workstations. These are the Mirage IPS/10 Model 30 (a SPARCstation 10 Model 30-compatible), the IPS/10 Model 40 (a SPARCstation 10/40-compatible), and the IPS/10 Model 41 (a SPARCstation 41 SPARCalike). All three have standard features such as 16 MB of memory, expandable to 512 MB; twisted-pair and 15-pin AUI Ethernet connectors; a SCSI-2 port; two serial ports; one parallel port; a 16-bit CD-quality audio port; an integrated ISDN port; four 32-bit SBus expansion slots; two 64-bit MBus expansion slots; a 17-inch monitor with 1,152-by-900 resolution and 256 colors; room for up to 4 GB of internal hard disk; a 3½-inch floppy drive, a Sun Type 5 keyboard and a three-button mouse.

When shipped with a disk, they come with OpenWindows 2.0, a choice of Solaris 1.1 or Solaris 2.2, X11.5 and Motif. Where the products differ is in such things as cache size–36 KB for the Models 20 and 40, 1 MB for the 41–and in relative ease of expandability. The 41, for example, can be upgraded to a two-CPU system for a total of 220 MIPS, though all the systems can support the Texas Instruments Inc. dual-CPU modules for a top performance of 500 MIPS.

In the monoprocessor configuration, though, the 30 yields 101 MIPS, 20.5 MFLOPS, 45.2 SPECint92, and 49.4 SPECfp92. Both Model 40 and 41, meanwhile, offer 109 MIPS, 22.4 MFLOPS, 53.2 SPECint92 and 63.4 SPECfp92. Pricing on the IPS/10 Model 30 is $8,985, while the Model 40 is $9,985 and the Model 41 is $10,985.

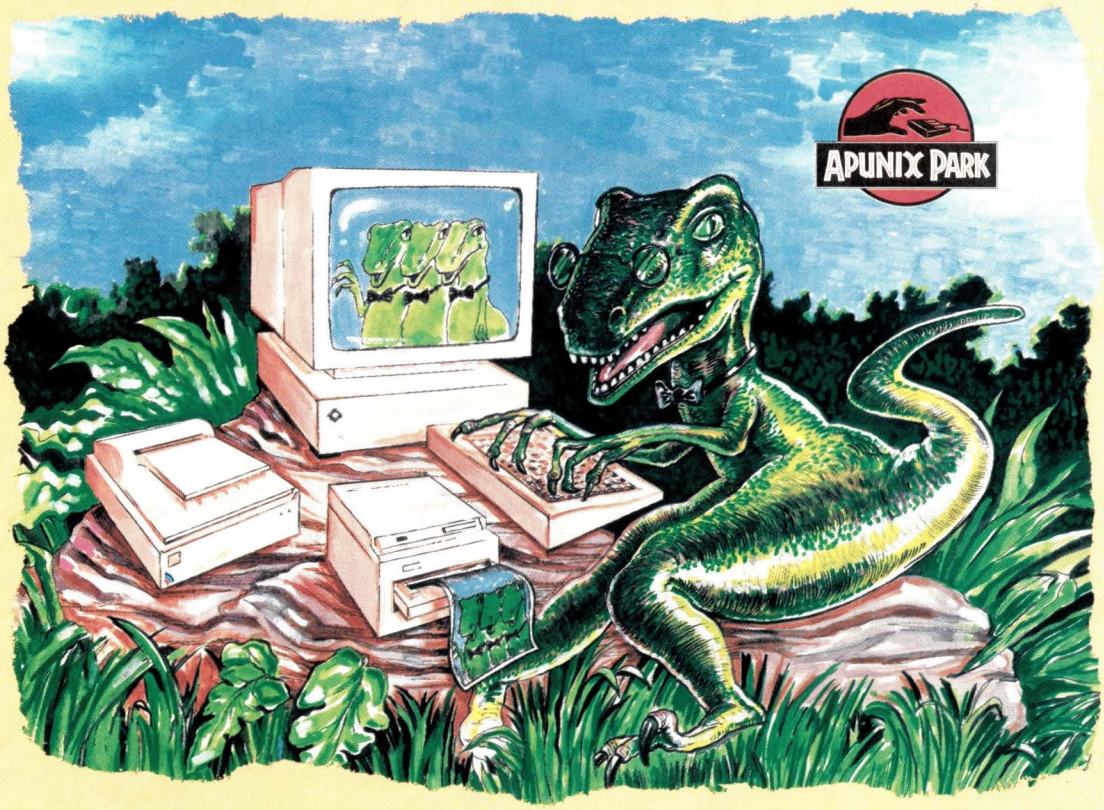
"Now, you'll notice that we don't have anything equivalent to a [SPARC]Classic or a Classic 2X," says Stouffer. That's where the Solaris Intel platforms come in. "In a sense, our version of the SPARCclassic is the Intel platform."

On September 20, Mobius announced new Intel Solaris machines–the Protege CX series. These are Intel 80X86 machines, running Solaris and equipped with the company's own CX+ graphics engines. The graphics engines allow the machines to provide X-based displays comparable to low-end workstations. With a Intel 486, the machines offer about 40 MIPS.

But the real significance of the products is in their CX+ graphics engine. A Protege with CX+ has a standard resolution of 1,280 by 1,024, with 256 colors (from a palette of 16.7 million). More important, it delivers 132,780 Xstones. The company says that a similarly configured SPARCstation LX from Sun itself will offer about 78,000 Xstones.

Spanning two processors, Mobius Computer Corp.'s Sun-compatible product line ranges from SPARCalikes like the Mirage (top) to Intel Corp.-based systems like the Protege (bottom). The company thinks of the Protege as its equivalent of the SPARCclassic.

CLONE YOUR OWN DINOSAUR!



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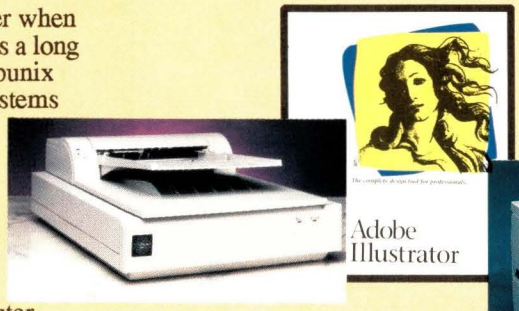
Even cloning a dinosaur is easier when you buy from a company that has a long history of accomplishments. Apunix was nominated by Sun Microsystems for a Smithsonian award based on the work being done with world renowned dinosaur expert **Jack Horner**, the lead consultant for **Jurassic Park**. Jack uses Apunix color scanners and printers in his pioneering work in computer visualization of dinosaur fossils.



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Need a scanner? Apunix offers the most extensive line of both document and color scanning solutions available for SPARC workstations. Our **document scanners** range from a low cost 12 page per minute to a 84 side per minute dual sided scanner. Our **color scanners** range from a low cost 300 DPI letter size to a 600 DPI B-size model all with over 24 bits of color depth in a single pass scan design.

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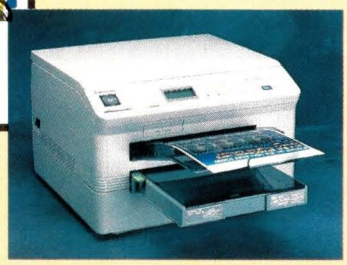

Adobe Illustrator is now available for Sun workstations from Apunix. Combined with Apunix's highly acclaimed OpenScan software, you can have a complete solution for almost all desktop publishing applications backed, for the first time, by the power and speed of a SPARC workstation.

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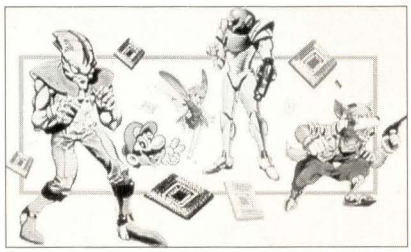
Moreover, the CX+ provides another resolution, 1,600 by 1,200, that is roughly twice the 1,152-by-900 resolution of most Suns. The company claims that in this TrueColor mode, the product can outperform a Sun GS 24-bit graphics accelerator by 200% when performing X Window operations. The CX+ TrueColor system operates at 71,200 Xstones.

Of course, display alone does not a workstation make. But it goes a long way. And, besides, the pricing is attractive. A Protege Series Model P466i with a 40-MIPS 80486, 16 MB of memory (expandable to 128 MB), a 3½-inch floppy disk, a 245-MB hard drive, Solaris preinstalled and standard 1,024-by-768 CX graphics with a 15-inch monitor is $3,448. The same system with CX+ graphics and a 17-inch flat-screen monitor is $4,123. There are options for EISA and VESA bus models, and for SCSI-2 hard drives.

Mission Assigned: Project Reality

Just when you're ready to throw in your control pad and game genie and pull the plug on Mario, Nintendo tempts us again! This time around, Nintendo, a world leader in video games currently capturing 80% of the home video game market, taps into Silicon Graphics Inc.'s visual computing knowledge. What they have in store for addicts is Project Reality–a truly 3D, 64-bit Nintendo machine for home use.



Project Reality from Nintendo is the company's first application of Reality Immersion Technology.

Project Reality is the first application of Reality Immersion Technology. Nintendo defines that as "a new generation of video entertainment that enables players to step inside real-time, 3D worlds."

The heart and soul of this system will be a version of the MIPS multimedia engine, a chip set consisting of a 64-bit MIPS RISC microprocessor, a graphics coprocessor chip and Application Specific Integrated Circuits (ASICs), making for realistic graphics, high-fidelity audio and record-setting speed. The MIPS RISC microprocessor today powers computers ranging from PCs to supercomputers, and this will be its debut in the video entertainment industry.

Nintendo and SGI, which have had an ongoing business relationship, have entered this project as a joint development and license agreement. Under the agreement, Nintendo will pay SGI royalties for use of the licensed 3D technology, and the product will be available from Nintendo exclusively.

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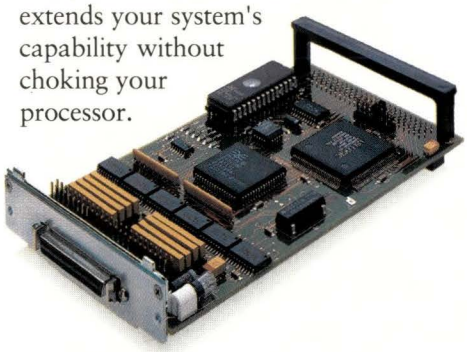

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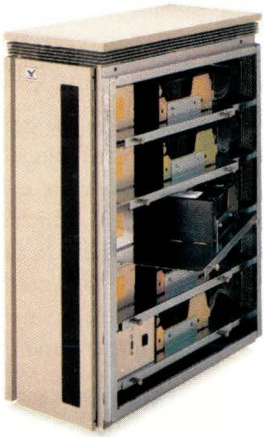

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SGI's Indy workstation provides the authoring system for current Nintendo developers wanting to create applications for the Project Reality Platform. Indy supports the Indigo Magic user environment, which incorporates SGI's original Media User Interface (MUI), a point-and-click interface that will enable developers to further enhance their home entertainment software.

The new technology, however, is not as easily explained on paper as the business agreement. Reality Immersion Technology uses the most up-to-date graphic and computing capabilities to allow video players to directly and intimately interact with virtual game environments.

One of Nintendo's policies is "to only introduce new hardware when it delivers dramatically improved value for their customers," according to Howard Lincoln, Nintendo's senior vice president. This new technology will first be seen in arcades in 1994 and will be available for home use by late 1995 for around $250.–*mm*

Island Graphics Sold

The Office Products division of Island Graphics Corp., a vendor of office productivity and prepress software, has been acquired by Computer Power Software Group Inc. (CPSG), Folsom, CA. CPSG has also hired what it says are "key" personnel of the Island Graphics division.

Island Graphics' products included IslandWrite, IslandDraw, IslandPaint, IslandPresents and IslandCalc. IslandWrite, Draw and Paint, meanwhile, were originally Sun products.

Under the terms of the agreement, CPSG has formed a new company, Island Software, of which Island Graphics Corp. will be a minority stockholder. Island Software will then take over the production, development, marketing and so on of the Island products.

AVS Acquires Uniras

Scientific visualization software vendor Advanced Visual Systems Inc. (AVS), Waltham, MA, has acquired Uniras Inc., a Danish supplier of visual data analysis software. Details of the deal were not made public. However, the company claims that the deal effectively doubles AVS' size.

The acquisition of Uniras was a product of the failure of its holding company, Hafnia Holdings, Copenhagen. AVS and Uniras are quick to say that Uniras was doing just fine, "with lots of happy companies," and did not itself become insolvent.

Hafnia, however, was another story entirely. It was a major financial services firm in Denmark, and indeed all of Europe. It ran into difficulties and, an AVS spokeswoman says, "when Hafnia crashed, it took out lots of companies with it." As part of its reorganization, Hafnia sold Uniras.

Meanwhile, AVS may have some competition for Uniras users. At least one competitor, Visual Numerics Inc. of Boulder, CO, has announced that

Uniras users can purchase its own PV-Wave and other products at up to 50% off list price.

Sun and TI Talk UltraSPARC

Sun Microsystems Computer Corp. has announced that it will work with silicon chip vendor Texas Instruments Inc. on UltraSPARC. This is the 64-bit version of the processor that is on the SPARC road map beyond SuperSPARC.

The agreement, or as SMCC puts it, the "extension of the partnership," comes hot on the heels of the announcement of the plan for the chip itself, and of the announcement of a partnership with Intergraph Inc., the workstation vendor whose Advanced Processor Division has kept the Clipper processor alive and kicking long after most pun-

Client/Server Development

An April Forrester Research Inc. report on client/server power tools predicts that the market will grow to represent 700,000 seats by 1996, compared with roughly 65,000 seats this year. That's a lot of seating room, and newcomers such as the following two companies are starting to make reservations.

Forté Software Inc.

What is Forté Software's recipe for success? Hefty financial backing, strategic partnerships with Apple Computer Inc., IBM, Digital Equipment Corp. and Sequent Computer Systems Inc., a management team comprising former employees of Ingres Corp., Oracle Corp., Sybase Inc. and Banyan Systems Inc., combined with a new object-oriented development environment.

Oakland, CA-based Forté announced its company charter this month, which includes a mid-1994 release of a product now in beta testing. The clincher to this client/server development environment, among the host of products all proclaiming client/server capabilities, is an application-partitioning function that allows developers to build an application without having to decide in advance on how many, or on what types of systems, the application logic will be divided and deployed. The company says the Forté system will automatically split up the application, giving appropriate portions to each of the clients and servers available.

"What other companies do is database application partitioning," explains Richard Scheffer, Forté's vice president of marketing. "That is a limited special case of application partitioning in which an application residing on a client talks to a database on a server," he says. "Our model is far more flexible," says Scheffer, adding that client applications can talk to a range of server applications, not just databases, such as electronic mail systems or electronic stock feeds. Forté's partitioning technology also includes performance and reliability functions that include partition failover, transactions on application components and run-time version checking. Forté will also support such technologies as 3GL code generation, RDBMS stored procedures, and the ability to move applications from one machine to another to reduce network traffic.

The Forté 4GL-based environment will support Windows, Macintosh and Motif GUIs, server systems including DEC's OpenVMS (VAX and Alpha) and Alpha/OSF/1, IBM's RS/6000 (AIX), Sequent/Dynix, Sun Microsystems Inc. (SunOS and Solaris) and Hewlett-Packard Co. systems running HP-UX. Database support includes Oracle, Sybase and Rdb, and network support includes TCP/IP, DECnet, SPX/IPX and AppleTalk. At press time, Forté could not disclose specifics about its relationship with IBM, but Scheffer says it involves joint engineering and marketing efforts.

Bridge Builder Technologies

Rather than starting from scratch, start-up Bridge Builder, based in Wellesley Hills, MA, has developed a full-fledged development environment based on the existing Contessa 4GL from Contexture Systems Corp. Bridge Builder announced its suite of products at UNIX Expo this past September after significant testing from large beta sites such as Boeing and Credit Lyonnais. Bridge Builder will ship in a developer and a run-time version, as well as in prepackaged bundles. Pricing varies, but as an example, a developer version, for $11,495, includes the 4GL, the DP Application Tool and the Client License Generator.

The "bridge" portion is key to Bridge Builder's new suite of tools, which extends the Contessa 4GL to a full-fledged object-oriented rapid application development environment that includes bridges not just to relational databases, but also to 3GL-based external legacy systems, to applications and to real-time data feeds. The tools are intended to help companies develop what company Vice President of Business Development Jim Daniell calls "mission-basic" applications–the types of applications that companies can't typically buy and are crucial to enterprisewide operations. Bridge Builder wants to combat the limitations of existing client/server tools that make it difficult and time-consuming for companies to build such applications because of lack of database and platform support, lack of support for building graphical applications and lack of connectivity to legacy systems, says Daniell. The Bridge Builder DB Application Tool supports Informix, Ingres, Interbase, Oracle, Progress, Rdb, Sybase and Unify databases. Bridge Builder Realtime Bridges support Capiti, Reuters, Teknekron, Telerate and MarketVision data feeds. Initial Bridge Builder Application Bridges support Interleaf, FrameMaker and XyVision.

The development tools will run on UNIX platforms, including the RS/6000, with future support planned for Windows NT, according to Ted Joseph, chairman and CEO.

–Jane Majkiewicz

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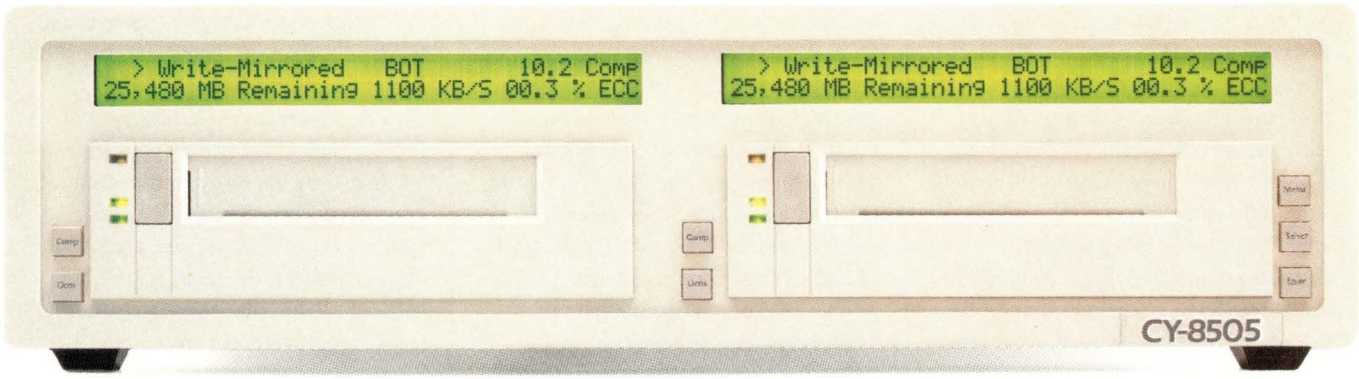

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dits had judged it dead and buried. Intergraph is, moreover, planning to put NT on the SPARC (see *SunExpert*, September, Page 6).

Sun spokespeople say that there is no connection between the Intergraph and TI accords. Intergraph will continue to work with Sun on the development of the UltraSPRAC, and TI will work on manufacturing it.

Thus, the two agreements may say much about Sun's own strategy for SPARC and its development. Originally, Sun had said that it would rely on silicon vendors to do future R&D for the processor. However, the silicon foundries proved to be more interested in mass-producing standard chips, or doing custom ASIC work, than they were in doing research.

Thus it is that the new plan seems to be to partner with organizations with both real interest in processor development–such as Intergraph's Advanced Processor Division–while signing up with one or two silicon vendors, like TI, who know manufacturing very well.

In addition, Sun's SPARC Technology Business (STB) group has announced an early-access program for the UltraSPARC. Sun says that STB will offer systems designers preproduction access to UltraSPARC core technologies, development tools and processor prototypes.

Meanwhile, rumors continue to circulate that Sun is itself planning on selling SPARC chips. Sun spokespeople will not comment on the subject but add that nothing has been ruled out.

A United UNIX?

This month, the proposed specification for a common set of UNIX interfaces will be submitted to X/Open. If approved, the spec will be quickly integrated into X/Open's Portability Guide (XPG). And software developers may have a quicker and easier way to port their applications to the many flavors of UNIX.

The specification was announced in September by 75 UNIX vendors, including IBM, Hewlett-Packard Co. and Sun Microsystems Computer Corp. It defines a common set of kernel-level and base application programming interfaces taken from existing standards (see "Common APIs for UNIX"). The spec comprises 1,170 APIs consisting of 926 system interfaces, 70 header files and 174 commands. About half the APIs and all 174 commands come from XPG4, while another third were taken from the System V Interface Definition. Others were gleaned from applications from such vendors as Autodesk, Cadre Technologies Inc., Informix Software Inc., Lotus Development Corp. and others.–*Anne Knowles*

This Just In...

• Sun Microsystems Inc. hardware service provider ***Apex Computer***, Redmond, WA, and ***ACT Computer Support***, a third-party maintainer based in Hemel Hempstead, England, have signed an agreement to jointly establish a Sun support facility in the United Kingdom.

• ***UniForum***, the UNIX user group, has elected two new board members. Hugh Brownstone, vice president, technical research and development at IMS America, and Steve Zalewski, director of UNIX marketing at Oracle, joined the board in September.

• In a case of strange bedfellows, ***IBM Corp.*** and ***SunSelect*** have announced an agreement under which IBM will license Wabi for use on the RISC System/6000 workstations. Wabi is the environment that allows UNIX systems to run Microsoft Corp. Windows applications. While it is hard to imagine Sun and IBM cooperating, they both have much to lose before a united Windows NT front.

• In a major victory for the ever-promising but never-quite-there SPARCalike market, the ***U.S. Department of Defense*** has signed a major purchase order for Axil workstations, the brand of SPARCalikes from ***Axil Workstations***, San Jose, CA, a subsidiary of Hyundai Electronics America. Under the terms of the agreement, the Radix II systems integration company will supply the DOD with several thousand Axil workstations as part of a workstation-oriented worldwide telecommunications project.

• Mergers and acquisitions seem to be on the rise in the high-tech world. ***Cadence Design Systems Inc.***, the electronic design automation (EDA) technology vendor based in San Jose, CA, has acquired the ***Comdisco Systems Inc.*** (CSI) subsidiary of Comdisco, Inc. The Foster City, CA-based CSI sells advanced tools for the production of Digital Signal Processing applications.

• Real-time operating system vendor ***Lynx Real Time Systems Inc.***, Los Gatos, CA, has lost its vice president of international sales and marketing. Moses S. P. Joseph, is going to another real-time software company, Wind River Systems Inc., Alameda, CA. Lynx markets real-time UNIX, while Wind River markets a much smaller real-time executive.

• The ***Display Industry Association***, the trade group founded to advance the AlphaWindows terminal standard,

Common APIs for UNIX

Functional category	Spec Total*	XPG4	SVID-3	AES**	Use-based
Memory	19	11	12	12	17
Curses	324	114	324	0	27
Clib	114	92	98	81	65
Math	64	43	52	43	24
Internationalization	62	60	12	11	9
Proc	61	32	43	37	36
File system	44	28	40	35	35
Standard I/O	41	40	41	41	33
Signals	25	12	16	12	16
Dev	20	12	18	13	6
Sockets	19	0	0	0	15
All other	113	22	60	15	16
Headers	70				
Commands and utilities	174				

*Totals for each functional category exceed total because APIs are used by more than one standard.
**Open Software Foundation's Application Environment Specification

Source: Hewlett-Packard Co.

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has named a board of directors. The new board members include Vincent P. Luciano of ADDS AT&T/NCR, Paul Vance of Structured Software Solutions Inc., John Ashall of Microvitec Inc., Steve Jones of JSB Computer Systems, and John Darke of Cumulus Technology Corp.

AlphaWindows is the standard developed to provide windowing and limited graphics to ASCII character terminals. The DIA was founded in 1991 under the direction of the Dataquest Inc. market research group.

• An on-line bulletin board that acts as a matchmaker between buyers and sellers of used Sun hardware has been announced. Called d.BOARD, the service is offered by *Davie Data Services* of Atlanta. Subscribers can log on to the board and gain access to listings of available equipment. Subscription fees range from $50 per month for unlimited access to $20 for five logons.

• Service, support and peripheral vendor *Apex Computer* of Redmond, WA, is branching out into RISC System/6000 and Silicon Graphics Inc. support. Apex has traditionally been in the Sun and Digital Equipment Corp. markets. It now adds IBM Corp. and SGI.

• *IBM Corp.* has announced its plans for the Application System/400. Big Blue says that "within the next few years," the AS/400 will gain a 64-bit RISC processor based on the PowerPC architecture, object-oriented programming facilities, and assorted database and systems management enhancements.

• *Sun Microsystems Inc.* is going green, or at least greener. The company has recently announced that two of its planets, Sun Microsystems Computer Corp. and SunPics, are shipping energy-efficient products that meet the Environmental Protection Agency's guidelines for energy savings. The products include the SPARCclassic and the NeWSprinter CL+ jet printer.

• In patent news, *Multi Access Data Devices* (MADD), Placentia, CA, has been awarded a patent on its disk mounting design. In the MADD design, rotating memory disks are mounted on a shock-absorbing polymer, which dissipates shock and vibration.

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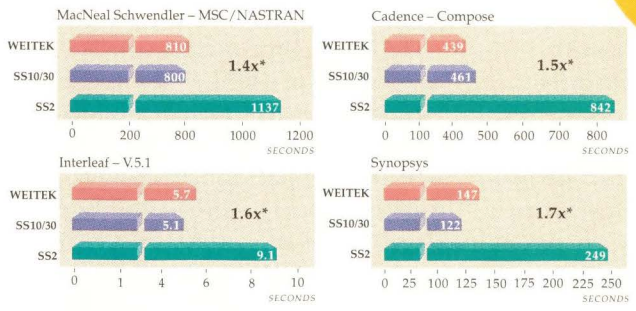

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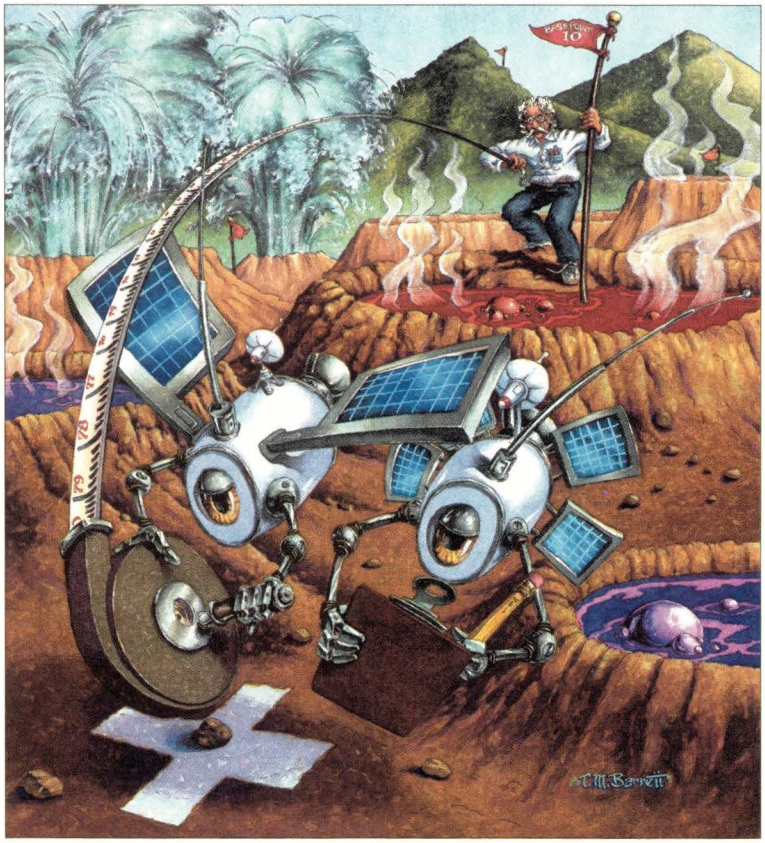

TOM BARRETT

Putting Them in Their Place

by MICHAEL O'BRIEN

"Today, my jurisdiction ends here."
–Silverado

"There isn't any there there."
–Gertrude Stein, on Oakland

"You can put the base station here in this furnace."
– A practical suggestion from the Yellowstone Research Geologist

Q: Oh no. We're back in that place, aren't we?

A: You bet. We're sitting in front of Grand Geyser, in Yellowstone National Park, at the end of an interesting couple of weeks. Turban Geyser started erupting just a few minutes ago, but although the level of the water in Grand's pool hasn't fallen appreciably, Grand hasn't erupted yet, which probably means it will be another cycle of Turban, about 16 minutes, before the next chance for Grand to erupt. Grand Geyser, you see, almost never erupts except at the start of an eruption by Turban. Had Grand's water level fallen, it would have meant a minimum of two or three more cycles of Turban before Grand would be likely to erupt. Got that?

Last year at about this time, as you may recall, we were shooting a video documentary here. This year, we were a bit more adventurous. This year, we decided to try to find out exactly where some of these features are. You might consider this an extension of the Mexican venture of a few months back. But this time there's a twist. We don't get to pick the sites we're surveying. In fact, getting to some of the survey points amounts to a minor adventure.

The Global Positioning System is a constellation of satellites that may be used to locate one's position precisely anywhere on the surface of the Earth. The degree of precision depends on who you are and how you use GPS. A single GPS receiver, which is a combination radio receiver and special-purpose computer system, can locate

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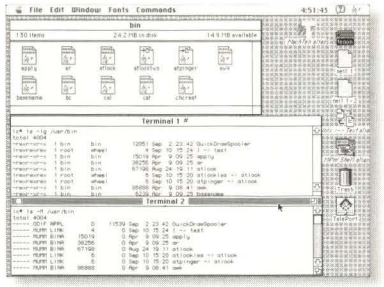

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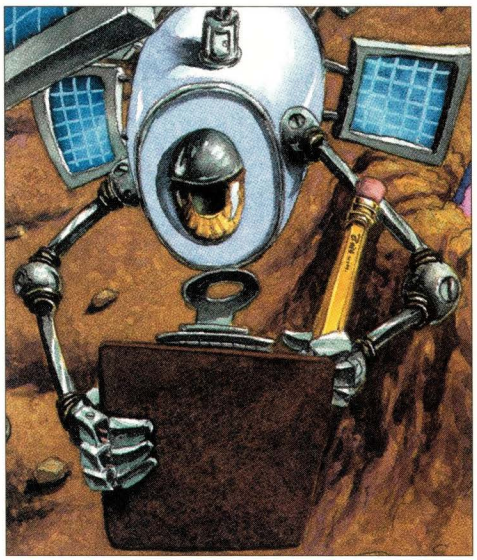
itself anywhere on Earth to within about 17 meters, and usually to within 10 meters. However, because 10-meter targeting ability is highly desirable in a tactical missile system, the U.S. Department of Defense decided that donating the ability to reduce the cost of guidance computers to around $700 was probably being a bit generous. Therefore, the signals sent by the GPS constellation are encrypted in such a way that a single GPS receiver may be off by as much as 300 meters, unless the receiver has access to the correct cryptological keys, which of course eliminates just about everyone outside the DOD.



All is not lost, however. Those who remember Mr. Protocol's Mexican outing may remember the existence of a clever end-run around the problem of "Selective Availability," which is the DOD's characteristically bland euphemism for the way in which GPS lies about position.

In fact, SA is only one factor (albeit the largest one) that contributes to GPS position errors. The nice thing about differential GPS is that it eliminates almost all of these, and with sufficiently sensitive receivers and sufficiently clever post-processing, positions may be determined to within centimeters, or even millimeters.

The basic idea behind differential GPS is that the DOD tells the same lies to everyone at the same time, and so does Mother Nature. Two receivers located near each other will therefore be told nearly identical lies. By comparing the information obtained by both receivers, it is possible to locate one *relative to the other* to very high precision and accuracy. This procedure of comparison amounts to taking the difference between the received signals, hence the term "differential" GPS.

Of course, this does not solve the problem of locating either receiver absolutely. If one of the receivers is located at a known point, however, the other receiver may be located to very high accuracy.

What does this have to do with Grand Geyser? Mr. Protocol is glad you asked.

It is a sad fact of life that, among geologists, geysers receive far less attention than, say, volcanoes. Vulcanology is a glamorous profession because the objects of its study have an unfortunate tendency to eat entire towns. Governments are willing to spend large amounts of money studying phenomena that eat towns. In a good year, a geyser may eat a buffalo. This does not generate dollars. (N.B.: It does generate a big stink–trust me on this–but not the kind that gets attention in Washington.)

The result is that there have been few people willing, and in a position, to study the thermal features of Yellowstone. In fact, there has generally been only one man at a time: the Yellowstone Park Research Geologist. At the present time, this position is held by Rick Hutchinson, a man who believes he has the best job in the world. There are other geyser-gazers who agree with him in this assessment. Consider that Mr. Hutchinson is uniquely responsible for all the thermal features in Yellowstone Park: their mapping, their study and their upkeep. Upkeep consists of the unglamorous business of pulling trash out of thermal features, trash that generally has been thrown in by park visitors. Study consists not only of conducting his own studies, but of approving and coordinating the study programs of researchers from outside

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the park. Mapping is perhaps the trickiest business of all.

Historically, thermal features in the park have been located and studied by a variety of people with a variety of credentials. The U.S. Geological Survey maps the park, of course, as they map the remainder of the country, but their surveys are both infrequent and incomplete. Although they do make some attempt to map thermal features on the USGS maps, they are not experts in regard to geysers, and they miss more than a few and misplace others. A more severe problem is that Yellowstone is one of the few places on Earth where geology is on the move on a human time scale. Features mapped and described to a fare-thee-well 10 years ago may be nonexistent today, or completely changed.

Geographic Information Systems are in their infancy, but they show great promise as powerful new kinds of information systems.

Add to this the fact that most current close observation of the thermal areas is carried out by an all-volunteer force of geyser-gazers, under the Research Geologist's loose supervision. These people know as much as anyone about geysers, and in some cases considerably more, but they are not trained experts in mapping, for the most part, and their sketches vary in accuracy. Their criteria vary as well, so that what one considers a geyser, another may only consider a spring. This lack of uniformity can be distressing when attempts are made to correlate data. Finally, location of back-country features, or even those features that are among a large number of similar features in a geyser basin, are all too often documented in terms such as "three ridges over and two stumps to the left." Even features that are better-documented today may have been documented in this way in, say, 1936, so that attempts to identify earlier features with newly activated features, to decide if they are reactivations of old features, often degenerate into simple arguments over the dinner table.

Enter GPS.

At Mr. Protocol's instigation, Dr. Art Lange, of Trimble Navigation, agreed to provide GPS equipment for a demonstration project to map thermal features in Yellowstone. The way was made easier by the fact that Yellowstone is no stranger to GPS, although the prior use of GPS was for different purposes entirely. A university consortium called UNAVCO has been doing GPS surveying in Yellowstone for some years, studying the deformation of that particular part of the planet caused by the large magma chamber that lies under Yellowstone (and which is going to once again blow the whole place to tiny bits one of these millennia, see if it doesn't).

The UNAVCO study has provided the one essential piece needed for a differential GPS operation: a known basepoint. Starting from this point, it was possible for Mr. Protocol and Dr. Lange to get into all sorts of trouble and to expose their own personal bodies to dangers that they really had to work to get into. At least, they would have, if Mr. Protocol had a personal body. As it was, it was left to Dr. Lange and Mr. O'Brien to handle that part of it, and personally I think Mr. Protocol gets off too easy as it is.

The regime was established early. A differential base station was established at the Old Faithful Visitor Center, with an antenna high on the roof. This station recorded signals from all visible satellites continuously and saved the data in hourly files on a laptop computer. It was started each morning and the files collected each evening. Several trips were then made to a pleasant meadow by a stream, where the folks at UNAVCO had placed a base marker whose position is known down to the centimeter. A portable

GPS station was set up at this site and data collected. The Trimble Pathfinder Professional uses a commercial data recorder with a megabyte of memory in it for such applications. The data recorder doubles as a controller and display for the receiver. Space considerations make it necessary for the keyboard on this strange little 8088-based box to be in alphabetic rather than keyboard order, making typing an interesting proposition, especially when one is balanced on the edge of some thermal feature that might decide at any moment to do something interesting.

The UNAVCO basepoint on Nez Perce Creek allowed the determination of an equally exact position for the basepoint at the Old Faithful Visitor Center, using carrier-phase processing. In this type of processing, the data files from the base station and the Nez Perce rover store not only the normal navigational information from the GPS satellite constellation, but also information that allows the post-processing software to determine the number of radio wavelengths from each station to each satellite...and since GPS uses radio wavelengths around 20 centimeters, this allows very precise location indeed.

At that point it was time to go out into the field. With Mr. Hutchinson as guide, guardian and living passport, the party went out into the Kaleidoscope Group of geysers, which is ordinarily off-limits. This group has been heating up and changing spectacularly in the past couple of years, as the party had reason to discover. The most visible geyser there, variously called Deep Blue Satellite Vent or, simply, the Firehose, jets water 70 feet into the air, at an angle, for weeks on end. Standing more or less directly on top of this feature, with a five-inch column of superheated water roaring out of the ground at an angle away from one's feet, while one waits for the GPS receiver in one's backpack to collect several minutes' worth of position data, is an interesting proposition, you may be safely informed. The gaping holes in the rock surrounding this feature, which may allow one to break through into boiling water, also necessitate care.

Deep Blue itself, also in this group, is a beautiful (blue) pool about 40 feet across. About once an hour, this pool will suddenly erupt to about 20 feet, with attendant consequences for those who may be standing around the rim. On the other hand, standing on the rim, one may see the initial boiling episodes producing steam bubbles the size of Volkswagens on their way to the surface. Dr. Lange circumnavigated this pool with a receiver, collecting a set of position points that allow its shape and location to be known precisely.

Another expedition, undertaken only after a sizable herd of buffalo convinced us that our primary surveying target was perhaps ill-chosen for that day, took us into some country about which Mr. Protocol feels ambivalent. Having chosen the wrong direction in which to go around the mountain (i.e., Mr. Protocol's way instead of the correct way), the party found itself on a 45° talus slope that most of us sincerely wish never to see again. Instead of the Geyser Creek area, the group found itself in an equally fascinating acid sulfate area that sported a perpetually erupting spring of a blood-red color more brilliant than any Mr. Protocol, at least, has ever seen before. Not to mention that perpetual spouters don't belong in acid sulfate areas. All was surveyed and logged, however, so this area is, at least potentially, now better documented than Geyser Creek.

Why potentially? Because the work is only half done. The differentially corrected points for all of the features that have been surveyed in this effort must now be used to produce the actual survey results. The modern way to do this is to use a Geographic Information System, of which there are now several competing commercial products. These allow the survey results to be combined with existing information to provide maps of the surveyed areas. Potentially, at least, these may be interactive maps, which may be queried for information.

Geographic Information Systems are in their infancy, but they show great promise as powerful new kinds of information systems. This is where

Mr. Protocol may perhaps feel more at home, for these systems typically run on Sun workstations. This is not an industry where portable Sun workstations hold much sway. The GIS systems typically live "back at the office," and the field work is handled by PC clones, because if you are looking for a generic portable computer, the immediate answer is that it will be a PC-compatible machine. Hence, all of the field software is written for the PC. The large GIS systems, however, need the power that a Sun can deliver. It will be an interesting marketplace when it really begins to produce software for PCs that are as powerful as Suns. Mr. Protocol notes that this is probably not an original observation.

Several different sorts of toys were actually used in the survey, which incidentally provided moderately complete inventories of the Kaleidoscope and River Groups, a less complete survey of the hideously complicated and dangerous Sprinkler Group, and a complete survey of the wrong group, where Geyser Creek was the destination and a much more difficult area was the actual target.

In addition to the very powerful Pathfinder Professional, the workhorse receiver was the Pathfinder Basic Plus, which just happens to resemble one of the receivers used by the armed forces. This receiver is capable of doing all the day-to-day single-receiver work required in the field but also may be used to store data files for later differential correction.

One interesting toy, which more or less came along for the ride, was the Scout, which is aimed at the consumer market, and which may be used not only to do the usual waypoint navigation, but also can inform you of your exact coordinates in your friendly local city map book. If you aren't in the city, it will tell you exactly where in the sky the sun and moon are, so you can use them to determine the direction in which you really wish to go.

Actually, this is less useful than one might believe. When Mr. Protocol was in the field, there were generally only two directions in which it was possible to go: forward and back. Knowing the direction of one's origins from where one currently was, did little or no good. The most pertinent question was, "Did I come in from this side of the ridge, or that side?" (Actually the really pertinent questions were, "Did I really want to do this?" and "Am I going to survive?" but GPS has little to offer in these cases.) What is needed is a pocket navigational machine that tells you just where you came from, and allows you to retrace your steps. Unfortunately, the errors produced by Selective Availability make this just about impossible at present. Given that, Mr. Protocol can only say that the user interface on some of these machines can range from puzzling to bewildering, and he urges the boys in Sunnyvale to take another look.

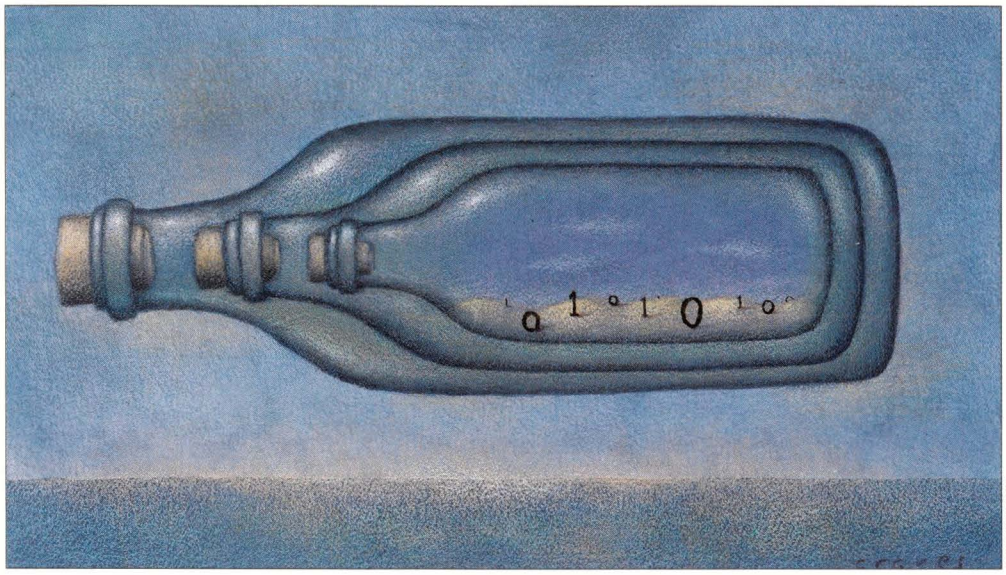
The end result is that there is new grist for Sun workstations to produce truly accurate maps of thermal features that are now "nailed to the geoid," as it were. Mr. Protocol only wishes it were possible to transmit the data files out of the field via the Internet, in case the survey parties don't come back. Sometimes he's a single-minded twit.

Mr. Protocol would like to thank Rick Hutchinson, Dr. Art Lange, Tom Lange, David Bank, Rocco Papierello and Rhonda Gailey for their valiant and invaluable assistance. Mr. Protocol would also like to thank Valerie Polichar for all of the above, and also for his survival.

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.



KEITH GRAVES

Network Protocols

by **PETER COLLINSON**, Hillside Systems

Last month I began to look at how the set of protocols that are supplied with your machine fit together to provide network services to your system. I started from the bottom, examining how Ethernet works and then moved on to discuss the Internet Protocol (IP).

Much of that article was concerned with addressing, because that's mostly what IP does. It provides a transport-independent way of getting datagrams from one machine to another. We use the word "packet" to refer to the messages too.

Datagrams are unreliable messages that contain a header and some data. The header holds the source and destination IP addresses, among other things. The IP address of a machine is a 32-bit number usually written as a dotted quad. The address of my machine is 192.88.50.1. The data part of the message carries packets from other protocols. There is a kind of Russian doll effect, with protocol messages inside protocol messages inside protocol messages.

The Ethernet packet is the largest Russian doll. IP rides inside the Ethernet packets along the wire to the destination machine. IP can use many different types of carrier, but I am mostly talking about Ethernet because that is the LAN that the code was designed to drive originally.

Before I get onto the higher protocol levels, I need to finish the IP story. I am going to look at three protocols that help IP to function.

ARP, RARP and ICMP

The first of these protocols tackles a necessary transformation, turning an IP address into an Ethernet address on the network. We often call the Ethernet address "the hardware address" because in most cases, it's burnt into the chips at manufacturing time. The IP address is more variable: You obtain one and assign it to your system by loading the kernel at bootstrap time.

Packets will originate in the user applications and will come tumbling down through the layers in the kernel and reach the Ethernet driver. The driver will be instructed to send the packet to another machine. But the packet does not contain the remote Ethernet address; all it holds is the destination IP address. Something has to translate the IP address

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into the 48-bit address of a station on the Ethernet. For Ethernet, this something is called the Address Resolution Protocol, or ARP.

Its job is to keep a translation cache of IP addresses and their corresponding Ethernet addresses. It gets the packet that you have sent and looks up the IP address in the table. If it finds the address, it loads the Ethernet packet with the value and sends it on its way. If ARP cannot find an appropriate address in the table, it sets out to find it.

It broadcasts an ARP request to the network, saying, "Hey, you dudes out there, anyone got this IP address?" The appropriate machine will respond with an ARP response, saying, "Yo. It's me." Your host now loads the cache, sets the machine address into the Ethernet packet and sends it off to the right machine.

If your machine gets no response to the ARP request, it will retry it. The packet may have been lost; it's an unreliable datagram service.

Before a host replies to the ARP request, it will load its cache from the Ethernet and IP addresses of the originating system, both included in the ARP address. This removes the need for an ARP request in the opposite direction–and also means that you can change the IP address/Ethernet pair fairly easily. A host will load its table even if it does not reply. The effect of an ARP request is to advertise *your* machine's IP/Ethernet address pair to everyone on the local network. So a machine can come up, ask for an address and be instantly accessible by everyone else for the cost of one packet.

Some operating systems time-out the entries in their ARP cache. Systems derived from BSD, like SunOS, will time-out their ARP cache every 20 minutes. Entries that have not been completed, where an IP address has been broadcast but no machine has replied, are timed out after three minutes. The idea here is to recover resources and remove dead entries from the tables.

Systems believe what they are told in an ARP response. This provides some interesting opportunities for one system to pretend to be another and get around security. Another possibility for problems is two systems coming up on the same network with the same IP addresses. ARP implementations tend to complain bitterly about such happenings.

ARP has a partner, Reverse ARP or RARP, whose function is to provide IP addresses to systems that are coming up. A diskless workstation will not know its IP address and will come up in a bewildered manner, asking, "Who am I? What is my address?" using a RARP request. Some system on the network needs to be running `rarpd`; this will reply with a soothing response, sending the IP address that the host should use. It will derive the mapping from the `/etc/hosts` and `/etc/ethers` files on its disks.

The final protocol that co-works with IP is Internet Control and Management Protocol or ICMP. It's really an integral part of IP and uses the IP packet to carry messages. A system will send an ICMP message to another when it has detected some error in the IP packet that it has just received. For example, a system that has been sent a packet to be forwarded to a host that it cannot reach will send an ICMP

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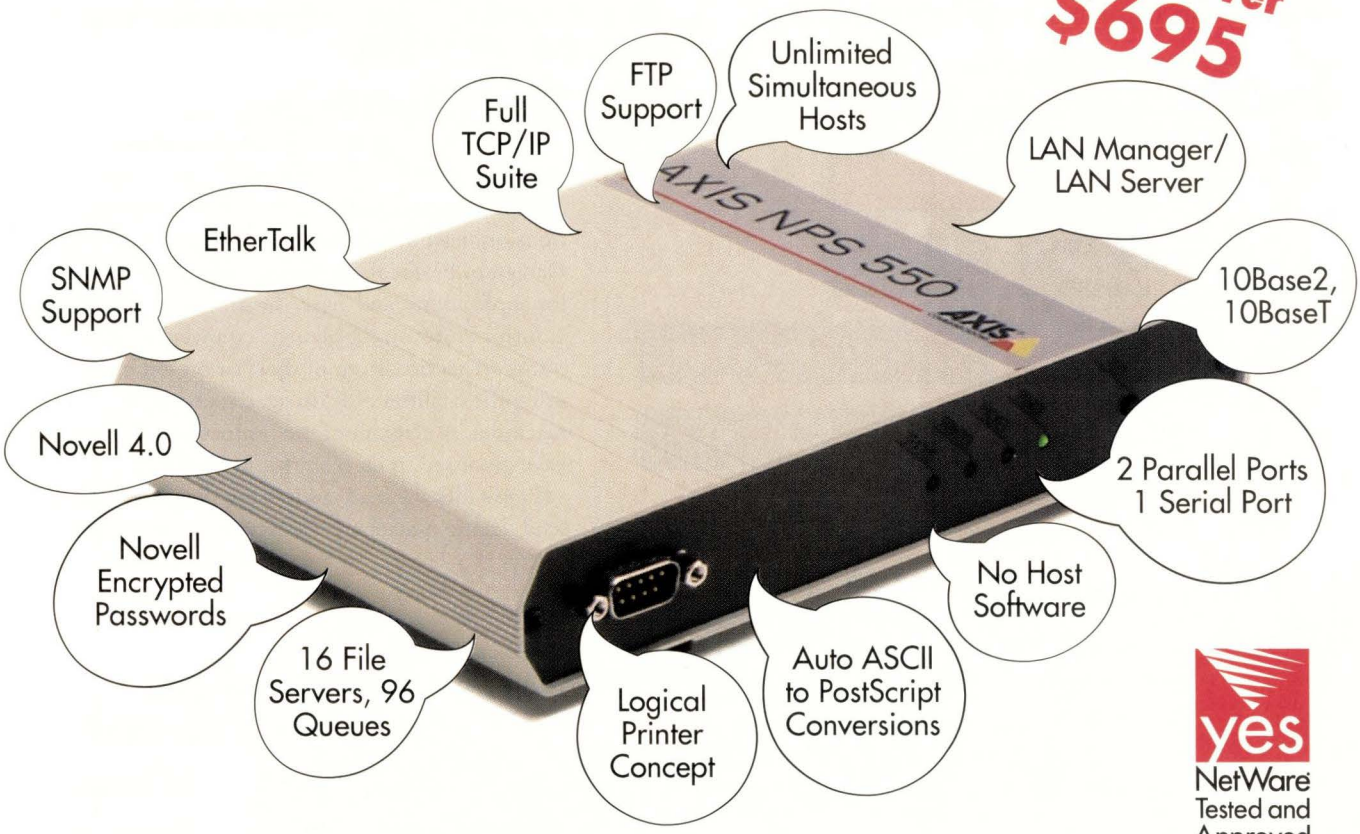

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message back to the originator bearing the sad news. The IP code in the originating system can react to this and change its routing tables. Inbound ICMP messages are processed in the kernel code and affect the operation of the IP layer.

There are few user-visible tools for examining how well your machine is performing at the IP level. You can get the statistics on ICMP messages by saying

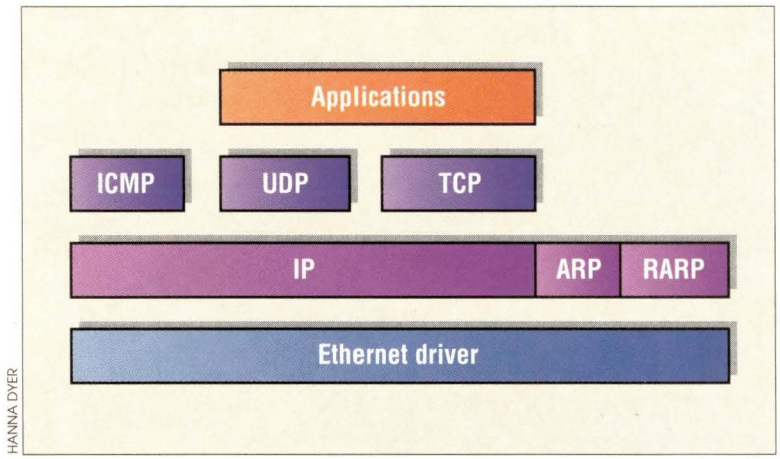
```
% netstat -s
```

and looking for the ICMP output. The output from the Solaris version of this program is less "human readable" but is probably more amenable to automatic processing by a shell script than the more user-friendly output from SunOS.

ICMP messages fall into three general classes. The first includes various errors that may occur somewhere in the network and will be reported back to the originator of the packet that provoked the error. The second set of messages are sent from routers to hosts. For example, a router can send a host a "source quench," asking for the host to slow down when sending packets.

The third class includes network management, testing and measurement. The `ping` program sends an ICMP "echo" message and waits for an ICMP reply. Although ICMP is usually contained inside the kernel IP code, this is one case where a user-level program gets access to the kernel routines to support a user-level function.

Figure 1. The TCP/IP Protocol Stack



HANNA DYER

Transport-Level Protocols

We now move up in the protocol stack and consider the two main protocols that are used by applications to communicate with other applications on machines. These are UDP, the Universal Datagram Protocol, providing a datagram service for applications; and TCP, the Transmission Control Protocol, supplying a connection-based transport service. Both of these sit on top of IP, using the facilities of IP to get data between machines. A diagram of the protocol stack that I have discussed so far is shown in Figure 1.

IP provides the basic addressing that is needed to send data to a machine. However, just being able

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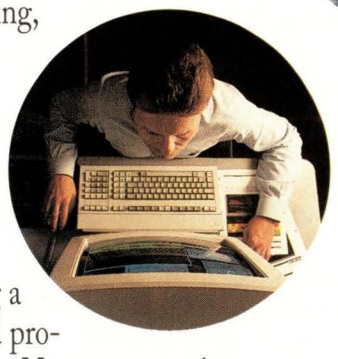

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to address the system is not enough. We need to be able to route data to a particular application on the system. This is done using a 16-bit port number in addition to the IP address. The port on a machine is owned by a specific process, and the number will be unique on that system.

UDP is a simple, unreliable datagram service. It does little more than add a small header along with some data into the data part of the IP packet. The header contains a source and destination port number, as well as a length and optional checksum. It uses the IP header to provide machine addressing. IP will also deal with fragmenting the message into small parts should your network be unable to carry the whole UDP packet.

DP is a very lightweight protocol, and this has attracted developers who were worried about the overhead involved in TCP.

Many UDP applications use the now familiar client/server model. A server will sit on a machine waiting for a client to send a request. When the request appears, the server will reply. The client will need to know the IP address of the server's machine and also a port number that is used to route requests to the server. The port number on the server will be "well known"–all potential clients will send a request using that number.

The request UDP message will contain the client's IP address and a port number so the server can reply. The port number here does not need to be well known; it can be assigned to the client for the duration of the transaction with the server.

If the server takes some time to create the answer, then it might want to start a new process to do the work and go back to listening on the well-known port for more requests. This new process will do the work and will create the reply in a UDP message that will be sent to the IP address, port number pair of the client. The message will be sent from a new serially assigned port and not the well-known port of the server.

A number of ports are predefined for the use of the current application set. You can find these in `/etc/services` on your machine. The file contains both UDP and TCP well-known numbers. If you want to set up your own application, then you must use a port number that is not in this reserved set of 0-255.

UDP is a very lightweight protocol, and this has attracted developers who were worried about the overhead involved in TCP. Sun's NFS uses UDP for this reason. However, the unreliability of the datagram is then a problem. NFS is implemented on top of a remote procedure call interface, RPC. Transactions are generally a request to the server followed by a reply to the client carried as UDP messages. Either of these can be lost because of network problems or for other random reasons. The NFS code has to cope with this and runs its own retries and timeouts to ensure data integrity. This smacks of reinventing the wheel; TCP does this kind of thing. Recent releases of Net2 and 4.4BSD contain an implementation of NFS that successfully uses TCP as the transport medium for NFS.

TCP

There are many applications that require the transfer of data that is reliable–what you sent is what you get; acknowledged–you are told that what you sent *has* been got; sequenced–what you sent arrived at the other end in the same order; and flow-controlled–how much is sent is controllable by the receiver. Copying a file from one machine to another is an example of this.

Protocols that do this generally create a connection between two machines, often exchanging some initialization information, and then maintain a reliable connection. They will use some form of error recovery so that the integrity of the data is assured. Communication usually ends with the exchange of close messages. The connections are bidirectional and symmetric; data can flow in both directions (think of `telnet`, where one direction is the data that you type and the other is the output from the remote machine). Also, either end of the connection can initiate disconnection.

TCP provides a connection-based link between two machines. As usual, the protocol consists of a header and a data part sitting inside an IP packet. The header contains our old friends, the source and destination port. It contains a 32-bit sequence number that counts the octets within the entire data transmission sequence. An "octet" is com-speak for an 8-bit byte. At the start of a connection, each end exchanges its initial sequence number and starts transferring data. They may also exchange a maximum send size–this is the amount of data that a receiver has space to store before passing it on to higher levels. A transmitter will send segments of this size to a receiver.

Other protocol suites use a sequence number that numbers the packets that they have received. TCP is designed to use IP and knows that the datagrams can arrive in any order, so TCP counts the octets within the data stream to allow the receiver to keep "holes" in the data that are filled in by packets arriving out of sequence.

The header can also contain a 32-bit acknowledgment number. This informs the sender that all octets up to but not including that value have been received safely. If the IP packets for the receiver do arrive out of order, then it can be waiting for one crucial packet that completes a sequence before it can send the acknowledgment.

The presence of an acknowledgment number in a packet is signaled by a bit in the flags word in the header. Other bits are: "push," forcing data out of any buffers and up to the destination application; "reset," used to initiate a close

sequence when all else fails; "sync," used at the beginning of a connection to set sequence numbers at both ends; "finish," sent to terminate a connection; and "urgent," used to signal the presence of some urgent "out-of-band" data in the segment. The stream is only closed when both ends have exchanged finish messages.

Error Recovery and Flow Control

What happens if a packet gets lost? The mechanism is simple. A segment is resent if an acknowledgment has not been received for it within a certain time. The clock that controls the timeout is reset to a longer value than before so that if the delay was caused by congestion then the system will not be adding to the problems.

An important part of making TCP work smoothly is the choice for this timer value. If the period is too long, data flow will stop for some unnecessary period before a segment is resent. If the period is too short, then segments will be retransmitted needlessly. TCP implementations have surmounted this problem by estimating the round-trip time for the connection by measuring how long it takes for the receiver to acknowledge a particular segment.

Another aspect of the communication is flow control. If the receiver is forced to acknowledge every segment that it gets, then data throughput can be low because each segment is held up waiting for an individual response. To improve this, TCP uses sliding windows. This allows multiple segments to be transmitted without waiting for a received acknowledgment.

The receiver will want to control the amount of data that is sent so that it can safely deliver it to the upper levels. TCP must be reliable. Unlike IP, where you can throw packets away if you have no space to put them, TCP must preserve its buffer contents and so needs a way to stop the sender from transmitting anything else.

The maximum send size defines the largest segment that a receiver is prepared to deal with. In addition to this, the receiver transmits a window size back to the sender. The sender will continue to send data until this window is full even though the data has not been acknowledged. When the window is full, the sender will stop sending until it sees acknowledgments making enough space in the window to send another segment. The receiver can stop the sender completely by sending a window size of zero. This is used in `telnet`, when a user types Control-S to stop output.

If output is stopped like this and the receiver goes down, the sender will sit there forever waiting for something to restart the connection. Similarly, if the sender goes down, the receiver cannot differentiate this from refusal to send more data. The TCP protocol has no mechanism to cope with this.

Berkeley added the idea that each end should send something to the other if nothing has been received for some period. The "keep-alive" packet is intended to provoke some response: either an acknowledgment or a reset. If a reset is received, the connection is taken down. Otherwise everyone is happy to wait a little longer.

TCP provides a connection-based service between two ports on two machines. The connection means that each end has to maintain some considerable state; it must store sequence numbers, window sizes, timer values.

If you take a look at `/etc/services` on your machine, you will find that most of the mainstream services use TCP to transfer data. This is because most of these applications deal with transferring data between machines and want the reliability that TCP gives them.

Exceptions to this are "question and answer" applications that are inherently one-shot or applications where the TCP code would have to be reimplemented in a different environment. The `tftp` protocol is an example of this. It's used for primary bootstrap of machines, and no one wants the code overhead of TCP in some standalone bootstrap code.

inetd

The ports for TCP are dealt with in exactly the same way as UDP. The `/etc/services` file lives on all machines and contains a list of well-known ports that are used to make an initial connection to a remote server. In early systems, each service would have a daemon running on the machine, each listening for the port number of its service. It would get a connection and create a new process replying on a different port, as I described above.

Bill Joy had the smart idea that you could write a program that listened for these well-known services. When it receives a packet for a port it will run the appropriate program as a separate process. It will pass the port of the client into the program so that the server can easily reply. This is `inetd`.

It's controlled by a file, usually `/etc/inetd.conf`. This contains a single line for every server that you want to start on your machine. The line contains the service name (from `/etc/services`), the type of connection (stream or datagram), the protocol (TCP or UDP), some flags, the user id giving appropriate privilege to the process that is created, and finally the command and its arguments.

Adding and removing services on your machine is now a matter of changing the control file and telling `inetd` that you have done so. In time-honored fashion, this is done by sending a HUP signal to the daemon.

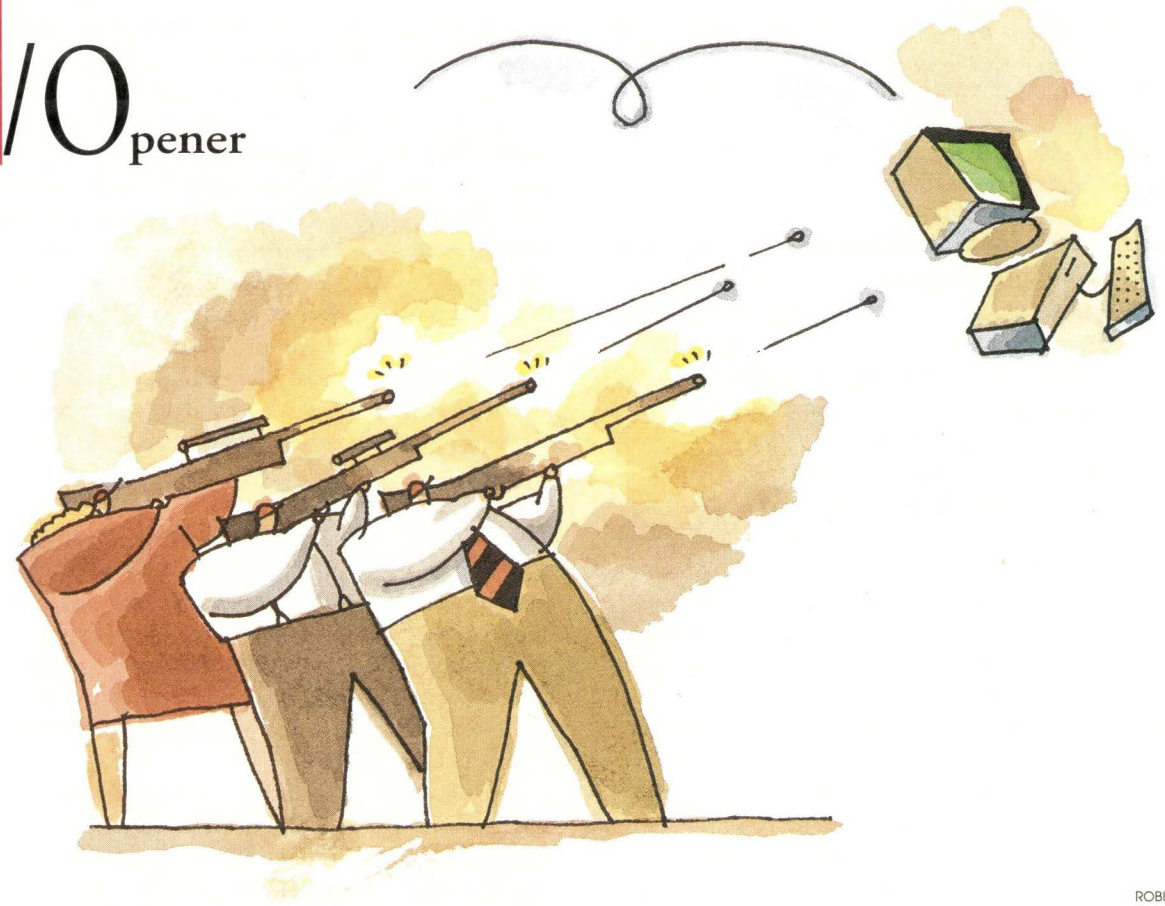
Further Reading

Many of the details in this article have been derived from a new book from Addison-Wesley: *TCP/IP, Running as Successful Network* by Kevin Washburn and Jim Evans (ISBN 0-201-62765-5).

Other information has been taken from my old friend: *The Design and Implementation of the 4.3BSD UNIX Operating System*, by Leffler, McKusick, Karels and Quarterman. This is also published by Addison-Wesley and is ISBN 0-201-06196-1. ⊸

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

I/Opener



ROBIN JAREAUX

Open Season on Operating Systems

by RICHARD MORIN, Technical Editor

A decade ago, when Sun was first starting up, most computer systems were mixtures of standardized and proprietary components. The CPU and system software were always proprietary. Peripheral devices and interfaces varied, depending on market conditions and the vendor's degree of vertical integration.

Sun wasn't interested in playing this game, and said so. Their first products used off-the-shelf components, industry-standard interfaces and generic peripherals. SunOS, a Berkeley-flavored variant of UNIX, was not that different from raw BSD UNIX. In fact, it was sometimes questionable whether Sun or UC Berkeley was in charge of BSD development.

Over the years, many of the details have changed. Specific peripherals, processors and interfaces have come and gone. Sun's basic orientation has remained relatively constant, however.

SunOS has been under continuous development for nearly a decade. It is now a reliable, polished version of UNIX, supporting the entire range of Sun's uniprocessor offerings. Despite Sun's wishes, SunOS will probably be around for quite a while. I'm unlikely to see an improved version of SunOS for my 3/60, but my ELC may well get another release or two.

Whither Solaris?

Solaris has some significant barriers to overcome if it is to take over from SunOS. SunOS administrators, programmers and even users find the SVR4 aspects of Solaris to be unfamiliar and occasionally annoying. The unbundling of the C compiler suite has angered many developers and other technical users. Finally, Solaris' lack of performance and outright unreliability are legendary. They are discussed on the Usenet, at conferences and wherever Sun administrators gather.

Solaris has many positive aspects, from multiprocessor and real-time support to enhanced security features. These may not convince the users, however, if they are seen as trimmings that must be weighed against the loss of more fundamental benefits. In short, Sun must fix Solaris' problems ASAP, or see it go the way of the 386i.

The prospects for Intel-based Solaris are even shakier. The PC market is a lot rougher than the workstation market. Vendors have been dealing with razor-thin margins for years, in an incredibly competitive marketplace. PC customers are cheap, demanding and very fickle.

PCs have to work, quickly and without hassles, or customers will move on to alternative solutions. A small retailer can't afford to wait around for a solution; the system has to work *now*. Workstation vendors like Sun will have to adapt to these standards if they are to survive in the PC arena.

There are difficult technical considerations, as well. Workstation vendors design their hardware and software to work together. PC-based OS vendors have to live with a glut of brain-damaged hardware. There are hundreds of add-in cards out there, and the manufacturers couldn't care less whether they work with Solaris. If it supports MS-DOS (and possibly Windows), they are quite satisfied. Emerging standards may improve this situation, but the current hardware environment is very nasty, indeed.

The Competition

The Intel-based OS market has well over a dozen contenders, some of which have very entrenched customer bases. Commercial UNIX and UNIX-like systems are available in a variety of forms: BSD (original, Mach-based or even NeXT-ified), System V (ranging from skim to extra rich), Xenix and a host of other variations.

There are also a variety of freeware UNIX-like offerings. Jolix (386BSD), Linux and NetBSD are available from Internet FTP archives, on CD-ROMs, etc. Listen carefully, and the sounds of the Free Software Foundation's entry can almost be Hurd. Commercial support, once considered a joke in freeware circles, is rapidly gaining in availability and credibility.

Add in the non-UNIX contenders, from DR DOS to Windows NT, and you can see that Sun will really have to work to gain any foothold in this market. They will have to solve demanding technical problems, meet stringent user expectations and create new distribution channels. Should be interesting to watch, even if it isn't too much fun for the players.

Open Systems in the '90s

The Intel situation may well be a small taste of things to come. System software could become decoupled from the hardware vendors. This would free us to buy computers on the basis of performance, reliability and service. Works in the PC arena; why not here?

Adventurous types could mix and match their system software. Pick up a microkernel here, a file system there, and a user interface somewhere else. This might sound like a lot of hassle, but some folks might like it. Besides, any decisions have to be made only once. New hardware platforms would run the same configuration, making installation and administration a snap.

Compare this scenario to the current situation. If I want to get one of Wombat Industry's speedy new boxes, I have to put up with their miserable excuse for a UNIX implementation. Even if their OS isn't all that bad, I still have to learn how to use (and worse, administer) yet another kind of system. Paraphrasing an old Apple ad: "I want to install a computer to help me do my job, and my job isn't installing computers!"

There are three UNIX systems on my local net, along with a couple of MS-DOS systems. I *really* dislike looking up and/or trying to remember the files and commands needed to administer these systems. When I consider bringing in a new system, increased administrative overhead occupies a large part of my thinking.

Sometime in 1994, I will be buying another box, mostly for increased MIPS. (I use more `gzip` cycles than any other site I know. :-) If Sun can provide a cheap box with lots of usable MIPS and a reliable OS, it will be in the running. If it can run SunOS, it will have a significant advantage.

This is not to say that SunOS is better than other UNIX variants. I know, for instance, that AIX provides several features that SunOS lacks. I wouldn't consider subjecting myself to AIX administration, however. I've watched an experienced AIX administrator installing a disk, fighting SMIT's incomprehensible options and uninformative help dialogs. Even Solaris can't be *that* bad...

Could It Happen?

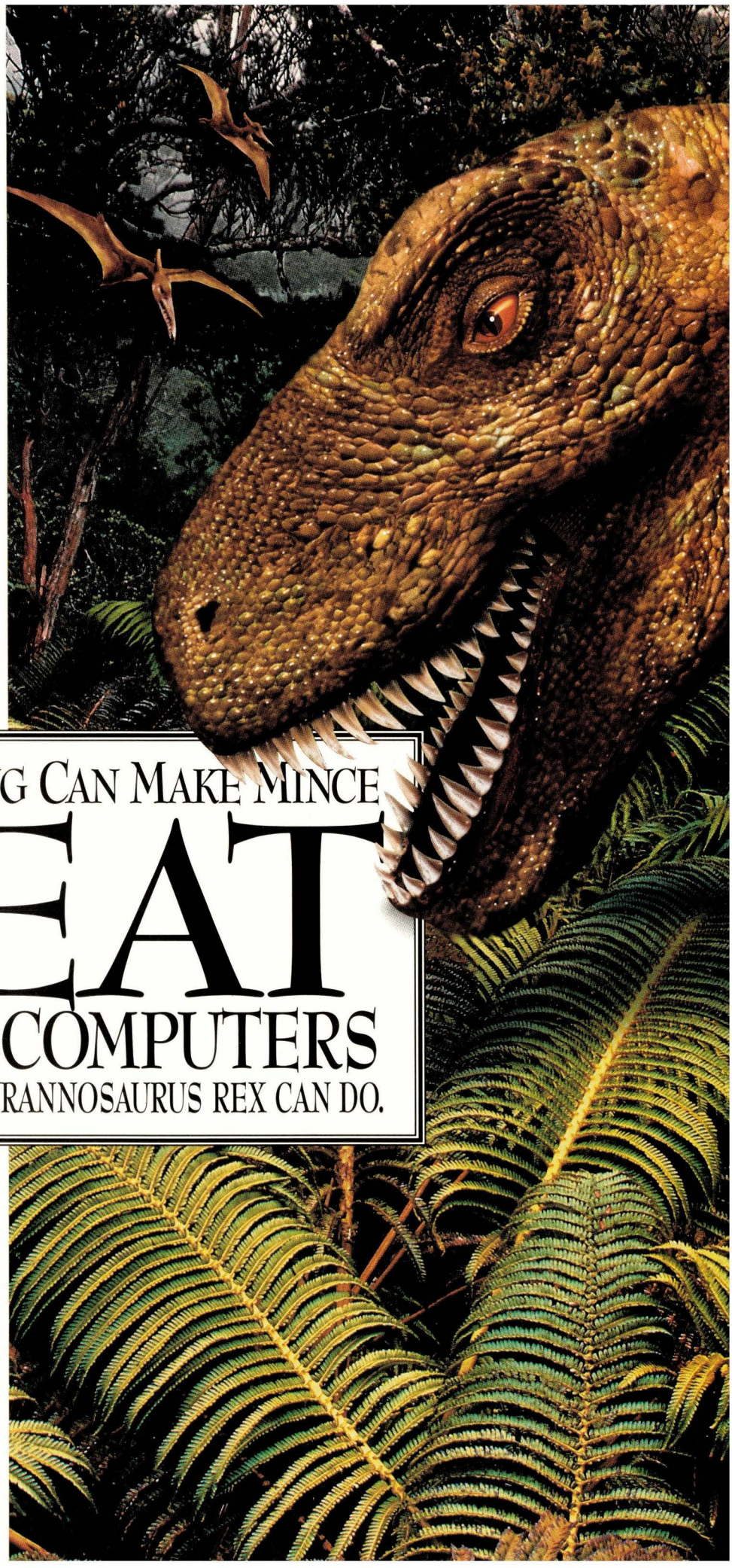
Architecture-independent system software is clearly on the horizon. Several companies (BSDI, Microsoft, NeXT, Sun...) have expressed interest in producing system software for multiple architectures. Right now, the playing field is mostly Intel-based, but that should change. Squabbles about hardware interface data shouldn't last too long: "We're buying 5,000 NT systems. Who wants to be considered?"

Today's freeware UNIX clones are all tied to the Intel X86 architecture. The source code is available, however, so someone *could* port one of them to a SPARC or other workstation. If and when USL gives up its legal challenges to BSD, a raft of BSD-based ports could emerge for assorted machines.

I think the real keys to portability, however, will lie in Mach and assorted system call and library interface standards. Mach appears to provide a very portable set of low-level OS primitives. If system software is built on top of this interface, it can migrate across platforms in much the same way that UNIX applications do. The interface standards define the application programming interface, making the new system software usable by existing applications.

Several commercial systems are already based on Mach, and more are under development. A full BSD port to Mach has been in existence for quite a while. Should the USL/BSD battle cease, this could become available immediately. The Hurd will also be based on Mach, and other experimental systems are likely to use it as time goes on. As I see it, we are about to enter a new and exciting era in system software. Should be fun... ⊸

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



Even dead, they're trouble. ◆ Dr. Jack Horner will tell you that. He's the man whose research brought the monstrous dinosaurs back to life in the hit movie *Jurassic Park*. And more than once, he recalls, he nearly lost the fight. ◆ "How did dinosaurs run?" the Montana paleontologist asks. "How fast did they grow? How long did they live? We would have been short of answers without some very sophisticated statistical analyses and three-dimensional imaging." ◆ All of which pit the fearsome beasts against Sun™ workstations. ◆ Using images, Dr. Horner was able to envision the eyes, ears, nose, and brain structure of the long-extinct lizards. He

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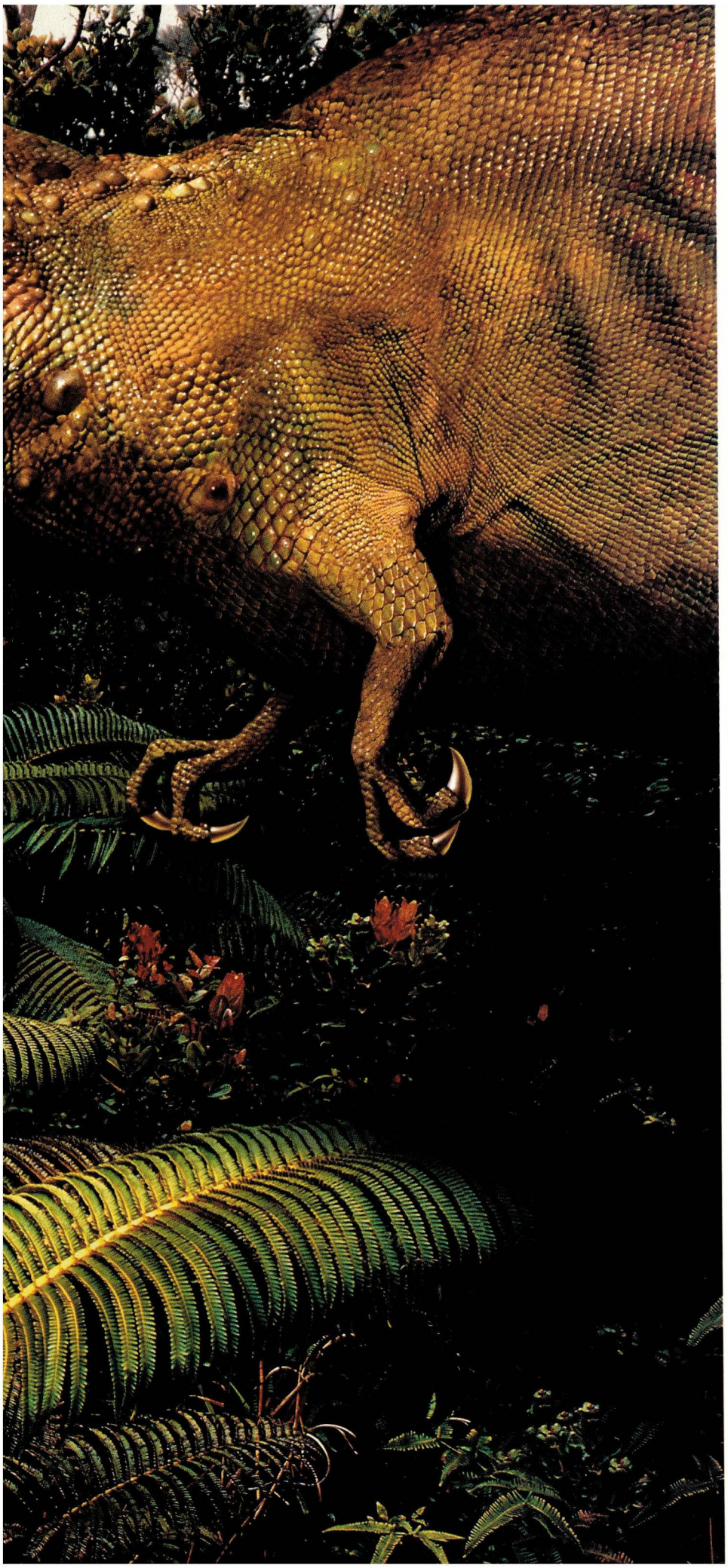

was also able to look at them three-dimensionally, right on the screen, from every conceivable angle, testing theory against fact. ◆ Using Sun, Dr. Horner was soon able to pin dinosaurs down, quantifying how well they could hear, even how they sounded. ◆ And what might a dinosaur say, should one meet you? ◆ Mostly, a kind of growling. ◆ "They weren't very intelligent," Horner says. ◆ But they were pretty hungry. ◆ Sun computers. Just the thing to handle a towering lizard, or whatever monstrous task you're facing. ◆ More than one million people are using Sun systems, powered by the SPARC® chip and the Solaris® operating environment, to gain a competitive advantage. Jack Horner is just one. To learn how you can benefit, call 1-800-426-5321, ext. 605.

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PETER KALABOKIS

Compressed File Systems

by S. LEE HENRY

File systems are always getting tight where I work. Workstations used by several scientists, many writing their own data analysis software and all storing large data files, are constantly on the brink of fullness. For one particular workstation, I've been compressing files through `crontab` using an `atime` parameter set to target only those files that have not been accessed in six weeks or more. When one of the researchers on this system didn't want certain of his files ever to be compressed, I taught him to "touch" them periodically, so that their access times were always recent.

This approach works but has some drawbacks. For one, that one user's "touch list" has to be kept up to date. For another, the compressed files have to be deliberately uncompressed before they can be used. This can be quite annoying if you're feeding huge data files to a hungry application and the third data file turns out to be compressed and chokes the program.

I recently started evaluating a utility called dotZ from Mount Bonnell Inc., Austin, TX, that provides a compressed filesystem type for Sun workstations. Most files appear to compress to well under half their original size and uncompress without deliberate effort (i.e., when I use them). Further, the dotZ file system allows me to compress entire file systems, directories or individual files and isn't restricted to text or data files. Executables can be compressed as well, and they still operate as expected.

As "slee," I can compress my own files. As "root," I have access to anything. Looking at an IslandDraw document before and after compression, you can see the resultant file is only about 37% the size of the original shown in Figure 1.

• *Can I choose what I want to compress?*

Sure. You can easily specify which files to compress and those never to be compressed using regular expressions stored in a startup file (`~/.dotZrc`). The file systems appear

```
Before:
-rw-r--r--  1  slee   136682   Sep 14 12:27    HostForm

After:
-rw-r--r--  1  slee   50873    Sep 14 12:27    HostForm
```

Figure 1

to be mounted twice when dotZ is running, once normally and again under `/dotz` (e.g., I have a `/dotz/usr` and a `/dotz/home`). If I look at files in my home as `/dotz/home/slee/whatever`, I really don't notice any difference; they *look* as though they are the original size and work with standard I/O as expected. The alternate view of my file systems (i.e., without the `/dotz` prepended) shows

```
/dotz/home/slee/files:
-rw-r--r--   1   slee   136682   Sep 14 12:27   HostForm
-rw-r--r--   1   slee   136623   Sep 14 12:27   HostForm.bak
-rwxrwxrwx   1   slee   6138     Sep 14 14:02   formlist

/home/slee/files:
-rw-r--r--   1   slee   50873    Sep 14 12:27   HostForm
-rw-r--r--   1   slee   50841    Sep 14 12:27   HostForm.bak
-rwxrwxrwx   1   slee   348      Sep 14 14:02   formlist
```

Figure 2

me the actual file sizes as illustrated in Figure 2.

• *How will I know if a file is compressed or not?*

The file command identifies the type of the file as a "zark script." The header prepended to the compressed file includes information about the size of the original file and speeds up the decompression. You can probably recognize the header and magic number in the partial dump shown in Figure 3.

If you're working within the `/dotz` view of the file system, however, you will rarely need to be aware of whether or not your files are compressed.

• *How do I start the compression?*

DotZ compressions are generally run through `cron`, and the processing overhead doesn't appear to be painful. You can also invoke the compress utility, `ftw`, whenever you like. The `ftw` process looks for `.dotZrc` files and then figures out what to compress.

Individual files can also be compressed and uncompressed at will with a command called `zark`. The command `zark -Z filename` is like an `uncompress` (the files do not have little .Z's, but decompress in place). The `zark -e filename` command, on the other hand, sends its output to standard out, leaving the original file compressed.

• *What if I change my mind?*

This is always a concern I have when considering a compression algorithm or any file-archiving utility that may be proprietary or simply hard to duplicate; I like to know that if the company folds, my license expires, or the software stops working I can still easily recover my files. The dotZ system supports standard compression tools like the `compress` command and GNU's `zip` (`gzip`), and allows me to plug in a different compression package if I have special requirements.

• *Can it confuse me?*

Well, maybe. You might get a little flustered if you try to get a man page and, instead get something like what is shown in Figure 4.

Obviously, we're trying to feed `nroff` a compressed file! Getting past such problems, however, is easy. You can change your `MAN_PATH` to `/opt/usr/man`, and everything works as you'd expect. The manual suggests that you prepend `/dotz` to your home in your passwd file, so that you won't have to be conscious of the status of your files as compressed or not.

• *How much of a wizard must I be to set it up?*

Oh, the install was dead easy. I didn't need to configure a kernel or anything like that. I only had to `tar` off the contents of one floppy disk. Then, I added a line to `crontab` to make the compression tool, `ftw`, run twice a day and added an invocation in `rc.local` to start `/opt/dotz/bin/dotZ` on rebooting.

Setting up the user configuration files is also very straightforward. It involves configuring a file called `~/.dotZrc`

Figure 3

```
boson% file *
HostForm:      executable   /opt/dotz/bin/zark script
HostForm.bak:  executable   /opt/dotz/bin/zark script

0000000  043  041  057  157  160  164  057  144  157  164  172  057  142  151  156  057
           #    !    /    o    p    t    /    d    o    t    z    /    b    i    n    /
0000020  172  141  162  153  040  055  146  134  055  163  134  061  063  066  066  070
           z    a    r    k    -    f    \    -    s    \    1    3    6    6    8
0000040  062  134  055  157  134  172  143  141  164  012  037  235  220  061  140  340
           2    \    -    o    \    z    c    a    t   \n  037  235  220    1    `  340
0000060  000  001  347  314  234  061  162  322  300  241  143  247  214  034  020  012
          \0  001  347  314  234    1    r  322  300  241    c  247  214  034  020   \n
0000100  024  004  204  001  202  110  031  063  123  340  204  031  123  246  010  036
         024  004  204  001  202    H  031    3    S  340  204  031    S  246   \b  036
```

```
boson# man zark
Reformatting page. Wait... done
#!/opt/dotz/bin/zark -f-s1222-oat

Q'T40M9yfP)SDD4ilq)Y<...2%IB@yCGR[Z)cFNQSHcN:
F<iS&2W#>.qf+W0bIE5EsRh)S#F.......D  L"%   *I8y*r9_.l)YL9  h
```

Figure 4

(shown in Figure 5) with fairly obvious labels delimiting what I want done with different sets of files. I have to use the `ed` regular expression format; that was a bit odd, but not much of a hardship.

Figure 5

```
STARTPRECIOUS
.*\.c
/home/slee/datafiles/.*
ENDPRECIOUS
STARTNOCOMPRESS
.*lib.*
ENDNOCOMPRESS
STARTCOMPRESS
bin
mail
ENDCOMPRESS
```

- *What else does dotZ buy me?*

Well, another nice feature of dotZ is its "precious files" feature. Precious files are looked after; if you delete one of them, they will be saved in your `.wastebasket` directory, giving you a chance to recover from mistakes.

- *Will it slow my system?*

Probably, but not too badly. I made some comparisons with compressed and uncompressed man pages and couldn't measure the difference. If I were to compress all of OpenWindows, I might notice the slowdown. Tuning recommendations from the manual include *not* compressing xnews and xview libraries; this is easily accomplished in your `/.dotZrc` file.

To more fully evaluate performance, I executed a FORTRAN program, which did a linear inversion, first normally and second with both the program and data files compressed. Surprisingly, the timing difference was negligible, amounting to only a matter of seconds. ➸

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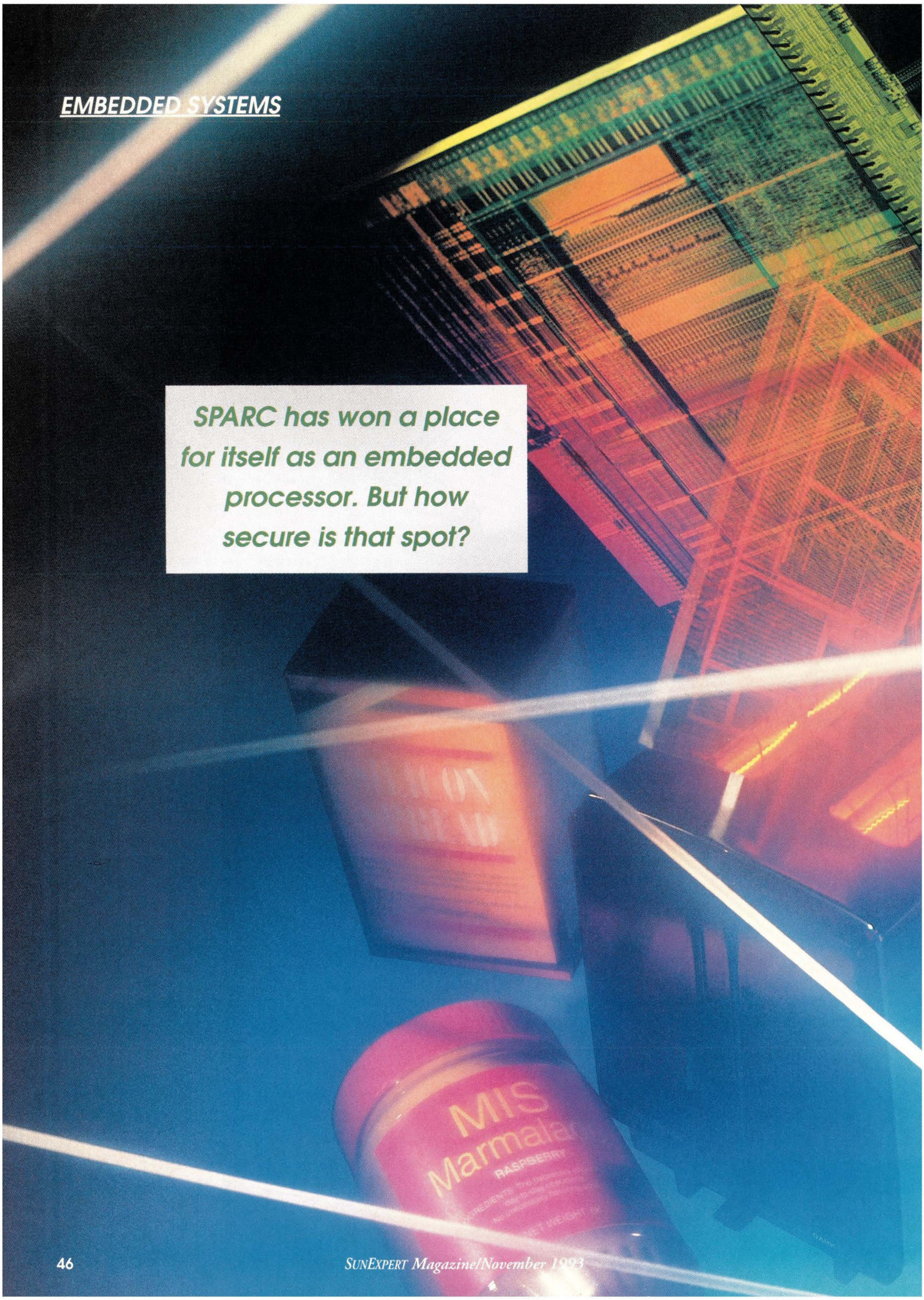


SPARC has won a place for itself as an embedded processor. But how secure is that spot?

SPARC, the processor that didn't even exist only a short time ago, has become a success in embedded systems. While winning an empire in workstations, it has also absentmindedly acquired a kingdom in the world of CPUs that are installed not in a computer, but rather in other devices–quite literally everything from printers to cars. SPARC and its variants have scored significant design wins in such applications as telecommunications, graphics and even industrial control.

Stealing Sockets

by MICHAEL JAY TUCKER, Executive Editor

However, even as SPARC is on the verge of its most brilliant successes in the embedded systems market, so too does it face new and unexpected perils. Not only are there new rivals for the sockets it would fill, but so too does the processor face a completely unprecedented threat: For the first time, SPARC must confront a crisis of confidence.

RALPH MERCER

The Great Diaper Victory

First the good news. SPARC is doing very well indeed in embedded systems. "In our latest figures," says market analyst Dan Baker, of the research firm Venture Development Corp., Natick, MA, "we estimated that SPARC stuff represented about $51.3 million in VME board sales."

That, he says, is a significant fraction of the entire market for VME boards, maybe as much as 14%. That's an astonishingly huge number, but less amazing when you consider the three leaders in VME boards are Motorola Inc., Force Computers Inc. and Themis Computer, and Force and Themis both have SPARC-based products.

In fact, Baker thinks things will actually get better for SPARC. Currently, the dominant processor in embedded systems is the Motorola 680X0–"which had about 75% of the market in 1991." But that share will decrease as the aging 68K line loses more and more sockets. That will leave room for more SPARCs. "We think that SPARC will grow in the near term," he says. "SPARC will taper off to about 16% of the market by 1996, but the market as a whole will have grown...to about $626 million. That's up from $274 million in 1991." So SPARC will have a larger share of a larger pie.

The reasons for SPARC's success are many, and sometimes surprising. One common explanation has been sheer power–SPARCs are just more muscular than CISC machines. Then, there's pricing. Traditionally, SPARC has been more expensive than comparable CISC machines.

But cost is a relative thing. "There are two areas where SPARC has advantages," says market analyst Paul Zorfass, International Data Corp., Framingham, MA. "One is where higher functionality is needed–telecommunications, for example–but the other is where there may be a need for a cheaper processor that can do more."

An individual SPARC may be more expensive than an individual 68K, but it can do more, and that may mean significant savings in the design as a whole. That's particularly true, he says, given the fact that the embedded systems industry as a whole is undergoing a transformation. "People are bringing out new products," he says. "And increasingly, product differentiation is in software."

And that, finally, is SPARC's biggest advantage–software. No other RISC processor can offer as much software, either in the form of applications, systems software or development tools. "There is an awful lot of interest in SPARC right now, and the 7,000-odd Catalyst applications are a major reason," says Sue Markowski, product marketing manger at VME board vendor Force Computers. "And certainly the development environment has also been attractive."

Indeed, it is a measure of SPARC's success that real-time operating systems are increasingly available for the processor. They range from tiny executives to full-fledged real-time UNIXs, such as LynxOS from Lynx Real Time Systems Inc. "We've just completed our port to the microSPARC," says company President and Chief Executive Officer Inder Singh. "And we've already had a lot of interest in it."

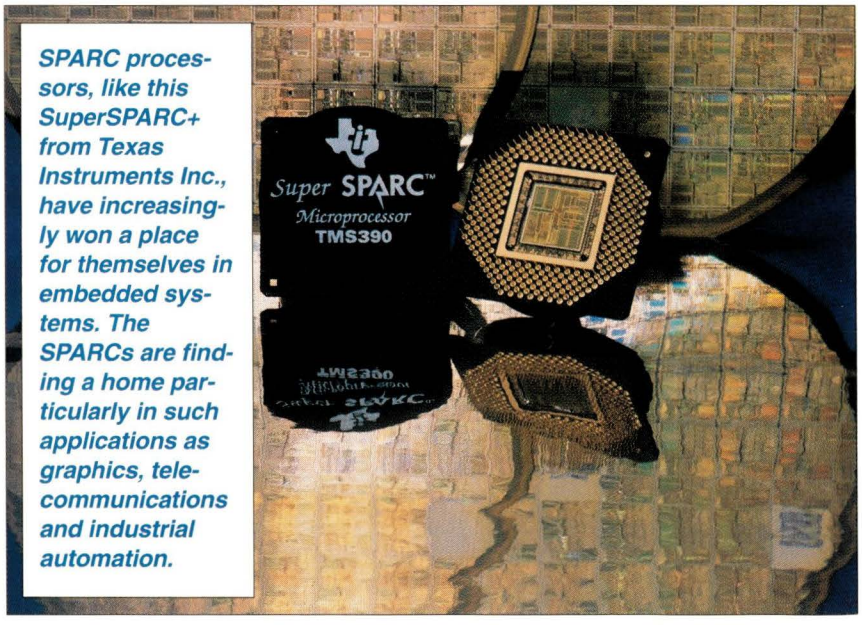
Thus it is that, with these advantages, SPARC is finding a place in several different applications. "Graphics accelerators, color laser printers, large photocopiers," lists Tony Barbagallo, director of product marketing at real-time OS vendor Wind River Systems Inc. "Plus, sophisticated computer peripherals, such as big data-storage devices, where you have to have very intelligent control units."

In general, analysts group these applications in two categories: graphics (X terminals, printers and so on) and telecommunications (switches, routers, bridges, etc.). Some analysts have argued that SPARC will not have a place in industrial automation for various architectural reasons. RISC processors, in general, are supposed to be less deterministic when they run real-time applications.

However, SPARC product vendors claim to have won several designs in just such embedded control applications. "At present," says Force's Markowski, "I believe we have SPARCs in such places as a diaper manufacturing plant and a weaving factory."

Sheep in Wolf's Silicon?

But not everything is sweetness and light. Some critics say that SPARC's success is less than meets the eye. The argument is that, right now, the Motorola 68K line of processors is the leading line of embedded processors. "It is by far the dominant processor on the market," says Stuart Schlitt, vice president of marketing for the software components group of Integrated Systems Inc. (ISI), which makes a number of real-time and embedded systems software products for a variety of systems. "But I think it is the general perception that the 68K family is running out of steam."



SPARC processors, like this SuperSPARC+ from Texas Instruments Inc., have increasingly won a place for themselves in embedded systems. The SPARCs are finding a home particularly in such applications as graphics, telecommunications and industrial automation.

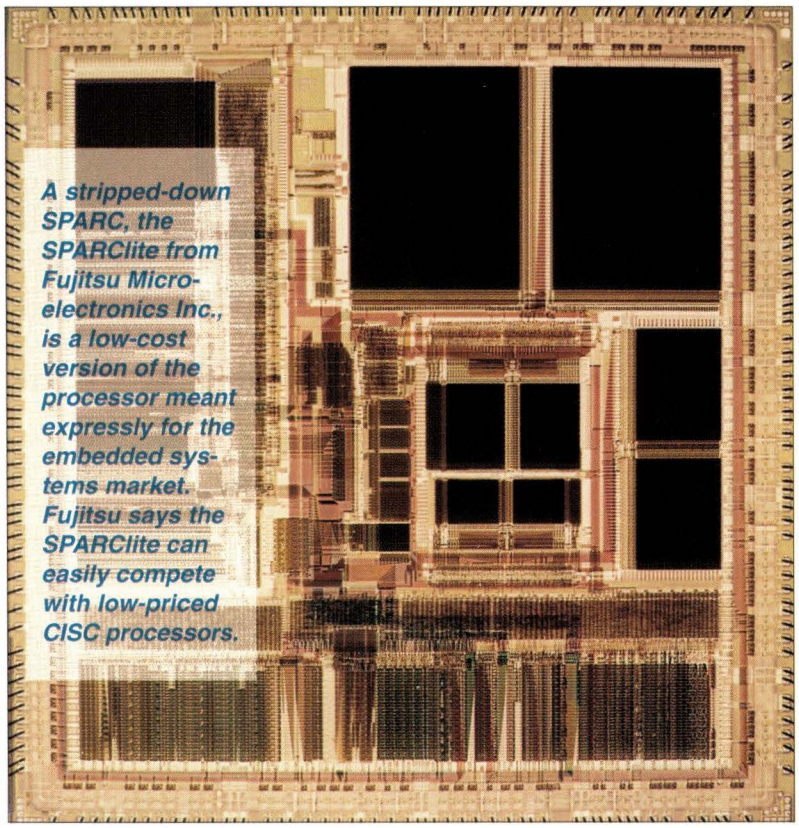
A Sizable Advantage

Among the variants of SPARC, two have taken leading roles in embedded systems–microSPARC, a small but complete SPARC processor sold by Texas Instruments Inc., and SPARClite, from Fujitsu Microelectronics Inc.

SPARClite is a scaled-down version of the processor specifically designed for the embedded market. "It is definitely showing itself as the true embedded processor of the SPARC family," says Dr. John Burns, product marketing manager for SPARC systems at Fujitsu. "It's been more and more successful as time has gone on."

microSPARC, meanwhile, is a complete SPARC processor. It is used in both workstations and some embedded applications. Sun, for example, uses it in its X terminal.

In theory, the two are not supposed to compete. "SPARClite is aimed at the end of the market where the microSPARC can't get because of cost," says Burns. What are the applications in that end of the market? "The one everyone thinks of is laser printers," he answers. "Another one is networking–bridges, routers–where there isn't really a need for a full-scale workstation chip."



A stripped-down SPARC, the SPARClite from Fujitsu Microelectronics Inc., is a low-cost version of the processor meant expressly for the embedded systems market. Fujitsu says the SPARClite can easily compete with low-priced CISC processors.

But these are exactly the same markets that microSPARC partisans also covet. "To be realistic, I am sure that there are going to be some attempts to sell microSPARC boards into those markets," answers Burns. "But a microSPARC is just not going to be able to get to the price points required." He argues that the embedded market requires very strict cost controls. "With SPARClite, you can get down to $20 a part."

The 68K architecture is, in other words, approaching the end of its useful life. That, in turn, presents an opportunity for other chips that may be in line to take its place. "It seems like everyone is in the business of stealing 68K sockets," says Auro Tripathy, product manager at Microtec Research Inc., a maker of embedded system software development tools.

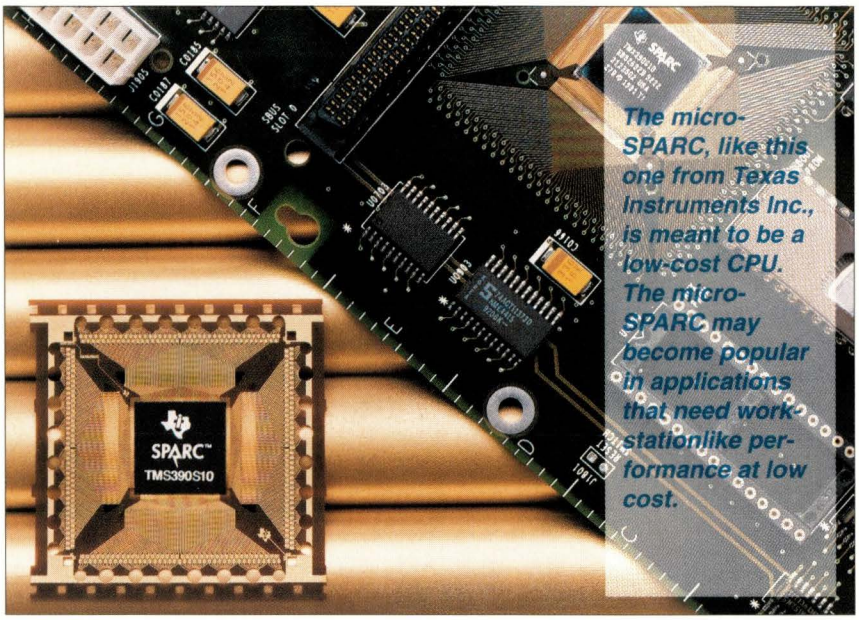
But, says Tripathy, that's not necessarily a sign of industry health. It means that no one is really bringing anything new to the market. SPARC–and indeed other RISC processors–is just trying to be everything a 68K is, but a little faster.

And in this race to be the best 68K mimic around, SPARC has serious rivals–like the i960, the processor developed by Intel Corp. expressly for the embedded market. "The Intel i960 is very strong," says Tripathy. "In fact, for us, our most successful products are for the 68K first, then the i960, and then the SPARC."

In addition, there is the PowerPC, the chip set jointly developed by Apple Computer Inc., IBM and Motorola. "Force is definitely looking into a PowerPC product," says Markowski. Adds ISI's Schlitt, "If I were a betting man, I'd say the PowerPC looks strong." Concludes Lynx's Singh, "PowerPC is perceived as having a bit more presence in the embedded market, because of the Motorola connection." For a lot of buyers, he says, PowerPC looks like the logical successor to the 68K.

Still, Motorola has already marketed one logical successor to the 68K–the 88000, a RISC processor that Motorola showed in the middle 1980s. That chip's relative lack of success does not bode well for the PowerPC. "Five years ago, I would have said I was concerned about the 88K," says Peter von Clemm, strategic marketing manager for SPARC processors at Sun Microsystems Computer Corp.'s SPARC Technology Business Group (STB). "Motorola has this problem. They have an enormous installed base of 68Ks...you'll probably have a situation where the sales force at Motorola will be pushing 68K long after they should be pushing Power."

Microtec's Tripathy actually laughs at the mention of



The micro-SPARC, like this one from Texas Instruments Inc., is meant to be a low-cost CPU. The micro-SPARC may become popular in applications that need workstationlike performance at low cost.

PowerPC. "The only people in the embedded market who've picked up the PowerPC are the same people who'd committed to the 88K and the 88110. When those chips went away, they really had no choice but to go with the PowerPC."

Phil Campbell, SPARC marketing manager at SPARC vendor Texas Instruments Inc., agrees. "The PowerPC has yet to ship," he says, "whereas Texas Instruments alone has shipped 300,000 SPARCs." That, he says, plus "Motorola's 'loyalty' to the 88K"–Motorola was accused of sabotaging the 88K's marketing in order to protect the 68K–are not good omens for the PowerPC.

Still, the PowerPC draws interest, and it has the backing of very powerful companies. Even in the unlikely event that it fails completely, there is another competitor in the wings–the Intel 80X86 architecture.

No one is particularly concerned about Pentium, which is widely seen as being too expensive and too difficult to obtain for the embedded market. "I think there's been an awful lot of press about how Pentium has been available only to select customers," says Force's Markowski. "People are concerned about how fast they could get Pentiums."

But the 286/386 parts are another story entirely. "We're coming out with tools for the X86 line," says Microtec's Tripathy. "Intel thinks it will relegate the X86 to the embedded market–make it a $5 part or something."

He believes that, of all the chips on the market, the X86 stands a real chance of challenging the 68K. "Because there is so much software for it," he says, "and because the price will be so competitive."

Lynx's Singh thinks that the X86 will be in the embedded systems market even if, or particularly if, Intel itself doesn't much care if it's there or not. "Intel isn't that interested in the embedded market," he says, "but they're getting there anyway." That's partly because of the vast numbers of processors out there, but also because "Intel is interested in laptops and palmtops, and that's pushing them in the technical directions they need to go for embedded systems: low power, low heat, that sort of thing."

And, beyond the hardware, there's Microsoft Corp., which is said to be working on derivatives of NT for real-time embedded applications. "The wild card in all of this is NT," says IDC's Zorfass. "Or rather, derivatives of it."

Microsoft has suggested that it is looking for an embedded role for some version of Windows NT–particularly in consumer products. It might run on an Intel architecture, or it might not. Both Digital Equipment Corp.'s Alpha processor and the MIPS processor, from the MIPS subsidiary of Silicon Graphics Inc., already support NT and are aggressively targeting the embedded market.

All of that would seem to mean bad news for the SPARC, one of the few major RISC processor that doesn't run NT. Still, the RISC partisans say they're not worried. They point

How Embedded Is Embedded?

How about a computer that is embedded...in another computer?

That's what Opus Systems Inc. says it sells. The company makes a SPARC-based system that goes on an AT board. Its customers, mostly OEMs, then install the boards in their PCs. "We believe this fits the embedded classifications," says John Chun, the company's vice president of marketing, "because the customer isn't buying the board to get a workstation. They want an application engine."

In other words, the end users don't need access to UNIX, nor even anything like the full environment provided by SPARC. What they need is access to one specific application or facility that is not available on DOS or Windows. "The OEMs are happy to put a SPARC card in the device, so long as they don't have to tell the user about it," explains company President Craig Foney. "It's embedded UNIX, masked from the end user."

Opus has been in the business of providing 32-bit coprocessors to PCs for years. It has, in fact, offered product based on almost all the major microprocessors, including the Clipper and the Motorola 88000. But now PCs sport their own 32-bit processors and, with NT, will shortly have their own multitasking operating systems.

This, however, doesn't concern Opus over much. "NT actually increased the demand for our boards," says Foney. "People built their products assuming that they could get NT by now. But, they can't." So, the developers turned to SPARC and UNIX instead. "NT, which should have been our death, has been a market opportunity for us," says Foney.

out that NT, even as a computer operating system, is only now beginning to ship, and no one has seen a real-time version. "I guess, this week, I'm more worried about peace in the Middle East," says ISI's Schlitt. "Windows NT is something to keep an eye on, but I suspect that the embedded market is too small for Microsoft."

The Vision Thing

But embedded SPARC has another problem: Its staunchest partisans are beginning to worry about its openness, and about Sun's commitment to the embedded market.

"There has been discussion of Sun selling chips," says Force's Markowski. "We're hoping that new Sun announcements don't eclipse our ability to get chips on the open market." Specifically, she says, she is concerned that Sun will play favorites, much as Intel was accused of doing. The concern is that only privileged customers will get unlimited access to SPARCs, while the rest will stand in line and wait for the leftovers.

"I believe that could happen," says Markowski. "I think they [Sun] will be smart enough not to let it, but it could."

SPARC partisans say that it won't. "I am sensitive to these perceptions," says STB's von Clemm. "But they are totally against the grain of what STB is meant to do." He says that Sun, and STB, would never restrict the availability of the chip.

He does note, though, that Sun doesn't rule out the possibility that it might itself sell SPARCs. "We haven't announced anything along those lines," he says. "But, STB's charter is to promote SPARC, and we're looking at different ways of doing that.

That worries Markowski. "I just want them to understand," she cautions Sun, "that they must keep it open."

And beyond even this, beyond the fundamental question of whether SPARC will remain an open technology, there is the Vision Thing. Is the processor being marketed in the embedded market with a coherent strategy?

Microtec's Tripathy doesn't think so. "I should champion SPARC, but I think they [the processor's partisans] lack some kind of vision on their position. They should position themselves and go after specific segments. For instance, in Japan, they've gone after the gaming market."

But instead, he says, SPARC has been sold as just another 68K replacement. "Everyone is just looking for some way to differentiate themselves," he says.

Clash by Night?

Still, even if SPARC lacks vision entirely, it has considerable advantages as it flails about in the dark. For one thing, the entire embedded systems industry is undergoing a rapid evolution–an evolution that could force them to SPARC. "What is driving this market," says Venture Development's Baker, "is that OEMs are gradually realizing that they can buy off-the-shelf parts."

Rather than buy individual processors, they are buying off-the-shelf boards. Rather than write their own software, they are buying real-time OSs and even, increasingly, applications. "The applications are getting much more complex," explains ISI's Schlitt. "People are being driven to packaged solutions. There isn't much of an alternative."

All of which gives SPARC an edge, since SPARC already has an industry built up around it. "SPARC, and Sun, are better positioned than some," says IDC's Zorfass, "because so much development is already done on Sun workstations."

And that, he says, could be important for the company. However, Zorfass believes that in the near term, Intel-based systems will not only deny Sun its long-held aspiration to be a PC replacment, but they will also challenge the workstation in the engineering and technical markets. "Sun, to be successful, needs to be a great deal more aggressive in this market," he says, "because they're about to get clobbered on the desktop." ⊸

Companies Mentioned in this Article

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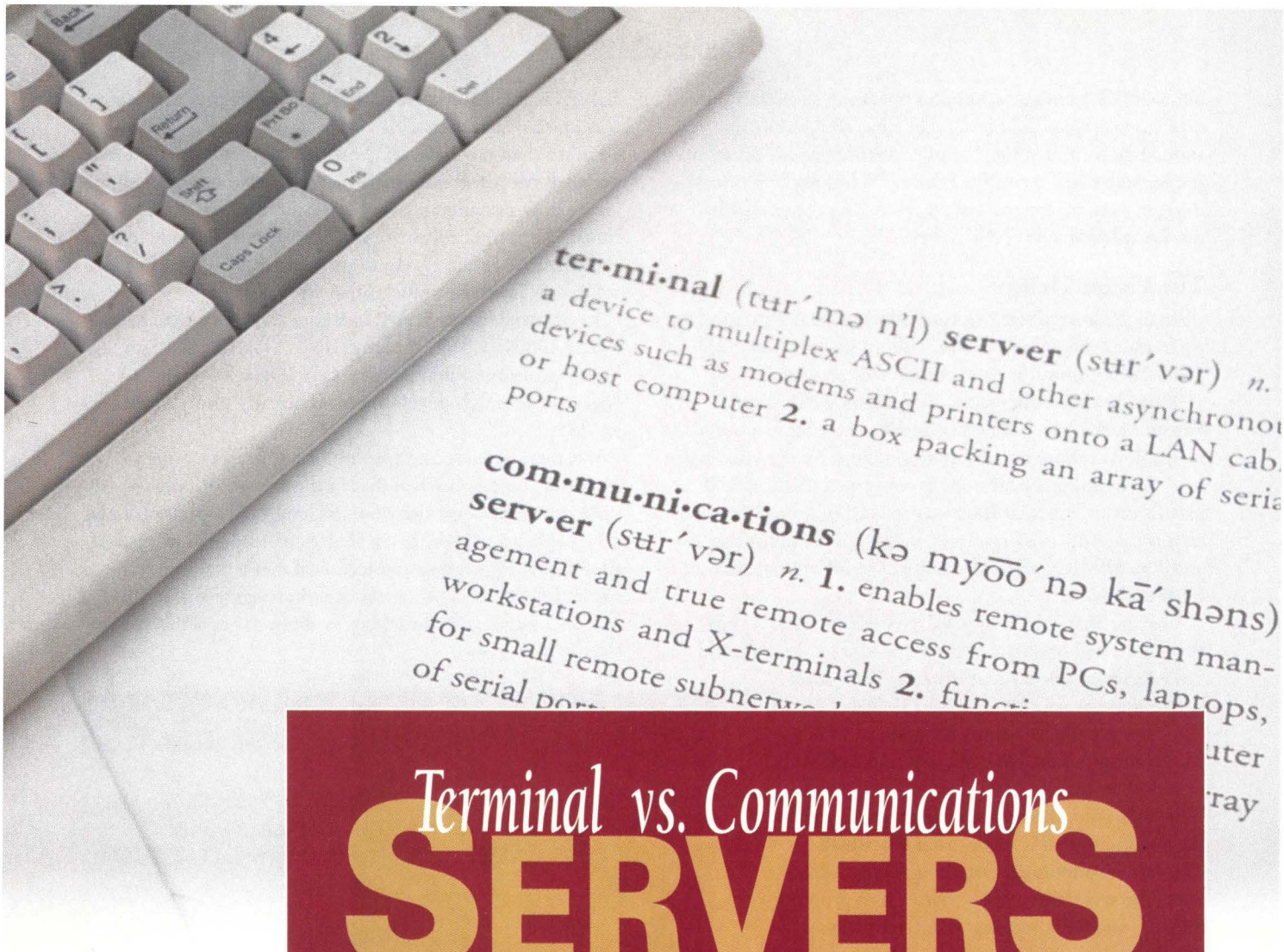


Terminal vs. Communications SERVERS

Which one best serves your needs?

What's the difference between a terminal server and a communications server? Most people, even "official sources," either don't know or don't agree. A recent search through three dictionaries of computer terms revealed five different definitions. But this disagreement is understandable in an industry whose lexicon is as inconsistent as the New England weather.

Terminal servers and communications servers are too often mistakenly cast in the same role due to their similar appearance (a box packing an array of serial ports) and basic functionality (networked serial ports). Yet beyond these similarities, the differences between the two devices have widened significantly in the past two years, both technologically and in the way they are used.

by JACK O'NEIL, Xylogics Inc.

Terminal Server Defined

The classic definition of a terminal server is a device used to multiplex ASCII terminals onto a LAN cable or host computer. However, users soon learned that terminal servers could be used to connect not only terminals, but also a variety of asynchronous devices, including printers and modems.

Terminal servers eliminate the difficulty and expense of hard-wiring these devices directly to a host computer by packaging multiple serial ports in a single intelligent box, rather than through point-to-point connections. This is a significant benefit for manufacturers of multiuser systems because it allows them to reduce machine size and wiring complexity. OEMs can "clean up" the back panel of their machines and support a larger base of users with fewer bus slots.

Although they are considered commodity products today, with a relatively simple architecture, terminal servers have become indispensable network building blocks for companies needing lower cost network connectivity of peripherals. The technology offers the flexibility of locating these devices anywhere they are needed, making it easier to relocate people and equipment on a network.

Terminal server architectures typically include a processor, firmware and sufficient RAM to support 8, 16, 32 or 64 RS-232 serial ports.

LAT to Telnet

There are two (virtual) terminal protocols for terminal-to-host connectivity in Ethernet networks. Local Area Transport, or LAT, is the Digital Equipment Corp.-developed protocol used primarily in DECnet environments for VAX/VMS connectivity. Telnet is the terminal protocol of choice among UNIX users for their TCP/IP networks.

While the two protocols are quite different, they can (and often do) peacefully coexist in a heterogeneous network. Consequently, many terminal server vendors now support both protocols, enabling terminals physically connected to a single server to establish sessions with any VAX and UNIX host to which they have access privileges.

A good terminal server will let users establish multiple, simultaneous sessions to one or more hosts, using a user-defined hot-key sequence to toggle between sessions. Individual jobs from these sessions can run in the background, allowing messages and notifications such as email to be displayed on the terminal while working in another session.

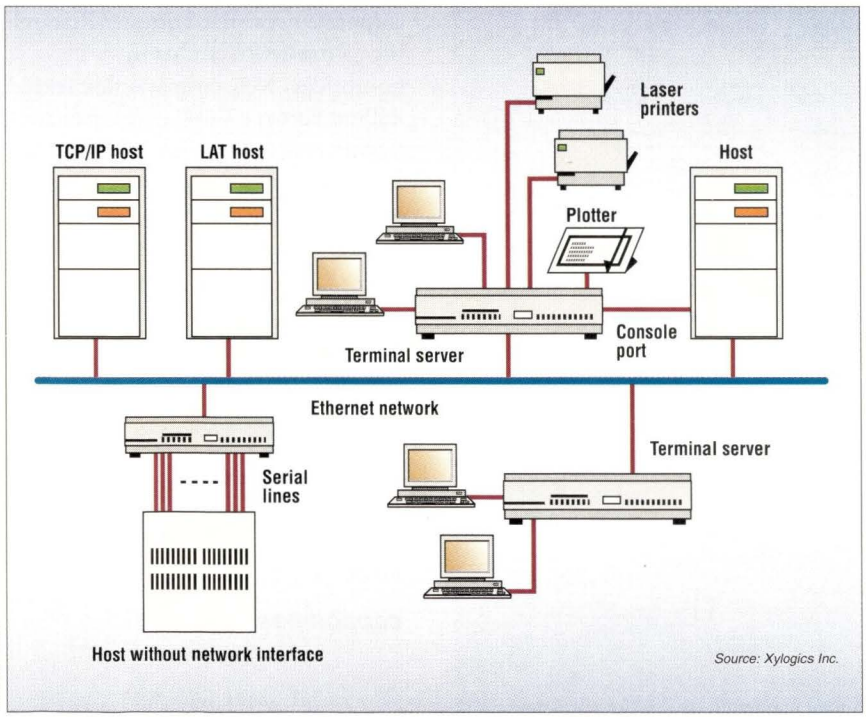
While today's terminal servers often support both major terminal protocols–LAT and Telnet–some communications servers offer additional protocol translation capabilities. Protocol translation is beneficial in mixed VAX and UNIX environments because LAT sessions cannot be routed across a WAN, and LAT performs poorly even when bridged on a WAN. To address this problem, some communications servers provide a Telnet-to-LAT gateway that enables VAX users to access remote LAT hosts by translating and using Telnet on the WAN. The gateways provide the necessary translation between LAT and Telnet protocols as they enter and exit the VAX.

Modem Management

Where the line begins to blur between terminal and communications servers is in the area of modem sharing. For example, both high-end terminal servers and communications servers are ideal for managing modem pools. By pooling together multiple modems with a single server, it is far easier for network administrators to manage, configure and troubleshoot modems than if they were connected to individual computers.

With a terminal or communications server, administrators can create rotaries–sets of serial ports assigned to a name–for their modem pools. As users try to access the modem, rotaries automatically connect users on a first-come-first-served basis, or hold them in a queue until the resource becomes available. Since administrators can define multiple rotaries for a server,

Terminal servers can be used to connect not only terminals but also a variety of asynchronous devices, including printers and modems.



HANNA DYER

users on large networks can access a virtually unlimited number of modems by automatically scanning multiple communications servers until an available device is located. The modem pool gives the connected user its full attention as long as the call lasts.

In UNIX environments, modem pools solve UNIX's inherent weakness in communications. For example, UNIX hosts have poor auto-baud capabilities, whereas good auto-baud algorithms are taken for granted with servers.

Modem pooling also has economic benefits. While the savings may not seem significant when considering the plunging cost of both low- and high-speed modems, it becomes apparent when you factor in the cost of multiple telephone lines, which can cost $70 to $100 per line per month.

When a terminal or communications server is dedicated primarily to this kind of dial-out communications, vendors sometimes refer to it as a modem server.

Advanced Routing

Another gray area spanning both types of devices is in advanced routing over multiple LANs or across WANs. Where LANs connected by routers or gateways require routing services to reach hosts on distant networks, terminal and communications servers can use either static or fixed-route entries.

The devices can also implement dynamic routing, in which the servers use messages received from a LAN to learn various routes available. The servers "listen" for dynamic routing updates provided by a routing daemon that uses Routing Information Protocol (RIP) messages to create a routing table. Administrators can also establish hard-wired routes, which essentially define a specific route for LAN traffic coming from the communications server.

The Communications Server Difference

Perhaps the simplest way to draw the line between terminal and communications servers is to say that the latter provide all the capabilities of terminal servers...and a lot more. Communications servers look like a terminal server from a hardware perspective but offer more advanced communications, internetworking and security features.

While these features vary widely from vendor to vendor, a good high-end communications server can

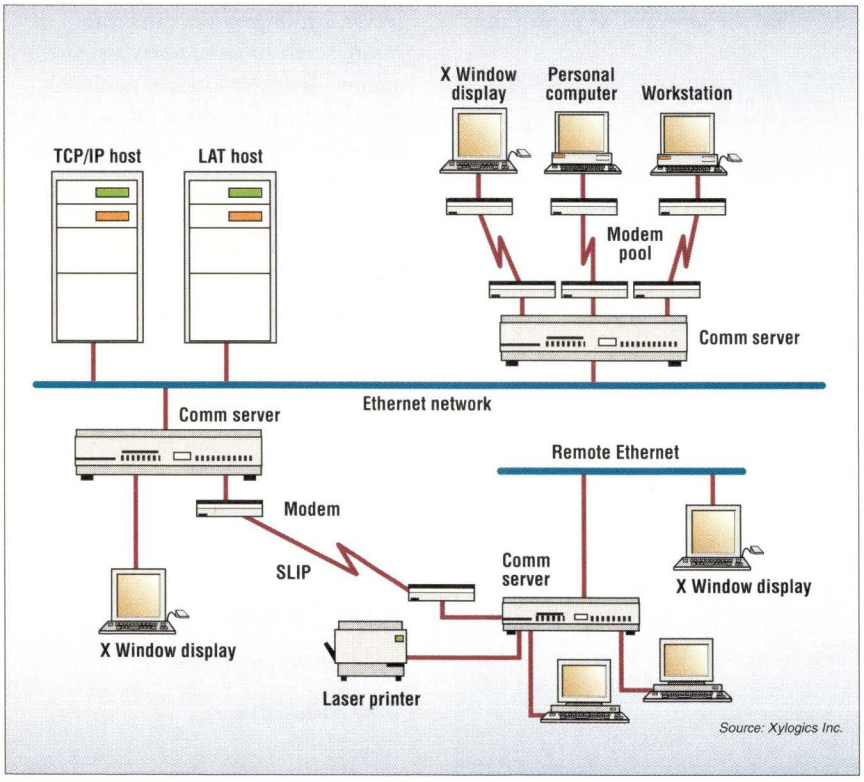
- enable true remote access (not just terminal emulation) from PCs, laptops, workstations, X terminals;
- enable remote system management;
- provide an additional security perimeter at the network over and above that offered by individual hosts;
- and function as a router for small, remote subnetworks.

By contrast, users cannot avail themselves of these features with a lower-end terminal server.

As the name implies, communications servers are best distinguished from terminal servers by their advanced communications capabilities. While both devices support modem sharing for multiple users, communications servers go a step further by enabling sophisticated dial-in/dial-out applications through advanced software and hardware configurations. Essentially, where terminal servers provide a basic serial connection to a shared modem, communications servers provide an application platform.

Remote Access

Take, for example, one of the fastest growing segments of the networking industry: remote network access. Mobile workers, remote branch office staff, travelers and so on are increasingly demanding greater access to their corporate networks. Forrester Research Inc., a market researcher in Cambridge, MA, estimates that several million Fortune 1,000 employees are disenfranchised from their networks, and there is mounting pressure for companies to serve these users.



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Communications servers provide modem management, advanced routing, remote access and other capabilities.

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Communications servers transcend terminal servers in this market segment by providing more than just a simple modem connection to a host. Called access servers by some vendors, these devices significantly improve and simplify network access through a dial-up connection by providing dynamic addressing. When users dial into the network through the communications server, specialized firmware authenticates the user and dynamically assigns the user's Internet Protocol (IP) address to the port.

Dynamic addressing enables users to use all the network resources to which they have been assigned rights. From the network's perspective, the user looks as if he or she were logging into the LAN from a local workstation. Users can retrieve applications from a host or file server, check email, transfer files, print on the LAN, send faxes via a fax server and perform just about any other normal network activity. It is also an ideal solution for running remote client/server database applications; that is, where the amount of data traversing the lines does not require a router or dedicated T1 line.

In comparison, terminal servers limit remote access to a dumb terminal paradigm.

Using a terminal emulation program with a communications server allows a workstation to log into a host as a terminal, providing the same connectivity as a terminal server. Some communications servers enhance this basic terminal session by providing binary file transfer protocols, such as ZMODEM, for sending files between the two systems.

But communications servers can also enhance remote communication sessions through enabling technologies such as the Serial Line Internet Protocol (SLIP) or the Point-to-Point Protocol (PPP). When a PC runs SLIP, which allows the use of IP over a serial line, it behaves as a host on the Ethernet. Users can issue commands to connect to any host to which they have rights. And using Telnet, they can transfer files back and forth, transparently switching to and from binary mode.

SLIP provides additional advantages. For instance, a PC using PC-NFS or some other remote networking software can access files on an IBM Corp. RISC System/6000, Sun Microsystems Inc. workstation or some UNIX systems acting as a file server. SLIP combined with the advanced remote access features of a communications server enables remote PC users to access the network and a local host through a modem pool.

PPP is a newer protocol that improves SLIP by adding header compression, support for other network-layer protocols and other features. Many communications server vendors now support, or have announced plans to support, PPP in their products.

These same SLIP or PPP benefits extend to X terminal users. The X Window System terminal market is just beginning to accelerate, so the ability to enable workers to set up low-cost X terminals remotely, with full windowing and graphical capabilities, in their home or branch offices, is another important application that distinguishes communications servers from terminal servers.

Network Management

Communications servers are also distinguished by their more robust network management capabilities. The devices often provide their own host-based management tools, which enable administrators to manage hundreds of communications servers remotely from a single workstation, if needed.

With some high-end communications servers, users can duplicate almost any function they can perform with a line monitor or breakout box. For example, they can tap into ports; force control signals from low to high, or vice versa; find out who is connected and if that user is active; send warning broadcasts to ports; and send test messages to users.

Using the remote access capability of a communications server, administrators can perform system administration functions from home or other locations by using Telnet to access the console parts. In addition, by connecting a server port to a debug port, programmers can work on hardware prototypes from remote locations.

These features make communications servers ideal for setting up low-cost network connectivity in remote office sites as well. Through SLIP or PPP, administrators can boot the remote servers when needed, run diagnostics and perform any network management feature included in the device. Essentially, the communications server does double duty and functions as a very inexpensive router for the remote site.

Some communications servers are capable of self-booting and standalone

Application Comparison

Communication Servers	Terminal Servers
Remote workstation access connectivity	Dumb terminal-to-host
Remote X Window System terminal access	Remote terminal users
Protocol translation or gateway services (e.g., LAT to Telnet)	Connecting printers and plotters
Remote office connectivity (e.g., routing for small remote subnetworks)	Simple modem pools
Remote network management	Networking computers that lack a network interface
Network access control; provides added security layer	Data PBX integration

Source: Xylogics Inc.

HANNA DYER

operation, which offer advantages in remote sites. Unlike conventional terminal servers, the devices are no longer dependent upon a specific host from which to boot or configure. Since they can operate independently, high-availability Ethernet access can be provided, even if a host system or other networking device malfunctions. It also allows administrators to shut down computers for security or maintenance reasons without affecting network access. These capabilities are especially important for remote sites where employees may not have the technical skills to deal with communications server problems.

In UNIX environments, communications servers usually support the Simple Network Management Protocol (SNMP) standard for network management. Some UNIX-based communications servers include their own Management Information Base (MIB), a built-in database of network management information that enables the device to be managed by a management station. This enables administrators to manage and monitor the communications server's ports from within another SNMP-compliant management package.

Security

When companies are only connecting terminals to a host via a terminal server, security isn't much of an issue–the host computer is usually well equipped to handle any potential problem. Add modems and remote users to the picture, and the security issue becomes paramount.

Many communications servers now come packaged with a variety of features that extend a security perimeter to the network. For example, some communications servers can force user validation before accessing the network, and they can restrict access to specific ports, hosts and/or networks. More advanced communications servers even maintain audit trails that show who dialed in, what machines were used, and for how long. Security software offered by some communications servers can be integrated with other security systems for a network-wide policy.

Communications servers also offer better physical security. Because modems connected directly to a host or workstation tend to be scattered throughout a facility, communications servers help administrators keep them physically secure in one central location by setting up modem pools. When modems are connected directly to hosts on workstations, security is only as good as the least secure host on workstations. UNIX is more secure than people think, but improper systems administration can easily cripple UNIX defenses.

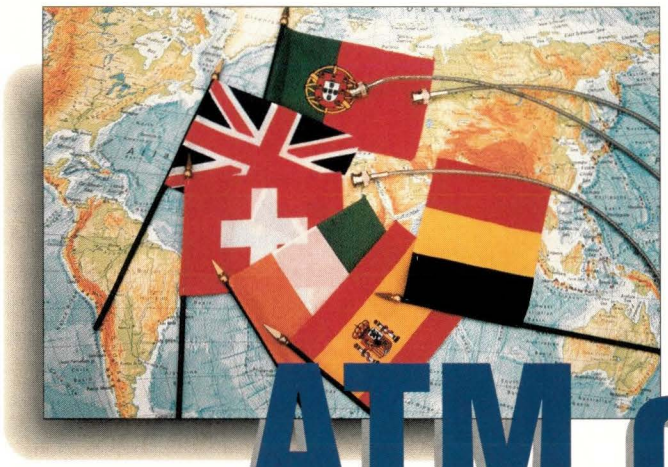
Summary

Terminal servers provide the most cost-effective way to add users to a network–if that's all you need. They offer a better wiring scheme, enabling terminal connections to be located anywhere they are needed on the network, instead of wiring terminals to the back of a host.

But sometimes terminal connections are not enough. Technology has evolved significantly in recent years, enabling more advanced types of devices to be introduced. This is important for several reasons. Companies need a single solution to support many types of devices, from PCs and X terminals to modems, printers and hosts. Networks are growing larger, requiring better management capabilities. More workers are disenfranchised from their networks and are demanding greater remote access. In turn, support for remote users requires defending the network from security breaches. And networks are becoming more segmented, requiring companies to find lower-cost ways to route data across the network without investing in expensive routers, bridges and gateways.

Communications servers are the next-generation devices designed to meet these ever-evolving, ever-changing network connectivity needs. ➸

Jack O'Neil is vice president of marketing at Xylogics Inc. in Burlington, MA.



ATM on Trial

by MARSHA W. JOHNSTON

A much smaller installed base of desktop-to-backbone FDDI connections and a widespread penchant for adopting new technology only when the business case has been carefully made could make Europe fertile territory for the growth of newer, rival technologies such as ATM and 100-Mb/s Ethernet.

In the meantime, 18 of Europe's public telecommunications operators are pushing the Asynchronous Transfer Mode (ATM) issue by instituting the largest trial to date of the ATM international standards guideline.

Users in Europe adopt a wait-and-see attitude toward high-speed networking schemes.

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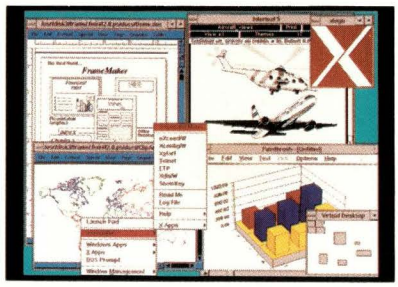

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Circle No. 15 on Inquiry Card

Since most users in Europe are still putting Fiber Distributed Data Interface (FDDI) onto their backbone networks to expand the bandwidth, the follow-on step of using the technology for backbone-to-desktop links has so far been taken by only a handful. Dataquest Europe estimates that the population of PC-to-FDDI links in all of Europe in 1992 was a meager 2,000 to 2,500.

In contrast, Dataquest says, the number of users putting FDDI on backbone networks has increased dramatically since 1991. Says David Taylor, industry analyst, "Cisco [Systems Inc.], for example, tripled its business in Europe in 1992 with AGS Plus, which was its platform at the time for FDDI connections. 3Com [Corp.], Wellfleet [Communications Inc.] and others have all seen increases in their FDDI backbone business as well."

The question then becomes which desktop link user organizations will choose when the use of high-bandwidth networks fosters a need for yet more bandwidth for PC or workstation applications.

With the increased use of FDDI on the backbone, the number of PC-to-FDDI connections will undoubtedly continue to multiply, if only as an interim solution. "PC connections to FDDI will start to appear progressively in work groups," says Dataquest's Taylor. "If people have adopted FDDI in the backbone, it's because it's a technology they're comfortable with, so connecting PCs into it will be no big deal."

At least for wide-area networking, Europe's public telecom operators seem intent on leading the world with ATM technology.

Without disputing that such connections will spread, Cees van der Stoep, operations manager, southern Europe, for SynOptics Communications Europe B.V., in Woerden, the Netherlands, says users are not necessarily jumping immediately to FDDI to increase the size of their desktop connections. "Customers see FDDI, but they also see new technologies and ask us whether it's the right solution," he said.

Southern Europe, which is typically slower to adopt technology than the north, is a case in point. "We see a slow trend toward FDDI in the south, but with the new technologies emerging, they are waiting a bit. Spain, for example, is an IBM [Corp.]-dominated environment, so there are no real requirements for increased bandwidth on the backbone network," van der Stoep says. "One thing I've found is that the south tends to skip technologies and go to the state of the art. In Portugal, for example, they insist on the latest in network management capabilities."

South versus North

Where some of the wait-and-see attitude in Europe's sunnier environs may be due to a lack of demand for bigger pipes at the server, even those few users in northern Europe who see the need are asking which desktop connection to use.

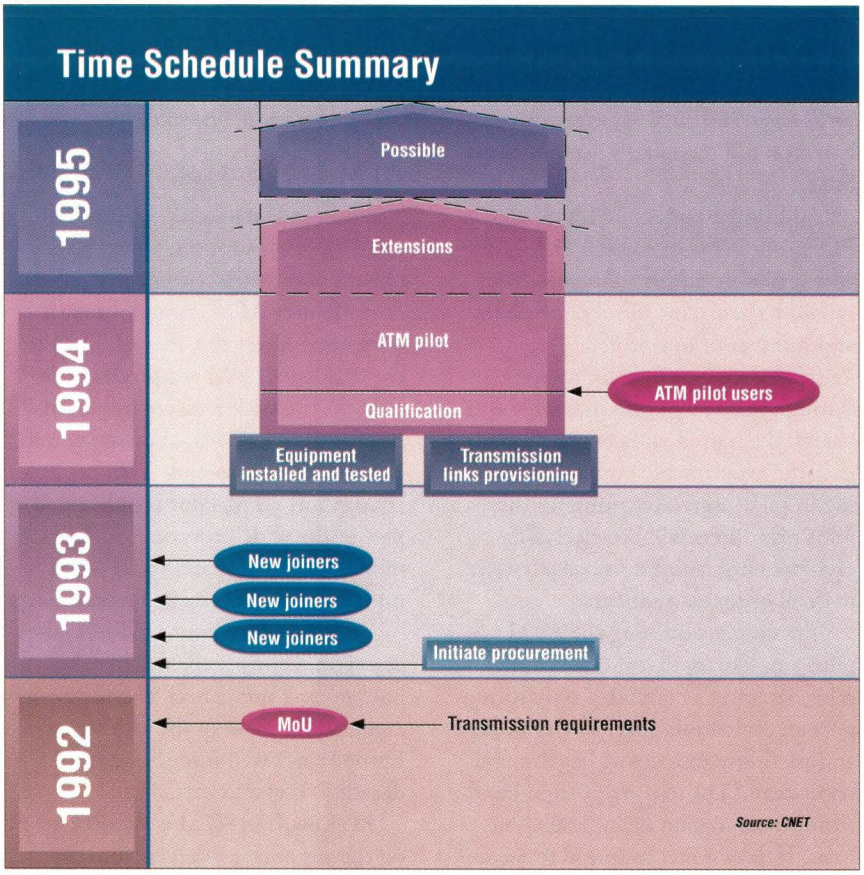
In countries like Belgium, the Netherlands and Switzerland, a few users are starting to segment 10-Mb/s Ethernet, which tends to create bottlenecks at the server, van der Stoep says. "These are mostly users with powerful client/server computers, Sun [Microsystems Inc.] workstations and Banyan [Systems Inc.] networks, who are seeing the need for bigger pipes and asking, 'Do I need FDDI or ATM?'" he says.

Van der Stoep says SynOptics tells users to design FDDI networks in a star topology, which will allow them to migrate to an ATM network by replacing the center hubs with ATM technology.

At least for wide-area networking, Europe's public telecom operators (PTOs) seem intent on leading the world with ATM technology. In July, ATC Finland and the Austrian telecommunications authority signed the "protocol agreement" for the estab-

Node Location:
Prospective Sites of International Cross Connects
(Minimum 34-Mb/s network for ATM MoU Members)

LEE A. BARTELL



LEE A. BARTELL

lishment of a pan-European ATM Pilot, which aims to check international ATM standards from the European telecommunications Standards Institute (ETSI) and International Telecommunication Union-Telecommunications Standardization Sector (ITU-TSS) Standardization. It will also check proposed specifications from Eurescom, a parallel organization set up by Europe's telecom operators.

The pilot organization, which was set up last November by France Telecom, British Telecom, Deutsche Bundespost Telekom, la Societa Finanziaria Telefonica p.a./Iritel (Italy) and Telefonica (Spain), comprises also Belgacom (Belgium), Telefones de Lisbos e Porto (Portugal), Telia AB (Sweden), Norwegian Telecom, Swiss PTT Telecom, PTT Telecom Nederland (Netherlands), Telecom Finland, Telecom Portugal, Tele Danmark and Telecom Eireann (Ireland).

With 18 operator-participants, "the European ATM Pilot is the first time to test the CCITT ATM recommendations at this level," says Pierre Adam, manager of the ATM pilot technical group at France's Centre National des Etudes de Telecommunications (CNET) in Lannion. Adam is a member of the ITU-TSS' Commission 13, which handles the ATM guide recommendations.

"In Japan, NTT is experimenting with a certain number of manufacturers, and there are some trials in the United States. Bell South in particular is very active. But the European project is the first configuration involving so many operators," he says.

The pilot aims to validate the technical and standards issues involved in the support of benchmark services internationally. Those services have been identified as FMBA/Frame Relay, CBDS/SMDS and CBR Circuit Emulation.

"At a European level, we're going to define specific elements from the ATM pilot of how the [ITU-TSS] guide recommendations work. We hope there won't be any problems, but if a particular recommendation does not work properly, we will propose adding amendments to it," Adam said. The ITU-TSS recommendations cover essentially the aspects of how to make equipment from different operators interoperate.

For the European ATM pilot, operator-participants will set up the following network architecture:

- A ring transmission infrastructure, based on bidirectional PDH 34-Mb/s links.
- Additional nodes and links, such as PDH 140 Mb/s or SDH 155 Mb/s, which may be added to increase the capability, capacity, number of nodes and number of operators.

After initial interoperability tests through June 1994 (see timetable chart), the participants expect to evaluate the experiment, probably bringing in pilot users. According to the pilot plan, users will be selected by each operator, subject to consultation with all of the participants.

A document outlining the ATM pilot emphasizes that the use of the pilot network "is intended only to support an evaluation of ATM technology and its ability to support benchmark services and not to provide high-bandwidth transmission on a permanent basis. It does not correspond to a commercial service."

Adam adds that none of the operators has made a decision to market ATM network capacity. "The objective of the pilot is to provide all of the elements to the marketing people at the PTOs, which will enable them to make a decision," he said.

Communication Vendors Mentioned in this Article

Cisco Systems Inc.
1525 O'Brien Drive
P.O. Box 3075
Menlo Park, CA 94026
Circle 141

SynOptics Communications Inc.
4401 Great American Pkwy.
P.O. Box 58185
Santa Clara, CA 95052
Circle 142

3Com Corp.
5400 Bayfront Plaza
P.O. Box 58145
Santa Clara, CA 95052
Circle 143

Wellfleet Communications Inc.
8 Federal Drive
Billerica, MA 01821
Circle 144

ATM End-to-End?

Although Dataquest's Taylor applauds the European telecommunications authorities' cooperative effort on wide-area ATM, he notes that it does not address the issue of ATM to the desktop. "ATM is a product not only for the wide area environment, but for the local area, allowing you to connect up end-to-end. The [European] ATM Pilot is public and part of the wide-area scenario, but it's only in the trial phase, which will probably last two years," he said.

"Unless you're running ATM end-to-end, you won't get the full benefits, but you will not get ATM end-to-end connections in all of the cities in Europe until well into the next decade," Taylor asserts.

The growth in ATM truly depends on the support it receives from the LAN supplier community, he adds. "Depending on which way the LAN community swings could influence the success or failure of ATM. It's fickle, too. Two years ago it was FDDI/CDDI, then came ATM as the flavor of the month, and now everybody's jumping on the 100-Mb/s Ethernet bandwagon," he said.

While the ATM applications that will spur the diffusion of that technology are being developed, it is entirely possible that LAN suppliers will move into the breach with 100-Mb/s Ethernet, Taylor argues. "If we have a common standard for 100-Mb/s Ethernet, it will become the common Ethernet product," he said.

CNET's Adam agrees that ATM must have applications that users appreciate in order to achieve market success. In the end, he said, "it will be up to the market to decide. Today, there is a niche for FDDI and a niche for Ethernet and it is for ATM to find its own place in the market. I'm optimistic that it will." ⊸

Marsha W. Johnston is a free-lance writer based in Paris.

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KnockKnock

by S. LEE HENRY

This month *SunExpert* takes a look at a handy, low-cost network monitoring and troubleshooting package.

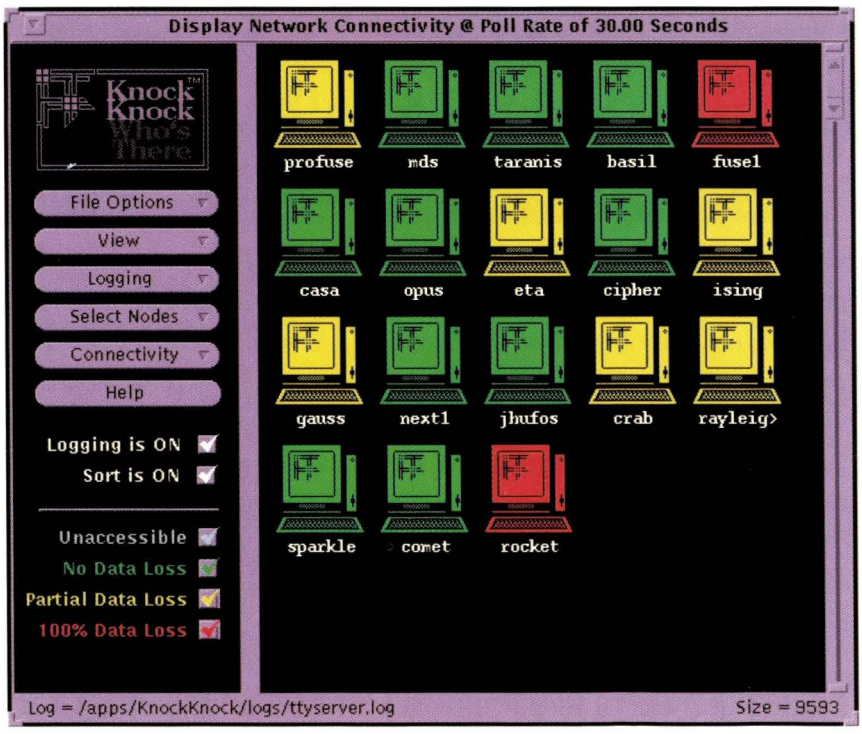
Knock Knock. Who's there? Ned. Ned who? Ned Work monitoring for the rest of us. For administrators and support staff who haven't made the plunge into SNMP-based network management because of the expense or because of the setup required, KnockKnock is going to knock your socks off. For a reasonable price of about $500, KnockKnock facilitates monitoring all kinds of network statistics. After covering some of the more obvious features of this little tool, I'll tell you how it helped me pinpoint a fairly serious network problem.

In its most basic application, KnockKnock monitors a collection of hosts. With a resizable window and zoom in/out features, you can easily adjust the view window to accommodate hundreds of hosts (each represented as an icon), sacrificing only the legibility of your host names if you get too carried away. You will usually select a smaller group of hosts using the tool's host selection form. All of my hosts were automatically included in the host list, and I was delighted that I could pick and choose a number of them before moving them to the selected list with a couple of button clicks. KnockKnock also let me save groups of selected hosts for later use. I created one host group (i.e., a "node file") containing all of my terminal servers and several others for hosts associated with specific projects.

KnockKnock uses four different colors to indicate how hosts are responding. These include: Unaccessible (this probably should have been "inaccessible," but who ever said software developers can spell?), No Data Loss, Partial Data Loss and 100% Data Loss. The "Unaccessible" state is your old network unreachable condition. The other loss states are obvious. Though I didn't really like the rather garish traffic-signal green, yellow and red used for the loss categories, I had to admit that the colors made sense. I also thought it was nice the way the tool, when closed to an icon, began to blink in red or green to indicate the latest state change for hosts I was monitoring.

Logging Changes

One extremely valuable feature of KnockKnock is its logging ability. All state changes involving monitored hosts can be saved in a log file. So, when a host goes from being partially to completely accessible, you'll see a line noting its change from yellow to green. In addition, the most recent state change can be pulled off the Connectivity menu, whether you're



logging or not. If you see a red icon on your display, you can quickly determine when it became that way.

Using the log file, you can review a long period of monitored activity using time and node information. If all of your monitored hosts change from green to yellow at about the same time, you can assume that at that particular time, your network became very busy. And, since the log file is in (yes, thank you!) simple ASCII, you can easily `grep` out data for a specific host or time period. Of course, you don't *have* to use `grep` (or any other UNIX command for that matter). KnockKnock's built-in queries and easily navigable menus provide easy access to most anything you'd want to do. Under the Connectivity menu, you'll find a lot of useful options. There are choices for `telnet`, `ftp` and `rlogin`. Each of these opens a window and starts up the appropriate connection. There is also a submenu of user-defined commands. This menu contains a sampling of commands like "Disk/User Usage," which shows you the file system statistics (using `df`) and users (using `w`), and TopTen, which shows you the 10 most active processes (a `ps` piped to a `head` command). You can build such commands yourself, you ask? Ah, yes. That's the beauty of it. Building your own shell scripts and adding them to this menu is a piece of cake. You can add your favorite queries for your personal convenience or prepare a set of scripts to allow someone less wizardly than yourself to monitor your network when you're too busy.

Performance

With my poll rate set for every second and monitoring 30 hosts, I could see a slight rise in network saturation amounting to maybe 2% or 3% of available bandwidth. The ICMP echo reply packet is small, after all, and KnockKnock `ping`s one host at a time. When I reduced the poll rate to 30 seconds, I could no longer pick the additional traffic from the background. KnockKnock allows you to poll as infrequently as once an hour or as often as every 25 milliseconds (for a single host). What works best for you depends on how critical the resources you are monitoring are as well as how many systems you're monitoring at a time.

KnockKnock

Company
Tantara Technologies Inc.

Address
26 W. Dry Creek Circle, #195
Littleton, CO 80120

Phone (303) 347-2957

Price $500

Best Feature
Extremely easy to use.

Worst Feature
Beyond host connectivity, monitoring requires you to take deliberate action.

Circle 156

Installation

Installing KnockKnock was a breeze. There was nothing to configure. Starting the tool and monitoring a collection of hosts was as easy as selecting

the hosts to monitor from a list. It only took me a couple of minutes to add a command to fetch the hostid from the remote machine and display it in a small shell tool using a nice fat font. More complicated scripts will take whatever time is required to build the shell commands.

Underneath, KnockKnock uses `ping` (the handy-dandy ICMP echo reply request) and the remote shell command, `rsh`, to do its work. To get a response from `rsh`, the monitored systems need to trust the monitoring host. Otherwise, you'll get a lot of "Permission denied" windows rather than a lot of answers when you use the connectivity and user-defined commands. These constraints are simply out-of-the-box UNIX. Though there's not a lot of magic in the guts of KnockKnock, the wrapper is worth a lot. The convenience of setting a timer for your `ping`s and depositing your queries in a pull-down menu means you'll probably really monitor many things you'd ordinarily check only when there's a problem. In addition, the logging of state changes provides a history for network troubleshooting

Testimonial

I started using KnockKnock at a time when some creepy-crawly network problems had only just begun to plague my network. High collision rates and occasional terminal server failures were beginning to wreak havoc in my ordinarily "under control" network operation. To see what would happen, I left KnockKnock running overnight with my workstation connected across a suspect repeater. When I came in the next morning, all of the hosts on my display had turned red. Numerous state changes had been recorded in my log file for the monitored hosts, long bouncing between green and yellow, and later between yellow and red, before the changes had stopped and the icons remained in the red state in which I found them. The final failure had occurred very late at night at a time when there was virtually no other network activity. The frequency of the state changes and the slow degradation led quickly to some failing hardware.

KnockKnock is not SunNet Manager. It doesn't support agents who watch for conditions to arise and then send you mail. You have to decide what you want to monitor (besides connectivity) and invoke queries (like TopTen) when you want an answer. It can, however, provide the same kind of information that you would want from a more advanced network management tool. And it's cheap and easy to use. ⊸

S. Lee Henry manages computer and networking services for the Physics and Astronomy Department at Johns Hopkins University. Email `slee@expert.com`.

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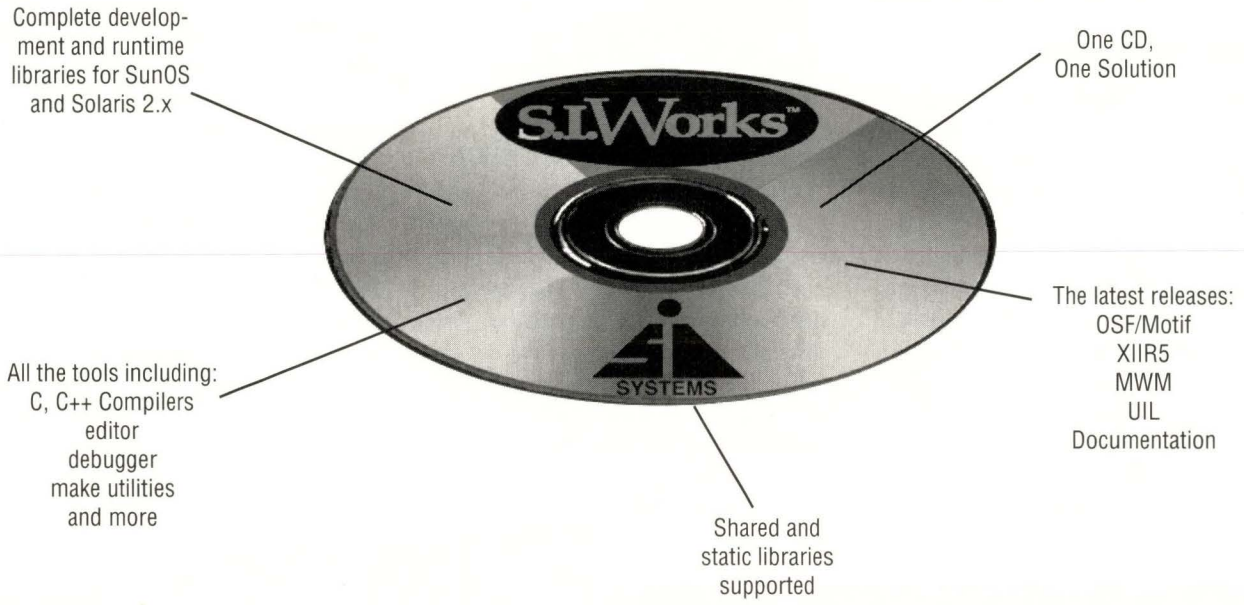

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NEW PRODUCTS

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Motif for SunOS

Metro Link has announced an implementation of OSF Motif 1.2.2 for SunOS Version 4.1 (Solaris 1) and above running on the SPARC architecture. The run-time package includes the Motif window manager along with 19 other Motif applications, including xim, an image manipulation tool kit; motifshell, a shell environment for using Motif; widgetView, a program for exploring widgets; and motifanim, an animation demonstration.

The development package includes a static and shared Motif library, and the Motif Resource Manager library. Also included is UIL (User Interface Language) for high-level specification of Motif application layouts. Manual pages are installed for all Motif functions, and source code is provided for all of the demonstration programs. Prices are $199 each for Motif Runtime, Motif Development, Metro-X X11.5 and Metro-XIE.

Metro Link Inc.
2213 W. McNab Road
Pompano Beach, FL 33069
Circle 101

Distributed HSM for Sun

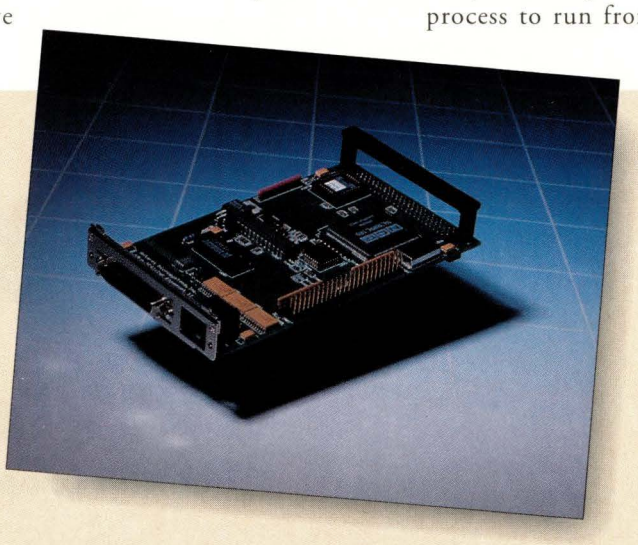
Introl has unveiled Hierarchical Storage Management (HSM) software for the Sun environment. FlexStor, as it's called, automatically and transparently migrates data files to the most cost-effective medium based on user-definable criteria. Migration is supported for all popular SCSI disks to rewritable optical disk libraries from Hewlett-Packard Co., Interactive Development Environments Inc., NKK and to all Exabyte Corp. 8mm tape libraries.

Once installed, no further administration is required. Files are monitored and migrated based on setup instructions. Migration can be based on file age, size, group, date, location, ownership, etc.

Client- and server-level migration are supported with files automatically migrated to and from local client disks through the network hierarchy to the server disk, near-line disk or tape, and then off-line tape.

Each client/server module operates as a part of the overall HSM environment, but they are also run as independent processes. Administrators can load each component of FlexStor on separate processors to increase reliability, facilitate maintenance and improve system throughput. Individual pieces of FlexStor can be started and stopped independently. Performance throughput is enhanced by allowing each process to run from

Fast/Wide SCSI for SBus



Antares Microsystems has announced what it calls the world's first Fast/Wide SCSI Host adapter for SBus systems. The SCSI-FWS board doubles the peak SCSI data transfer speed from 10 to 20 MB/s by increasing the width of the SCSI data bus from eight to 16 bits.

According to the company, the board allows Sun workstations to use the new-generation Fast/Wide SCSI disk drives and is particularly useful with RAID arrays that are choked by lack of SCSI bandwidth.

With the board, you can connect an additional 15 SCSI devices to your system. The maximum data transfer rate of 20 MB/s eliminates bottlenecks that cause one disk to wait for another. An on-board SCSI command processor, 16-byte burst DMA and a 64-byte FIFO buffer minimize system load.

A Sun Common SCSI Architecture-compatible software driver is included with the SCSI-FWS board for SunOS 4.1.3 on Sun's SPARCstation 10, SPARCclassic, SPARCstation LX, 600 MP series and compatible versions of these machines. After you reconfigure your kernel, the Antares SCSI-FWS uses the standard Sun disk, tape and CD-ROM drivers. With appropriate cabling, the Antares SCSI-FWS board is backward-compatible with slow or narrow SCSI devices. The list price is $645.

Antares Microsystems Inc.
160B Albright Way
Los Gatos, CA 95030
Circle 100

an individual server, maximizing the amount of available processing power.

Servers can be brought down for service individually, and when the server comes back on line, the software automatically detects it and reattaches it to the rest of the system. It is then synchronized with the rest of the network, and its contents are compared to ensure that each server has the correct current data.

FlexStor supports a full range of HSM features for all SunOS and Solaris 2.X-based workstations and servers and operates under Open Look and Motif.

Prices start at $4,000 and include in-house technical support as well as a 60-day money-back satisfaction guarantee.

Introl Corp.
2817 Anthony Lane South
Minneapolis, MN 55418-3254
Circle 102

XpressFax 2.0

Andataco and XpressWare have announced the release of XpressFax Version 2.0. XpressFax 2.0 features an easy-to-use Open Look-based GUI interface that allows users to send and receive fax documents directly from SPARC workstations or X terminals. XpressFax is a feature-rich and configurable fax package. Features inlude online HyperText help; OCR autorouting; seamless links from FrameMaker, IslandWrite, Interleaf and others; broadcast faxing; and fax previewing and editing.

XpressFax 2.0 is currently available from Andataco for $695 for a five-user floating license. Ftp-able copies are available from `ftp.uu.net` in directory `/vendor/andataco/xpressfax-2.0`.

Andataco
10140 Mesa Rim Road
San Diego, CA 92121
Circle 103

A Binary Editor

A developer's tool from DUX, the Fixer, allows the programmer to replace all the functions of `od`, `diff` and `adb` with one tool.

Among its features, Fixer loads and displays files of any length in a single three-column window. The first column shows the binary offset into the file, the second column shows the actual data in hexadecimal format, and the third column is ASCII representation. When a user presses the "Edit" button, a single-line data editor window appears. The user may then specify an offset into the file or search for a specific data pattern or string within the file. Once the offset is determined, the three-column main screen automatically scrolls to the desired offset, displaying a full page of data. The editing window understands data given in hexadecimal or quoted strings.

For binary comparisons, Fixer's "View" window contains a "Compare" button that will compare any named file with the one in the main window

on a byte-by-byte basis. When a difference is discovered, the main screen automatically scrolls to the correct offset and highlights the differing data. The price for the Fixer is $99.

DUX Software Corp.
4906 El Camino Real
Los Altos, CA 94022
Circle 104

C-Size Ink-Jet Plotter

Advanced Matrix Technology, originally a manufacturer of dot-matrix printers, has announced its first ink-jet plotter offering, the Intelli-Plot InkJet plotter. The Intelli-Plot uses Canon U.S.A. Inc.'s BJP-50 bubble-jet print engine to deliver C-size, 360-by-360-dpi drawings in less than five minutes. Unique features include a "plain-English" LCD display and a printer pedestal with built-in C-size roll-paper feeder so that long periods of unattended operation are possible. Fifteen logical pens are offered to allow lines 0.07 to 0.98mm thick.

The plotter can receive up to 20 HP-GL/2 and AutoCAD ADI plot descriptions via simultaneously active parallel and serial interfaces. Users manipulate drawing while in the print queue. The Intelli-Plot uses pop-in ink cartridges that provide approximately two million characters. Normal operation provides automatic head capping and cleaning, plus internal diagnostics and real-time fault reporting. The retail price for the plotter will be $1,995, which includes a one-year manufacturer's warranty.

Advanced Matrix Technology Inc.
765 Flynn Road
Camarillo, CA 93012-8077
Circle 105

Low-Cost Laser

NEC has introduced Silentwriter, a host-resident, Windows-compatible laser printer. The Silentwriter SuperScript 610 laser printer provides 300-dpi resolution with Sharp Edge technology for 600 dpi and engine speed of 6 ppm.

Users are given the choice of tracking

Upgrades, Enhancements, Additions...

• Aurora Technologies has added RS-422 and RS-485 signal support to its SBus expansion products. The RS-422 gives SPARC systems the ability to connect to dozens of terminals, modem banks and other peripherals at a distance of up to 4,000 feet. The RS-485 capability is suited for applications that require multiple peripheral connections along a single serial line. **Aurora Technologies Inc.**, 176 Second Ave., Waltham, MA 02154. **Circle 106**

• Phase X Systems has announced a new release of its X Window Server software. The new release, which is based on MIT's X11R5, improves the performance of the company's X terminals. It has enhancements in networking, file sharing, installation, ease of use and so on. **Phase X Systems Inc.**, 1600 NW 167th Place, Beaverton, OR 97006. **Circle 107**

• Solbourne has reduced the price of its 128-KB memory cards by 20%. The new price is $15,200. **Solbourne Computer Inc.**, 1900 Pike Road, Longmont, CO 80501. **Circle 108**

• Portable Graphics, a vendor of graphics and emulation software, has announced a new version of its NPGL library. The new release allows Silicon Graphics Inc. applications to be accessed through X terminals. With the product, NPGL-X, a user with a color X11 server can remotely access an SGI machine over a network. **Portable Graphics Inc.**, 1 Technology Center, 2201 Donley Drive, Suite 365, Austin, TX, 78758-4538. **Circle 109**

• Serial and parallel board maker Mesa Ridge Technologies has reduced the prices on its Magma line of products. A single Centronics parallel-port board is down to $145 from $175; a dual-parallel-port board is down to $295 from $350; a four-serial-port board is down to $395 from $425. **Mesa Ridge Technologies Inc.**, 6725 Mesa Ridge Road, San Diego, CA 92112. **Circle 110**

• X terminal maker Pagine has introduced new software for its products. The new version, CD2000 X, comes on a CD-ROM. It supports a light pen interface option and several local clients. **Pagine Corp.**, 1961-A Concourse Drive, San Jose, CA 95131. **Circle 111**

• Simon Petroleum Technology has shipped Version 4.0.2 of Tigress–The Integrated Geoscience and Reservoir Engineering Software System. Tigress integrates a variety of geoscience and reservoir engineering applications for use in such areas as petrophysics, mapping and geology. The new version provides enhanced data import/export facilities. **Simon Petroleum Technology Corp.**, Reservoir and Production Services, 11200 Westhelmer, Suite 200, Houston, TX 77042. **Circle 112**

• A new version of EpochServ, a group of integrated client/server data management software products, has been announced by Epoch Systems. The new version includes support for multilevel staging, the ability for files to span optical volumes and expanded peripheral support. **Epoch Systems Inc.**, 8 Technology Drive, Westboro, MA 01581. **Circle 113**

• Concord Communications has made its Trakker network management application software available for Hewlett-Packard Co.'s OpenView 3.0 network management system. Trakker is a network monitoring system. It is already integrated with Sun's SunNet manager. **Concord Communications Inc.**, 753 Forest St., Marlboro, MA 01752-3044. **Circle 114**

• A new version of Math Advantage has been shipped by Quantitative Technology. The product, which is a library of mathematics subroutines, has been expanded from 604 to 996 routines. These include routines for real and complex vectors, full and SPARSE matrices, polynomials, root finding and nonlinear system solving, integration, differentiation, differential equations, approximation and curve fitting, graphics, signal processing, image processing and so on. **Quantitative Technology Corp.**, 331 Page St., Suite 12, Stoughton, MA 02072. **Circle 115**

their print job with a traditional print job status indicator or an animated graphic of the document printing. A custom print manager provides direct, on-screen control of printer setting and operational parameters. An added bonus: The 610 powers down to under 20 watts after 15 minutes of nonuse. Price is $700 with a two-year limited warranty.

NEC Technologies Inc.
1414 Massachusetts Ave.
Boxboro, MA 01719-2298
Circle 116

DEC StorageWorks

Digital has announced StorageWorks, its line of storage solutions. Modular design is DEC's boldest feature, allowing for multiple configurations. For example, a Building Block Shelf packaged with a base support unit, top and locking access doors on the front and back create a standalone modular storage expansion pedestal. This unit can then act as a package that slides into the StorageWorks Datacenter cabinet, which holds multiple building block units and controllers. SCSI-2 storage devices in snap-in carriers provide the actual storage.

One product specifically featured for Suns was the deskside expansion unit consisting of hot-pluggable SCSI-2 devices in standalone or rack-mountable configurations. For now, the unit will support DEC's 1.05-GB and 2.1-GB, 3½-inch drives as well as the new 3.5-GB, 5¼-inch drive. DAT, 8mm and CD-ROM drives are slated for support later this year. Pricing depends on configuration.

Digital Equipment Corp.
146 Main St.
Maynard, MA 02754
Circle 117

Sourcebook for SPARC Architecture

SPARC International has announced a comprehensive catalog of "building-block" technologies for SPARC-based computer and embedded/real-time products. Called *SPARCBuilders*, the catalog gives builders of SPARC-based products a single reference to the infrastructure that supports the SPARC open, multivendor industry model.

The Spring 1993 edition describes the products and services of more than 360 companies. The catalog is published twice yearly–in the spring and fall. SPARC International members can purchase individual copies of the catalog for $12 plus shipping and handling; volume discounts are available. The nonmember price is $16 plus shipping and handling.

SPARC International
535 Middlefield Road, Suite 210
Menlo Park, CA 94025
Circle 118

Printer Control through a GUI

Seiko's CHCOPY is network printing software for UNIX and VMS workstations. CHCOPY provides a consistent way to capture, preview, correct and print screen images and graphics files to all Seiko color printers. The application runs on both Motif and Open Look window systems. The package is available for Sun, Hewlett-Packard Co., Digital Equipment Corp., IBM Corp. and Silicon Graphics Inc. workstations.

CHCOPY offers the ability to capture part or all of your screen in 8- or 14-bit color, and in TIFF, workstation native screen raster and X11 raster formats. Printer adjustments like gamma correction, rotation, positioning and offset, and zooming and fractional scaling can be controlled from the workstation. Images can be previewed and modified before sending to either a local or network printer. Other features include password access limitations; on-line help; and date, file name, user and record number printing on the document. CHCOPY can be configured to process the print job at either the local workstation or at a remote workstation on the network.

Pricing is $999 for a single-user license, $1,999 for a 10-user license and $2,999 for a site license.

Seiko Instruments USA Inc.
1130 Ringwood Court
San Jose, CA 95131
Circle 119

Fault-Tolerant RAID

ECCS has introduced a fault-tolerant network storage subsystem featuring RAID technology. The RAID Module FFT-1 uses advanced mirroring capabilities and contains redundant drives and power supplies that can be "hot-swapped" while the system is on-line. The product can be directly connected to systems from AT&T, NCR Corp. and Sun as well as Novell Inc. NetWare platforms.

The module was designed for standard 19-inch-wide cabinets and requires 3½-inch, 1.5-GB disk drives. Each FFT-1 enclosure in the cabinet features space for up to six drives.

Current pricing for a 4.5-GB configuration is $28,000.

ECCS Inc.
1 Sheila Drive, Building 6A
Tinton Falls, NJ 07724
Circle 120

New Power Hits the Market

The Pulizzi 3102 intelligent power controller is the second in the IPC series. The company, claims that, unlike many other power controllers, the 3102 will enable users to access and control power distribution systems individually from a remote location.

The 3102 comes factory programmed to control either the entire system or each outlet individually. It fits in one standard 19-inch rack space. The unit itself is protected by a two-pole, 20-amp circuit breaker. Eight LEDs indicate power to the individual corresponding NEMA 5-15R (switched) outlets, while a ninth indicates power to the unit itself.

The unit communicates with a computer via an RS-232 serial port. Should a remote workstation be used, a modem and telephone line may be employed. Among the options available are EMI/RFI filtering, spike/surge suppression and a watchdog function for system reboot. The IPC 3102's list price is $1,200.

Pulizzi Engineering Inc.
3260 S. Susan St.
Santa Ana, CA 92704
Circle 121

Elite Monitor

Hitachi Group's Nissei Sangyo America announced the latest member of its family of high-end CAD/CAM/CAE and Windows monitors, the

SuperScan Elite 21. The Elite 21 offers full scan capability for broad image display, true RGB color control plus white balance control for fine-tuning color, automatic pin-cushion adjustment and refresh rates of 50 to 150 Hz.

This high-end monitor features a flat, square CRT with 0.28mm dot pitch. It is capable of running with a wide variety of graphics boards, supports resolutions up to 1,600-by-1,200 at a refresh rate of 66 Hz and is compatible with most PCs and workstations.

The monitor was designed with dual inputs for dual-system configuration, detachable tile/swivel base and easy-to-access front-mounted controls. Horizontal scanning frequencies from 30 to 85 kHz, and vertical scanning frequencies up to 150 Hz produce a nearly flicker-free display. The SuperScan Elite 21 is priced at $3,495.

Nissei Sangyo America Ltd.
100 Lowder Brook Drive, Ste. 2400
Westwood, MA 02090-1124
Circle 122

Xyvision Software for Sun/Solaris

Xyvision now offers its two publishing products, Parlance Publisher and Parlance Document Manager, on Sun SPARC and Solaris platforms. Parlance Publisher is described as a traditional composition and pagination system and allows users to automate all phases of publishing production.

Parlance Document Manager is a publishing information management system that helps editorial and production groups manage their publishing environment. Document Manager is targeted at companies that require a structured authoring environment, content and work flow management and page production solutions for paper and electronic output.

The products are available now on Sun Solaris 4.1.3 and will be available soon on Solaris 2.0. The $50,000 price includes software, workstation and associated print equipment.

Xyvision Inc.
101 Edgewater Drive
Wakefield, MA 01880-1291
Circle 123

Mosaic Works

An email directory synchronization product has been introduced by Hitachi Computer Products. Called Mosaic Works, the product allows network administrators to maintain a common email directory across multiple dissimilar platforms within a network. The product is divided into two parts: a server, which is resident on a SPARC-based system; and agents, one for each type of platform in the network. Currently, there are agents for cc:Mail, Microsoft Corp.'s Mail, Novell Inc.'s Message Handling

Service, Hitachi Inc.'s X.400 3050 WE II platform and, of course, the NIX Email SendMail utility.

In effect, the product functions as a remailing facility. Email from one directory is sent to the server. There, it is readdressed, so as to be compatible with the reader's email facility, and then delivered. Pricing on the product varies according to the number of agents supported. A five-agent license is $2,495, a 10-agent license costs $4,995, and a 20-agent license is $9,995. Agents, in turn, are priced separately at $995 apiece.

Hitachi Computer Products (America) Inc.
3101 Tasman Drive
Santa Clara, CA 95054
Circle 124

Keyboard for the Visually Impaired

To assist in compliance with the Americans with Disabilities Act (ADA), Hooleon has released a custom keyboard kit for the visually impaired. The kit features high-contrast, large-print key top legends for a standard

101-key-style keyboard in combination with raised Braille characters. These letter legends are applied to durable labels that adhere directly to the top of the keyboard's keys and, if needed, can be removed without damage to the keyboard.

Hooleon Corp.
260 Justin Drive
Cottonwood, AZ 86326
Circle 125

X Terminal for Publishing

JCC is targeting its latest high-resolution X terminal at the desktop publishing market. The GX1600 allows the merging of text and graphics and offers full-page pagination on a 1,600-by-1,280-resolution, 21-inch screen. Complete color separation is possible by exchanging graphics from other color terminals and workstations. As with all JCC X terminals, the GX1600 is a RISC-based system and works with most platforms in a multiple-host environment. It is priced at $4,995.

JCC Corp.
1 Bridge Plaza, Suite 400
Fort Lee, NJ 07024
Circle 126

NEC Printer

The low-cost Jetmate 1000 ink-jet printer from NEC is targeted toward small- and home-office consumers. Print speed is three pages per minute with 300-dpi print resolution. Included are 20 free-scalable TrueType fonts and a snap-in ink cartridge that lasts for 1,400 typical business-letter pages. An X Window System driver as well as PCL emulation are provided. The price is $329 with two-year overnight replacement warranty.

NEC Technologies Inc.
1414 Massachusetts Ave.
Boxboro, MA 01719-2298
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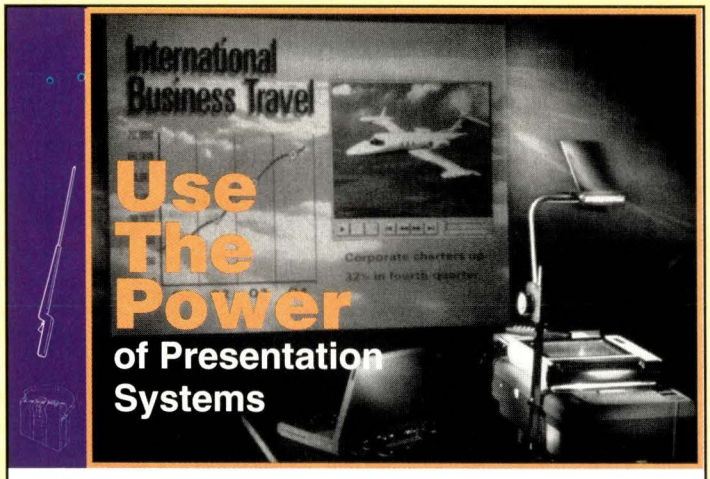

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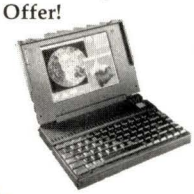

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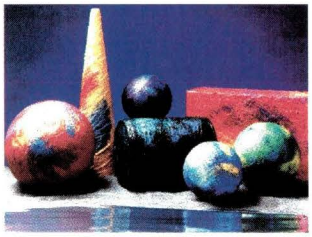

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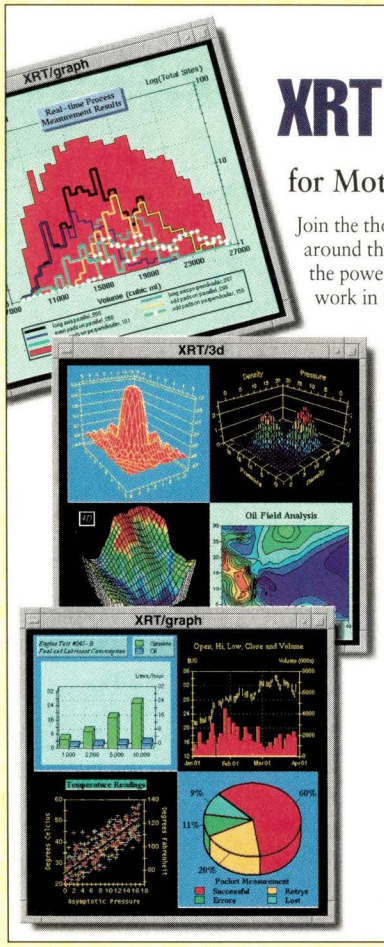

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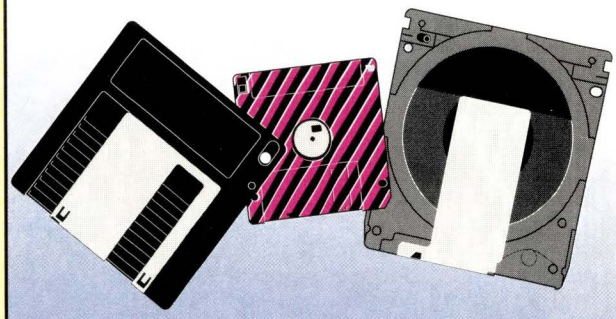

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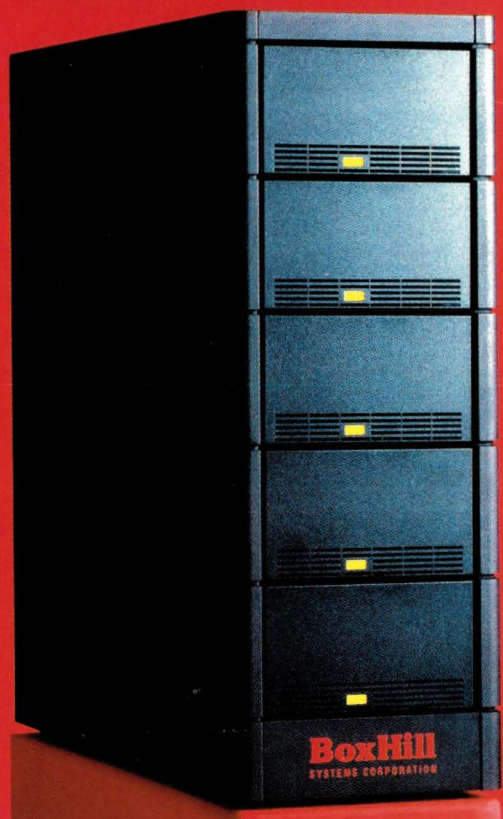

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