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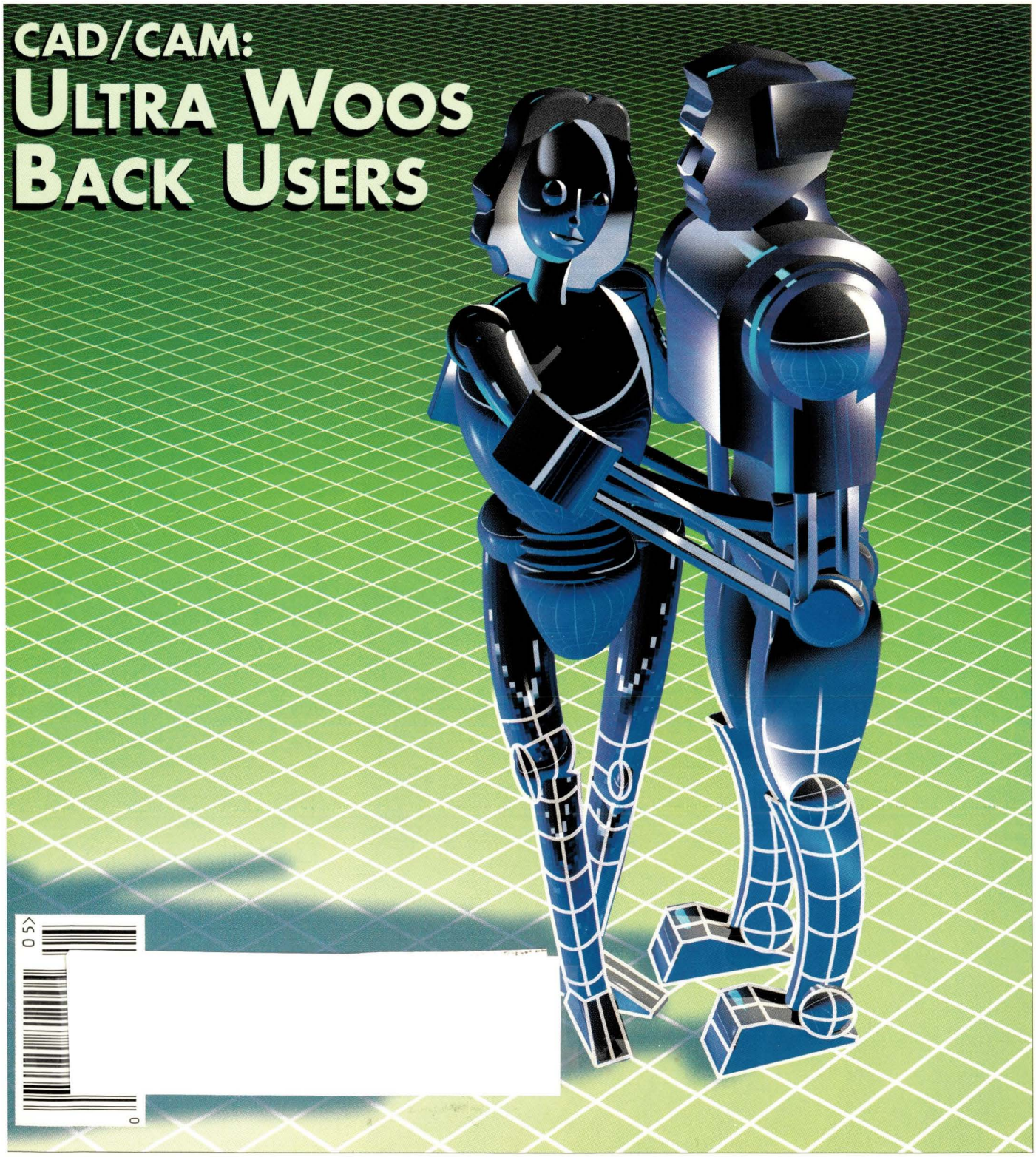

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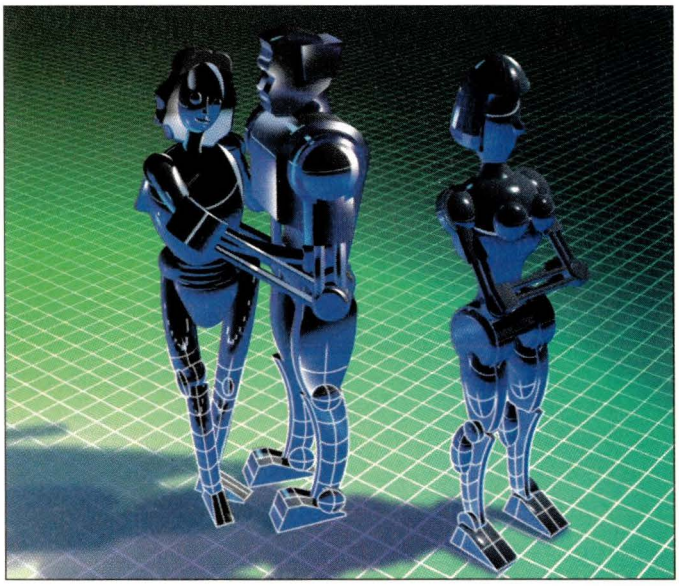

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PixelVision PV116sx Flat-Panel LCD Monitor
Ian Westmacott, Technical Editor

An active-matrix color LCD monitor is a must-see for anyone considering flat-panel displays.

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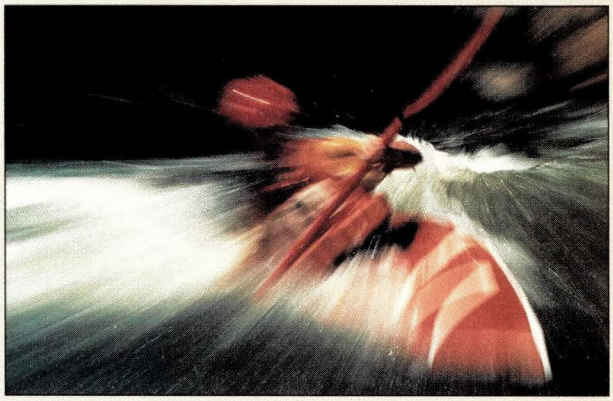

96 Full Speed Ahead

Karen Watterson

IBM's Internet technology is rocketing out of its labs so fast it's hard to keep up. Here's a starting place for those users who want to jump on board.

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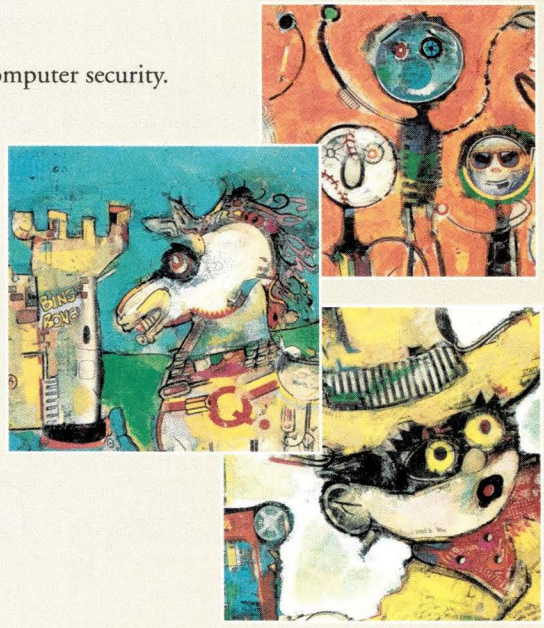

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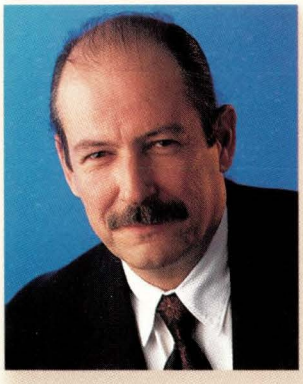

Two for the Road

Thanks to everyone who sent mail about the first issue of *SunExpert* with the RS/Supplement. As a general rule, the response was positive. There were, however, a few naysayers from both camps: Sun devotees and AIX partisans. We'll try in future issues to overcome the complaints by putting out a magazine that does justice to both platforms. I just hope that the few complainers are not indicative of why UNIX has never become a unified OS.

Our lead news item this month, on Page 6, shows how Sun has recently become more sensitive to its heritage. If you take a look at John Webster's story, you'll see that after all our complaining Sun has announced systems that address some of the performance problems dogging its bread-and-butter market–technical computing. As you'll see from the system specs, there is no longer a significant performance gap. Sun, long known for low cost, can now match numbers with the best of the high-end technical/scientific vendors. If you want to read more about Sun and its technical market offerings, turn to John's cover story, "Ultra Woos Back Users," Page 44.

On the AIX front this month, Karen Watterson, a frequent contributor to *SunExpert*, turns her attention to what IBM is doing on the Internet front. Although Sun servers and Java developments have been getting the lion's share of press attention, IBM has steadily built up a cadre of attractive intranet and Internet technologies. As Karen says, "IBM's Internet technology is rocketing out of its labs so fast it's hard to keep up." She makes a valiant effort in "Full Speed Ahead," Page 96, to take us on a guided tour.

Just a reminder for the Sun devotees: Java plays a prominent role in a number of IBM's offerings. And many of us speculate that as long as Java is viewed as a roundabout way of loosening Microsoft's grip on the corporate desktop, IBM will be a booster.

Doug Pryor

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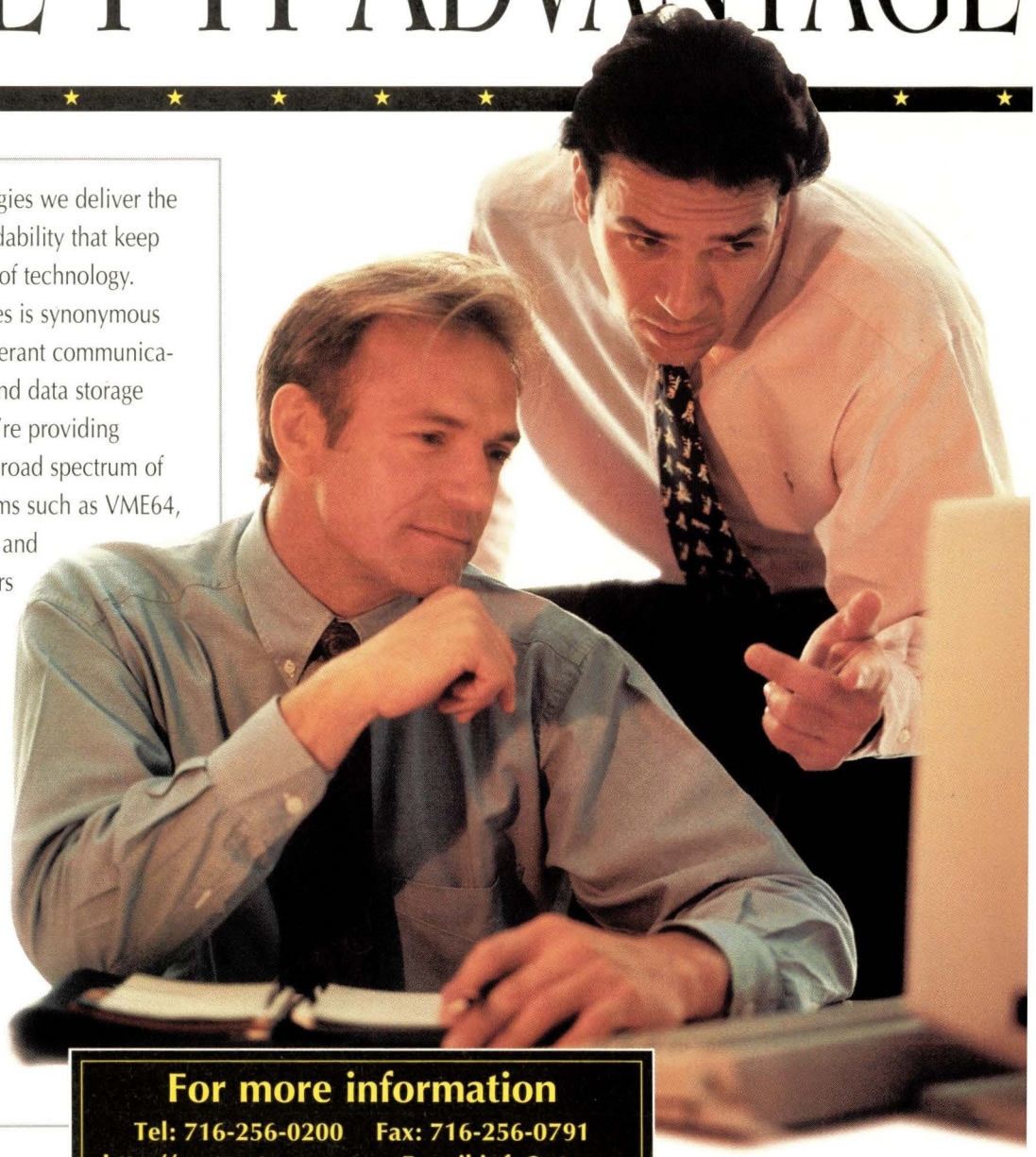

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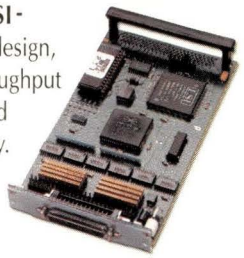

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Sun Bundles Management Software with Ultra Servers

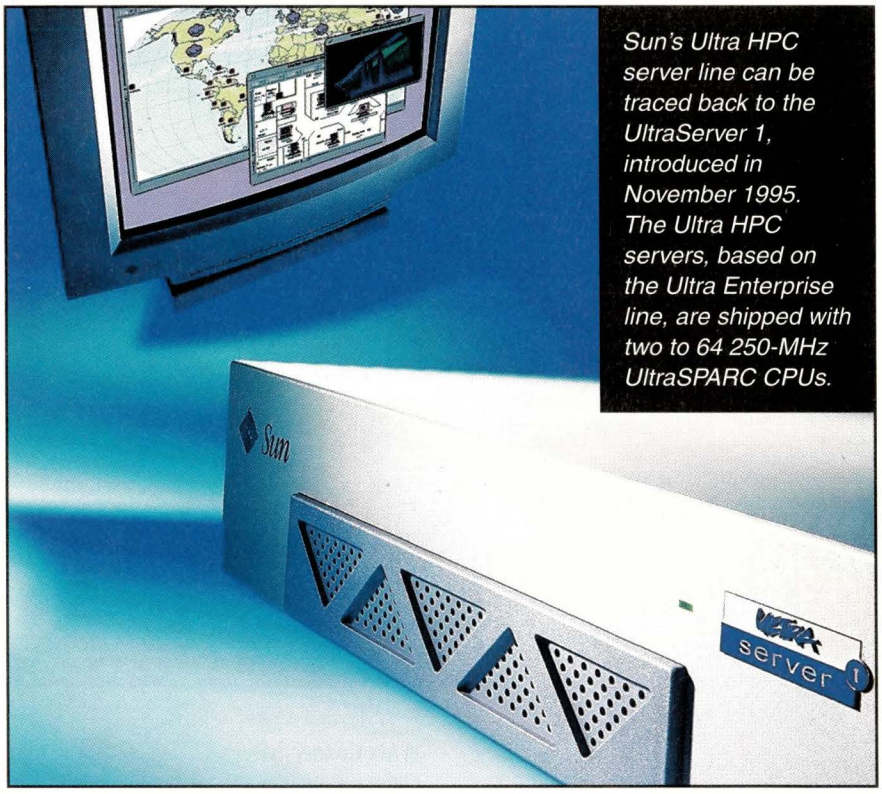
Sun Microsystems Computer Co.'s latest server announcement is more a portent of its technical computing road map than a substantive product introduction.

In March, Sun announced the Ultra HPC (high-performance computing) servers, which it calls a new line of symmetric multiprocessing systems. However, the Ultra HPC hardware is the same Ultra Enterprise line that Sun has been building on since November 1995, beginning with the Ultra 1 workstation and topped off recently with the Ultra Enterprise 10000 in January of this year. What's new about the Ultra HPC servers is the software the company now bundles with them, which eases the task of distributing and managing the application workload across server clusters.

This is primarily done with Load Sharing Facility (LSF) from Platform Computing Corp., Toronto, Ontario. The suite of system software products provides a single image of networkwide computer resources. This speeds batch, interactive and parallel job processing, and optimizes the use of all network resources, according to Sun.

Reiterating Sun's oft-stated desire to reestablish its foothold in the technical computing marketplace, David Yen, vice president of SMCC's Enterprise Server Product Group, says the ability to "effectively manage workloads across a distributed computing infrastructure is critical for any type of design, simulation or analysis... By bundling LSF, the de facto standard for workload management, with our new Sun Ultra HPC servers, we're delivering an integral part of the Ultra HPC operating environment."

Sun will preinstall LSF software on every Ultra HPC server, each equipped with two or more 250-MHz UltraSPARC CPUs, ranging from the dual-processor Ultra HPC 2, with 2 GB of memory and 1 TB of disk storage, to the Ultra HPC 10000, with 64 CPUs, 64 GB of memory and 20 TB of disk storage (with additional disk space available). In addition to Sun's SMP architecture, the servers feature Uniform Memory Access (UMA), the widely used model for developing and running parallel applications.



Sun's Ultra HPC server line can be traced back to the UltraServer 1, introduced in November 1995. The Ultra HPC servers, based on the Ultra Enterprise line, are shipped with two to 64 250-MHz UltraSPARC CPUs.

Sun has been using LSF software internally for years. And just as Sun's Network File System has become the de facto way for UNIX systems to share files, LSF is taking care of integrating various machines on the network to form a single image depicting things such as software licensing and processor types, as well as batch job scheduling and large-scale resource sharing.

"Load sharing is like providing a matchmaker for all the jobs on the network," says Songnian Zhou, president of Platform Computing. "Requests flow between the operating system kernel and the application, and LSF will automatically route them to the machine that is available, and run them on that machine without the user knowing where they're running. In this way, it acts as a dynamic load information scheduler."

In addition to bundling LSF with the HPC Ultra servers, Sun includes Message Passing Interface (MPI) and Parallel Virtual Machine (PVM) software libraries, and the Sun Performance Workshop, a suite of programming languages, including FORTRAN 77, FORTRAN 90, C, C++ and Java, all optimized for the Solaris environment, as well as debuggers, data visualizers and performance analyzers.

Analysts point out that the Ultra

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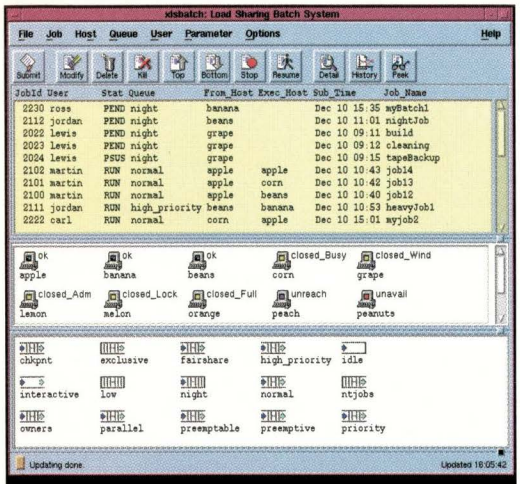


LSF Batch, part of the LSF suite of workload management software, provides seamless batch job scheduling for distributed and heterogeneous environments.

HPC announcement is mainly about Sun's renewed commitment to technical users, as opposed to a leap forward in its server technology.

"This is essentially the same Ultra server line, but it should be stated that it's a very good server line. The real message is that they've decided to compete in the high-end technical market, and the addition of LSF to the Ultra servers indicates that they're beginning to go out and get the pieces they need to successfully address this market. There's no doubt that there will be subsequent announcements about other pieces that they'll bundle with the servers," says Christopher Willard, research director of high-performance and technical computing at International Data Corp., Mountain View, CA.

Indeed, Sun itself states that, later this year, the Ultra HPC clusters will be able to support applications that require scaling beyond 64 processors, and can run parallel applications across multiple SMP nodes. In addition, the company says it will unveil server clusters that use high-bandwidth, low-latency connections between SMP nodes for message passing and data transfer.

Sun specifically states that the Ultra HPC servers are designed to quickly solve computationally complex problems using parallel computing. Applications might include computational fluid dynamics, logic and circuit simulation, seismic depth migration and reservoir simulation, and statistical trend analysis. Target markets include academic settings, petroleum, MCAE, EDA and financial and business analysis.

Ultra server users say the bundled software enhances Sun's commitment to the technical market and complements the impressive performance of multiple-CPU Ultra Enterprise systems. Not only does LSF software give the server line more cohesiveness, but coupled with other software business deals, such as the acquisition of products and technology from Thinking Machines Corp. last November, it is a big step forward.

From Thinking Machines, Sun seized the GlobalWorks operating environment, for cluster and SMP server management, and the Prism toolset, which includes compilers, libraries and conversion tools. Sun will begin integrating these technologies with the Ultra HPC line later this year.

"I'm pretty impressed by what Sun is doing in saying they'll provide the GlobalWorks software, and now bundling LSF to tie the servers together," says David Culler, a research fellow at the department of computer science, University of California at Berkeley. "In the long run, we need this kind of software bundling because it makes clusters more than just a checklist hardware item. Sun is moving its Ultra server line forward by doing this."

Others say that Sun's performance and scalability alone were enough to make them switch from competitor's systems. "We were very pleased with the ability to scale our own code on the Suns," says Clifford F. Mass, a professor in the department of atmospheric sciences at the University of Washington in Seattle. "Even though [our previous] DEC Alpha has the fastest single chip, on the Ultra HPC 4000 we had almost linear scaling, with 10 times the performance on the 14-CPU server, over an Ultra HPC 2 dual-processor machine."

Mass says that Sun makes up for slower chips by offering multiple CPUs that provide a better overall price/performance ratio than competitor's servers. Both Culler and Mass extol Sun's Gigaplane system bus, with its 2.6-GB/s throughput and wide datapath, adding considerably to system throughput.

Available now, the HPC Ultra server line ranges in price from $43,745 to $2.5 million.–*jsw*

Single System Image Two Years Down the Road

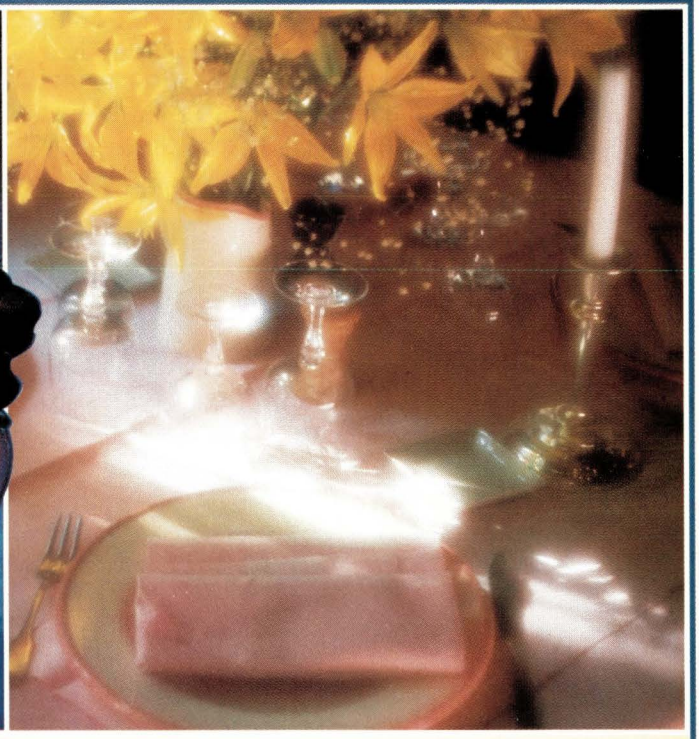
Clustering is in the news again. In March, at Internet World in Los Angeles, SunSoft Inc. revealed an ambitious two-year plan for Full Moon, the code name for its clustering solution.

Clustering–the process of linking two or more nodes to achieve greater performance and capacity–has been around for a long time. Digital Equipment Corp., Maynard, MA, was one of the first vendors to popularize clusters back in the early '80s with clusters of its VAX minicomputers. In the Sun world, work on clustering began in 1989 as a SunLabs advanced project. Out-of-the box Sun clustering solutions that run parallel versions of Oracle Corp.'s Parallel Server, Informix Software Inc.'s OnLine XPS and Sybase Inc.'s SQL Server have been shipping for more than a year.

But with all the talk of Microsoft Corp.'s Wolfpack cluster offering, scheduled to ship sometime this summer, the focus of clustering has shifted to failover and high availability, which were previously considered to be merely beneficial side effects. This phenomenon can be attributed to the fact that all Wolfpack does, in truth, is provide a two-node failover. But rather than attack Microsoft's simplified version of clustering, Sun has repositioned its cluster marketing efforts to address the high availability aspects of clustering with Sun systems.

Nowhere can you see the results of Sun's anti-Microsoft marketing efforts better than in the clustering project's name–Full Moon. Sun's habit of celestial product names aside, the full moon has a well-known effect on wolves: It makes them howl.

THE NEXT TIME YOUR BOSS SAYS HE'D LIKE TO HAVE YOU FOR DINNER, WHAT EXACTLY WILL HE HAVE IN MIND?



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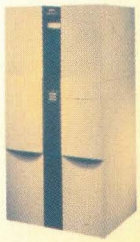

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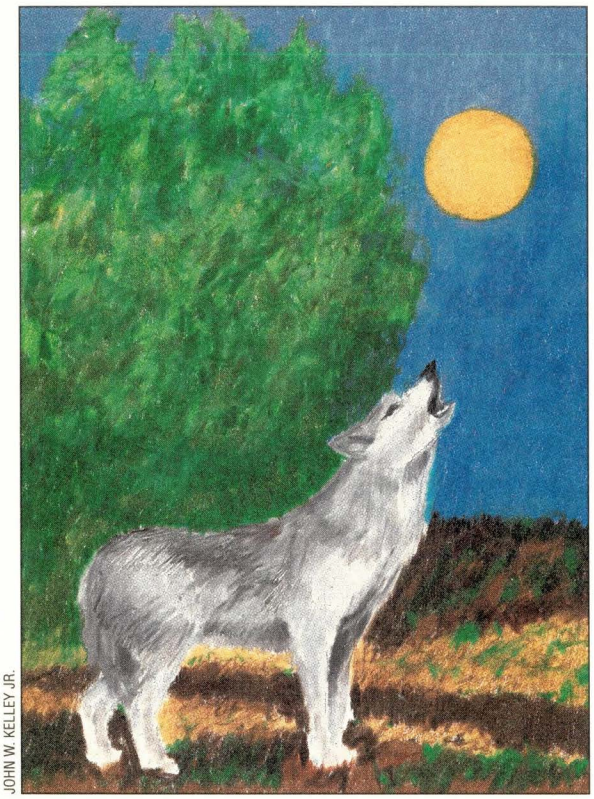
Never mind the antics of the Sun-Microsoft battle; Sun's road map for Full Moon promises to deliver solid benefits to clustered environments over the next few years. Ultimately, Full Moon's pledge is to deliver a single system image for clusters sometime in 1999. Getting there will occur in four phases. Each one will extend the previous offerings in terms of scalability (number of nodes), availability and ease of administration.



JOHN W. KELLEY JR.

Phase One of the road map began in April with the shipment of Solstice HA (High Availability) 1.3. Other current clustering features include support for two-node failover, not including the Ultra Enterprise, which is still in the queue for qualification; a clustering API, with which software developers can develop their own "cluster-aware" parallel applications; and highly available Internet services, including those delivered in Netscape Communications Corp.'s SuiteSpot; as well as NFS and DNS services.

Phase Two, beginning sometime in late 1997, will extend Full Moon clustering to four nodes. New Java-based administration tools will begin to replace current Motif-based offerings. Clustering support will also be extended to Lotus Notes, SAP AG's R/3, Sun's Internet Mail Server and Web Server. Finally, Phase Two will implement multiple logical hosts, so that applications don't need to be replicated across servers in order for them to failover properly.

Phase Three, scheduled for sometime in 1998, will bring the brunt of the necessary technology to the clustering project: a global cluster file system, so that file location is transparent to all the servers in the cluster (now up to eight nodes); global device access, so that a device installed on any node appears to be mounted on all nodes; global networking, so that the cluster can be transparently represented to the outside world as a single IP address; and finally, a Scalable Coherent Interface-based fast interconnect, replacing today's Fast Ethernet and FDDI-based connections.

At this point, says Sanjay Sinha, marketing manager for the Solaris server, Full Moon will have achieved the single system image as other vendors might define it. However, Sun will add one more feature–global process management–to make the picture complete.

To be delivered in Phase Four, global process management, Sinha explains, is technology that enables "rolling upgrades," or the ability to have different nodes on the cluster running different versions of Solaris. Typically, vendors require that all nodes on the cluster be synchronized in terms of the OS release. In this case, to do an OS upgrade, administrators need to take down the entire cluster. However, with global process management, administrators can simply partition the cluster, bring a node out, upgrade its OS and then reintroduce it.

By that point, incidentally, Full Moon clusters will support nodes of 64 processors (exemplified by today's Ultra Enterprise 10000). Eight of those nodes total 512 processors, bringing Sun clusters well into the realm of today's fastest massively parallel processing systems.–*as*

Promotion to Lure Installed Base to Solaris 2.5.1

Sun customers have traditionally been wary of abandoning their tried-and-true operating system release for the latest version. It's not uncommon to find sites still running under SunOS, even though Sun has relegated development on the legacy OS to the back burner. However, a new promotion from SunSoft Inc. might just have what it takes to get its customer base to migrate to 64-bit Solaris.

The Get Current/Stay Current promotion, good through June 30, 1997, is twofold: First, participating in the program entitles users to the latest release of Solaris, currently 2.5.1; second, upgrades and patches are free and delivered automatically for one year. The upgrade and subscription costs $295 for a desktop version, and $695 for the application server release. Previously, these price points only got you the upgrade.

The promotion also applies to users of competitive Intel Corp. microprocessor-based operating systems. For the same prices mentioned above, users running SCO UNIX, UnixWare, NetWare, Windows NT, OS/2, XENIX and OpenServer can upgrade to Solaris for x86 and, again, stay current with Solaris releases for a year. Without subscribing to the Get Current/Stay Current promotion, users who want to migrate to Solaris x86 would have to pay for a full Solaris license, that is, $795 per desktop license, and $1,295 for the application server.

With the promotion, SunSoft hopes to kill several birds with one stone. First and foremost, it'll move its existing installed base to a consistent base version. And from there, says Julie Sarbecker, senior product manager for the Solaris server, "we'll attract users of competing operating systems, and

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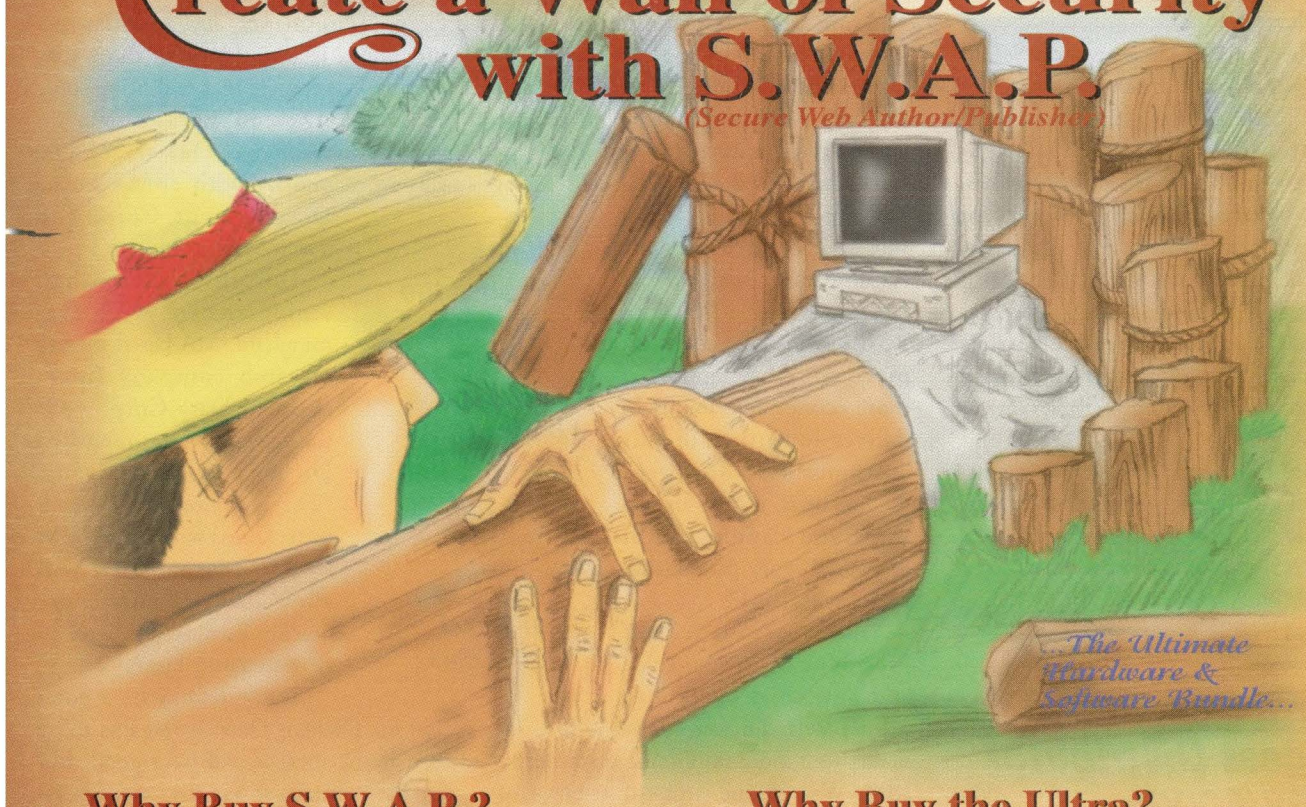

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Circle No. 3

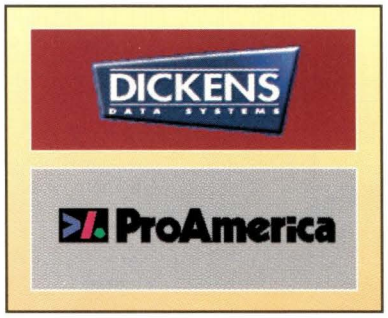
also introduce the subscription (Stay Current) pricing model, which we didn't have before."

Sarbecker also suggests that Solaris users who have been waiting for Solaris 2.6 to ship–reportedly in August–before they upgrade might want to consider this promotion, because whatever Solaris releases occur in the next year will be free under the terms of the promotion. Solaris 2.6 is reported to include such goodies as support for terabyte-sized files, advanced clustering and HA capability, and an integrated Web server, to name a few.

More information on the Get Current/Stay Current promotion can be requested at Sun's Web site, `http://www.sun.com/solaris/whatshot/getcurrent_promo.html`, or by calling 1-800-SUNSOFT, prompt 1.–*as*

Merger Creates Largest Distributor of RS/6000s

Roswell, GA-based Dickens Data Systems Inc. has become the largest distributor of IBM RS/6000 machines, in terms of volume, with its purchase of ProAmerica Inc., and at the same time has broadened its reach across the country. The merger, which was finalized at the end of March, combines the East Coast and West Coast presence of Dickens with the Midwestern foothold of ProAmerica and merges the two companies' IBM-related product lines. The new company will retain the name Dickens Data Systems.



ProAmerica, Richardson, TX, reported revenue of $86 million in 1996, and has a strong focus on selling RS/6000 systems. Dickens, on the other hand, had roughly $114 million in revenue for 1996 and offers not only the RS/6000 product line but IBM AS/400 systems and System/390 mainframes. ProAmerica, through its sister company ProAmerica Systems, also brings to the table Service Call Management customer support help-desk software.

From the standpoint of Dickens Data, the union of the two companies has several advantages. "We've become the only place you can go and get the entire IBM product line with full support," says Ted Davis, president of Dickens Data. "The other side of it is there are some economies of scale to the fact that we sell a fair bit of RS/6000s. Putting that piece together makes it more economical for us to deliver inventory to this customer base on a geographic basis. It gives us two shipping locations, and it gives us bigger purchasing power with IBM."

> ***'We've become the only place you can go and get the entire IBM product line with full support.'***
>
> ***Ted Davis, president of Dickens Data***

Jim Erickson, former president of ProAmerica and new chief operations officer with Dickens Data, adds, "It makes us a more important customer to IBM. We'll be the largest distributor of these midrange products."

While IBM would not quantify the importance of the newly joined companies, it did concede that Dickens would clearly be the number one distributor of RS/6000 machines in the United States. "This merger will make them in volume the largest RS/6000 distributor," says IBM's Fred Tufts, director of channel operations for North America.

As for Erickson's contention that the merger creates a more important customer, Tufts says, "We try to treat all of our business partners equitably. These are both very fine business partners with IBM. With this merger, I think they'll enhance their business and enhance their reach to other customers to sell and distribute our products."

In addition to the RS/6000, AS/400 and S/390 product lines, the merger gives Dickens some stronger ties with software vendors that had previous relationships with ProAmerica, such as Hummingbird Communications Inc., Wyse Technology Inc. and Genicom Corp. "[ProAmerica] has an infrastructure and a relationship with those vendors and customers that will bring some strengths to Dickens," Erickson says.

Prior to the merger, Dickens' software ties were mainly with IBM's Lotus Development Corp. and Tivoli Systems Inc.

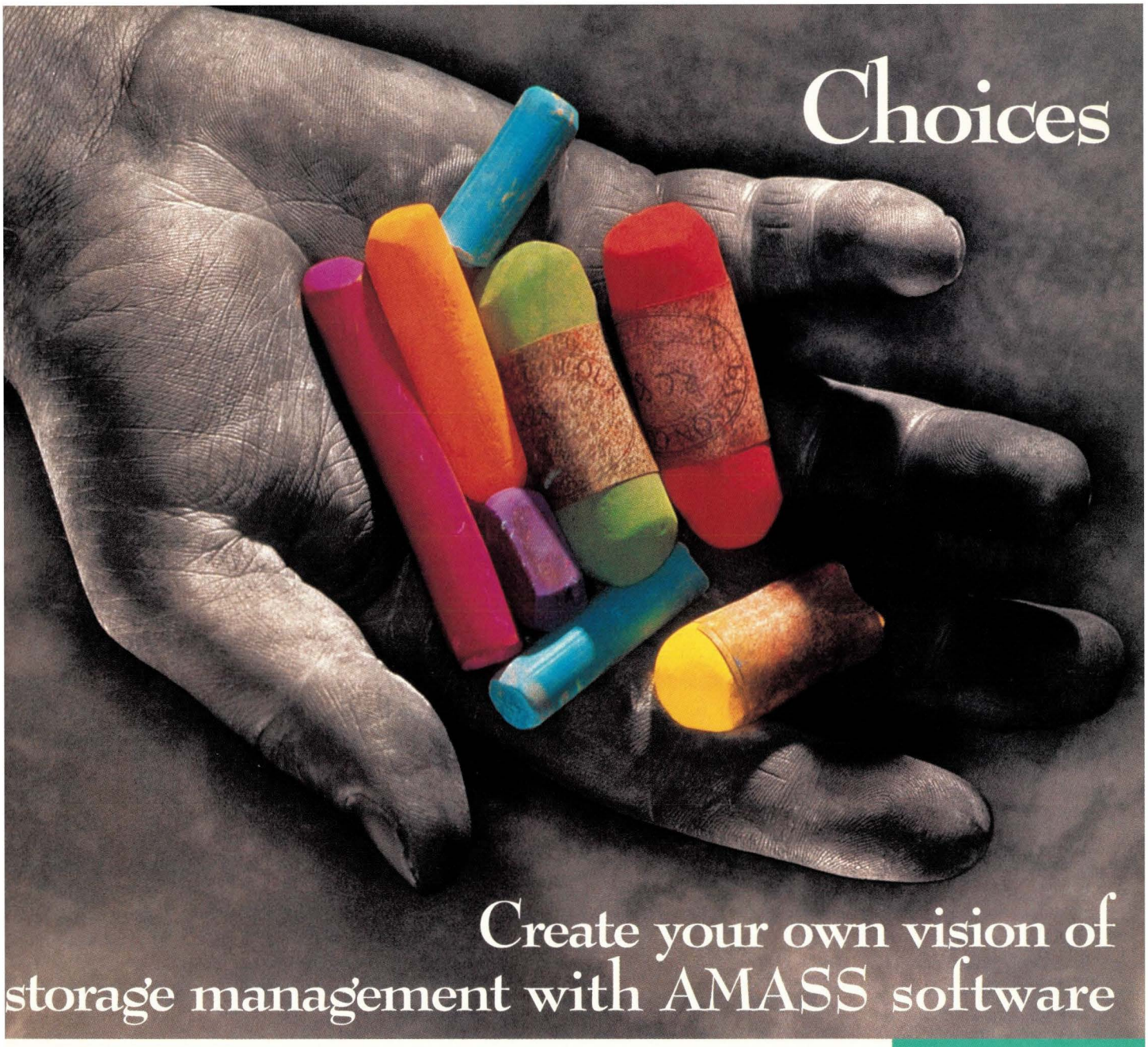
Dorothy Rosenthal, senior analyst with Framingham, MA-based market research company International Data Corp., feels the merger will strengthen Dickens as a company. "They are more of a force to be reckoned with in the IBM world," she says. "It will allow them to grow more quickly because you have to grow as a distributor."

While it may be a good deal for Dickens Data, it remains to be seen if the merger will be a good deal for the companies' existing customers. Robert Fleischmann, chairman of the board for the Baltimore, MD-based ProVAR Inc., a ProAmerica customer since the summer of 1996, is pleased with the move. "We think in the distribution business, bigger is better," Fleischmann says. "We're very positive about the merger. You've got to have critical mass; you've got to have size; you've got to have volume."

One area to watch, from ProVAR's standpoint, is that the company doesn't get so big that the size creates a bureaucracy. "I would call this a very minor worry, but my biggest concern would be that they got too big or too bureaucratic," Fleischmann says.

The present plan, Dickens says, is to have none of the personnel changes sometimes associated with mergers such as this one. There may even be new hires. "We have quite a number of field salespeople located across the United States, and we're going to continue to expand on that," Dickens' Davis says.

Changes will be made in the executive structure of the companies. Gordon L. Dickens will be chief executive officer, while Ted Davis will serve as president. Warren Turner, also



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of Dickens, will be chief financial officer and ProAmerica's Joe Ballew will serve as chairman of the board.

The company hopes to minimize any impact on its customers by maintaining the present set of contacts. "We'll still continue our existing relationships, so customers can contact the same sales reps that they are comfortable with," says Davis. "They'll just have access to more resources."–*pc*

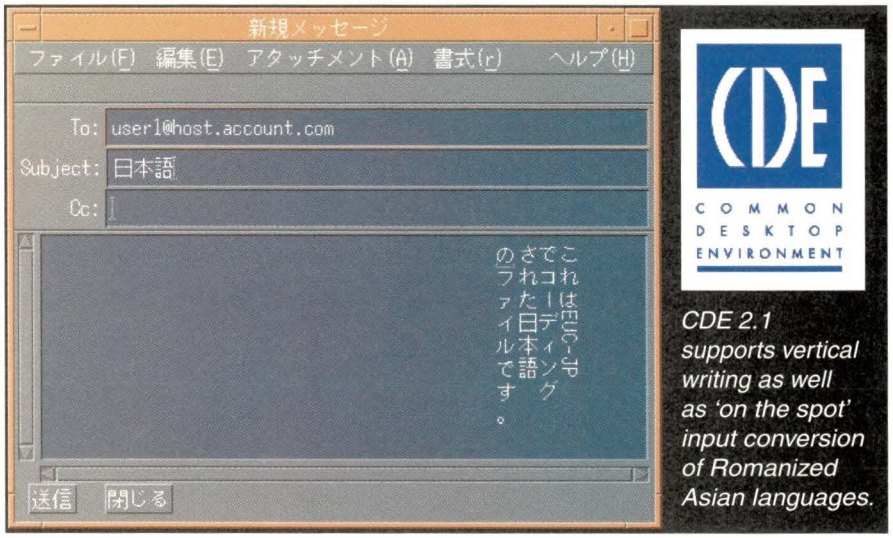
CDE Release 2.1

In February, The Open Group announced it had completed work on Release 2.1 of the Common Desktop Environment (CDE), the graphical user interface (GUI) that it hopes will eventually replace proprietary UNIX vendor desktops such as Sun Microsystems Inc.'s Open Look and Hewlett-Packard Co.'s Visual User Environment (HP-VUE). The Open Group licenses source code to vendors for integration into their respective UNIX operating systems.

In March, The Open Group also announced the so-called "unifying release" of Motif 2.1, the standard UNIX GUI on which CDE is built. With this release, The Open Group has synchronized development on the two projects, which will share a common development agenda, The Open Group says.

Any enhancements to CDE 2.1 are thus enhancements to the Motif toolkit as well. Enhancements include traits, which enable user interface objects to inherit characteristics of previously defined objects; and a uniform transfer model, providing developers with a single coherent way of coding different data transfer methods (for example, drag-and-drop, cut-and-paste).

Two new features of CDE stand out as timely additions: thread-safe libraries and 64-bit system support. "When Motif 1.0.10 came out last year," says David Knorr, manager of business development for CDE and Motif at The Open Group, "developers told us that they were going to wait for multithreading." Now, multithreaded applications (for example, some Java applications) can use CDE without requiring the developer to lock library routines and data, or limit the use of a library API to a single thread. Support for 64-bit systems ensures that CDE applications will run correctly on the emerging high-end, 64-bit systems such as Sun's Ultra line.



CDE 2.1 supports vertical writing as well as 'on the spot' input conversion of Romanized Asian languages.

Other CDE 2.1 enhancements revolve around usability issues. For example, Knorr cites CDE's new X-based printing system, whereby the system's X server generates the printer output. This way, printing is universalized across all CDE platforms, which are equipped with an X server.

The Open Group has also internationalized CDE's default online help: As of Version 2.1, help is available in French, German, Italian and Japanese as well as English.

Other usability enhancements include an SGML-based online help system. Online help documents conform to the DocBook document type definition (DTD), and developers can also write DTD-compliant documents for inclusion in CDE's help system.

Finally, The Open Group is engaged in an extensive localization effort for CDE 2.1, a feature that has extensive impact on international CDE users. Asian speakers, in particular, stand to benefit from the new features. For example, users can now select their preferred character input method at start-up, and can also create user-defined characters for character codes that are not part of a standard set. There is new support for vertical writing (both display and editing), as well as "on the spot" input conversion of Romanized Asian languages. The Open Group has also internationalized CDE's default online help: As of Version 2.1, help is available in French, German, Italian and Japanese as well as English.

Conspicuously absent from CDE marketing materials is the sense of CDE as a competitor to Microsoft Corp. Windows. "CDE 2.1 is not a 'Windows killer' and was never intended to be one, although it does do killer windows," says Ellis Cohen, user interface architect for The Open Group, in an article written for UniForum's *ITSolutions* in December 1996. However, this statement is a piece of "revisionist history," according to Jean Bozman, software analyst at International Data Corp., Mountain View, CA. "CDE most definitely was intended as a Windows killer. Believe me, I was there," Bozman says, recalling the 1993 Common Open Systems Environment (COSE) project that preceded the CDE initiative.

Clearly, CDE has not been successful in its bid to keep Windows at bay and, until now, has only had limited success in gathering UNIX users under its wing. However, Susan Bickfort, manager of the Enterprise Desktop Group at SunSoft, sees that changing in the near future. "CDE will be the default windowing system in the next release of Solaris [to be released at an undisclosed date later this year]," she says.

And already, Bickfort says, users new

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to Sun systems are bypassing OpenWindows and going directly to CDE. This process will only be accelerated by the fact that SunSoft has effectively discontinued any new development on OpenWindows and only issues bug fixes.

In Sun's eyes, CDE plays directly into its Java strategy. "CDE fits right into our Internet/intranet plans, as it's already a network-aware environment," says Bickfort. To this effect, Bickfort says, SunSoft is dovetailing its CDE work with JavaSoft's HotJava Views project. For example, the CDE and HotJava Views mail and calendar tools will both use the same back-end and data formats. Features such as these, together with a new HTML mailer and bundled HotJava browser, should greatly contribute to the acceptance of CDE on Solaris workstations.–*as*

Sun Trumpets Quad Fast Ethernet

Sun Microsystems Computer Co.'s new SBus board puts four 10/100 Fast Ethernet channels on a single card and promises performance up to 800 Mb/s.

"Network congestion between the server and the switch is no more," says Alan Dobbs, senior project manager of Sun's Internetworking Products Group. Dobbs describes this product, the Quad Fast Ethernet Board, as "a high-performance, high-density SBus card that will provide maximum performance from the CPU to the network interface."

Dobbs stresses that the creation of this product resulted from pressure placed on Sun by users who have high-performance servers, mainly Sun servers, that were not being used to their potential because of bottlenecks in the network. Names of installed beta sites were not available from Sun, but they are said to be automotive designers, jet engine designers and high-speed graphics application users.

The single-slot card allows customers to immediately increase network capacity from 40 Mb/s in an Ethernet environment to 400 Mb/s in Quad Fast Ethernet by installing the card into existing servers, without having to change their entire networking infrastructure. The speeds are made possible by taking each port and going to full duplex on each: 100 Mb/s in and 100 Mb/s out, which translates to 400 Mb/s inbound and 400 Mb/s outbound. Steven Moustakas, director of networking product marketing at SMCC, says, "For under $2,000, this network interface card [NIC] will enable 10 times the network performance of current solutions on the market."

According to Sun, one first-in-the-industry feature incorporated in this product is its full-duplexing capabilities. This technology allows data to be simultaneously sent and received on the network, eliminating collisions and, thus, doubling the bandwidth of each port from 100 to 200 Mb/s. Another bonus is its auto-negotiating ports, fully compatible with both 10 and 100 Mb/s, allowing customers to conveniently migrate from one bandwidth to the other.

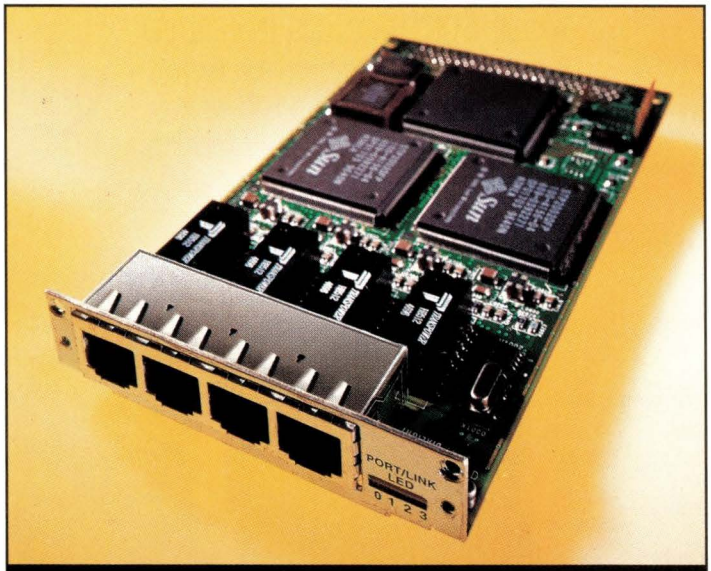
The Quad Fast Ethernet Board will be the first NIC to support trunking by combining multiple links in parallel to form a single, high-speed logical link. As trunking-capable switches are introduced to the market, customers will be able to take advantage of their benefits. Trunking configurations will be offered as a software upgrade and will provide the dedicated bandwidth required by multimedia and other high-bandwidth applications.

This first release of the Quad Fast Ethernet Board, however, will not include trunking software. Without the software, users will still be able to attain speeds of up to 400 Mb/s. Sun would not say when the trunking software will be available but predicts sometime this summer. At that time, customers will be able to purchase a software upgrade package separately that will enable trunking. Software pricing details were not available.

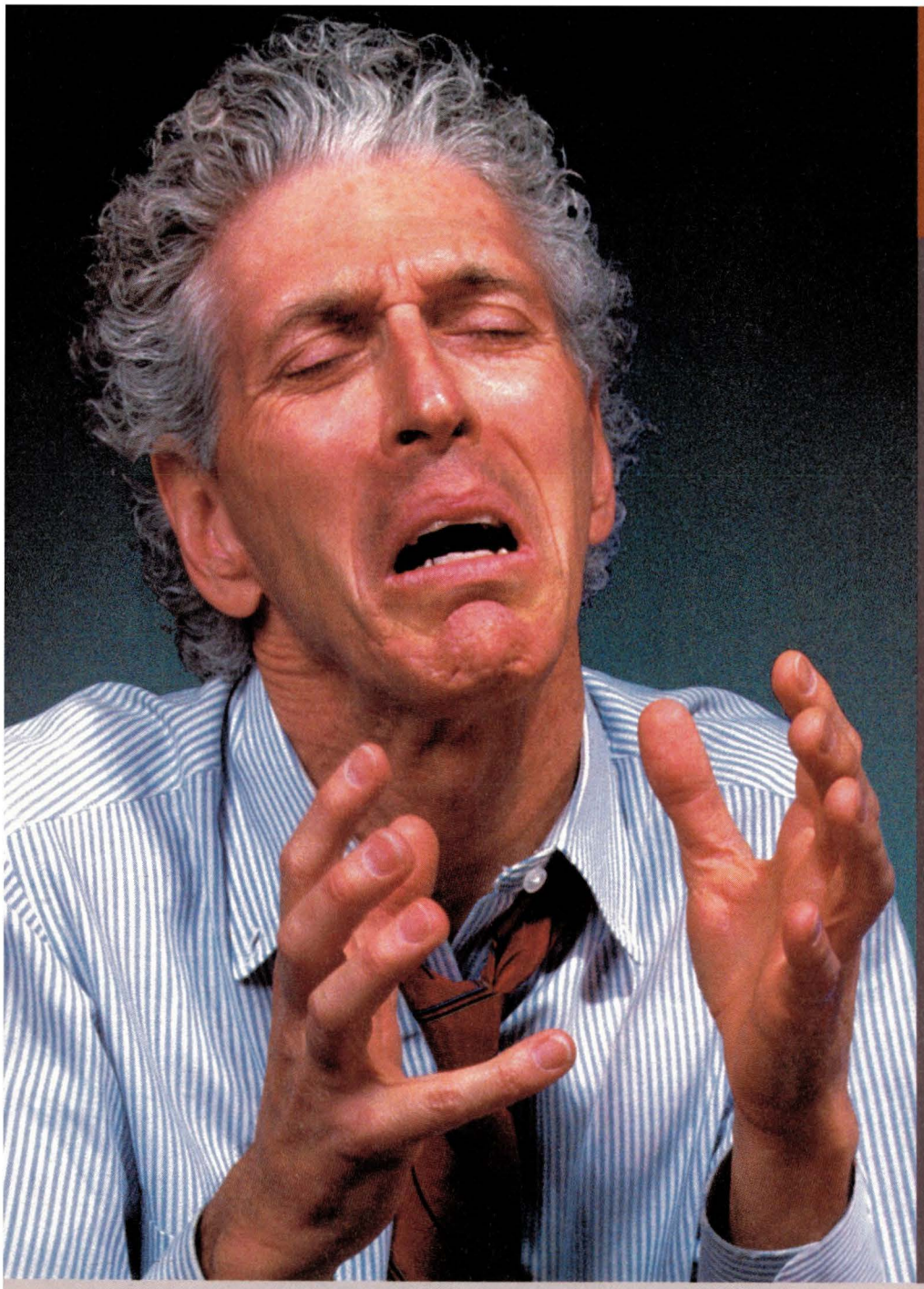
Justin Smith, a senior analyst at Framingham, MA-based market research firm International Data Corp., says products such as this high-performance, multiport adapter will soon become very important but are early to market at this time. "People are just now beginning to set up Fast Ethernet workgroups and, as they do, they're realizing that the IP stacks need to be made more efficient to really enhance broad-based adoption of Fast Ethernet workgroups," Smith says.

"Sun may sell only a few thousand of these this year. These are a pretty niche-specific things right now but will become much more important in the future," Smith says.

Sun says its Quad Fast Ethernet Board stands apart from similar products offered by vendors such as 3Com Corp. and Cisco Systems Inc. by being the first to support trunking, multihoming, full-duplex and Solaris. Although Sun hints that it may modify this product to support the PCI architecture, the fact that it supports the SBus architecture sets it apart from competitors. The Quad Fast Ethernet Board is IEEE 802.3u-compliant and costs $1,995.–*mm*



Sun says its Quad Fast Ethernet Board is a high-performance, high-density SBus card that will allow users to immediately increase network capacity from 40 to 400 Mb/s.



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Circle No. 18

Ask Mr. Protocol

by Michael O'Brien

TOM BARRETT

"Load gun. Aim gun at foot. Cock gun. Fire. Admire view through hole in foot. Do 'take.' Hop around madly, holding foot and yelling."
– Gun owner's manual from Toontown

"Click HERE to balance your checkbook!"
– Same thing, different arena

"Who picks these quotes, anyway?"
– An excellent question

Mr. Protocol Earns Some Trust

Q: *Did you ever see* The Exorcist*? Do you know if my computer has ever seen it? Because right now, it's floating above the table, spinning slowly counterclockwise. That's widdershins, isn't it? What comes next? Because I don't want to have it spewing bits all over the wallpaper. That would really be skanky.*

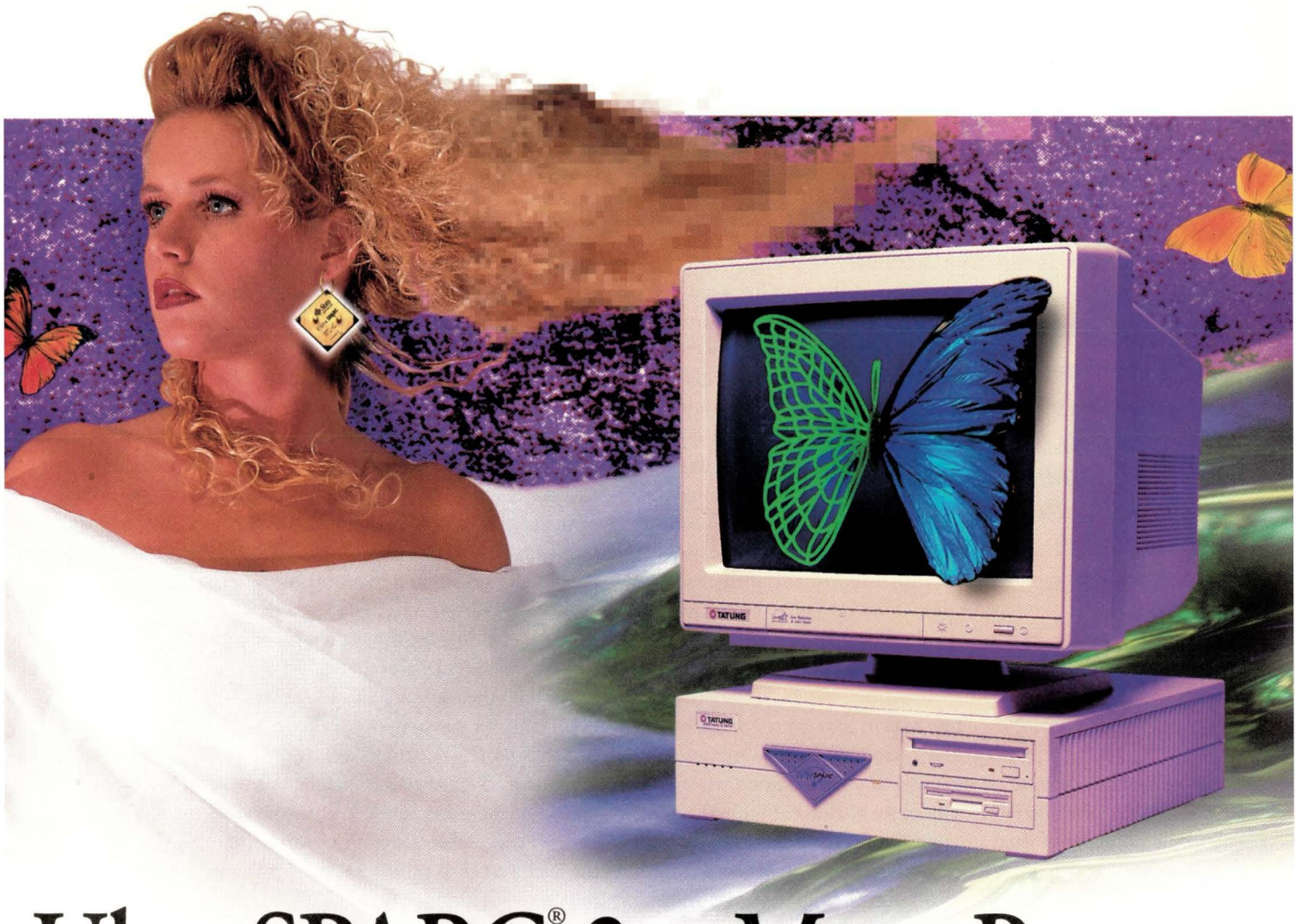
A: Ah, I see. This is actually relatively simple. You have downloaded a Death Applet, which has in turn opened the gates to the Netherworld somewhere inside your machine. Soon, unusual fluids will begin dripping down the screen, seemingly from nowhere. You will need to scrub your disk with lye soap, then run an antiviral agent whose disk has been soaked in holy water. And it'll serve you right.

The Internet was initially conceived as an extension of the proven principles of the ARPANET. The ARPANET, in turn, was designed to connect large, centralized mainframes, of the sort that are almost unknown on today's Internet. And while one of the main purposes of the ARPANET was the sharing of software, this sharing was generally done at a manual level. You used FTP to connect to a foreign machine and you sucked over the software that you needed. Generally, you retrieved the source code for the software that you were interested in, because modifications were necessary to make it run in your environment.

By far the most significant difference between ARPANET and Internet protocols is the ability of the Internet to connect not just individual machines, but entire networks of machines. When the ARPANET was designed, local-area networks were only just being invented. Because these nets were, originally, networks of similar machines, they were able to share software more broadly than the ARPANET could. The original PUPnet, at Xerox Palo Alto Research Center, supported the ability of the Xerox Alto to boot itself over the network if a local disk was not available. In fact, the disk drive in the Xerox Dolphin, driven as it was by a rubber belt connecting the motor and the disk drive proper, had a tendency to slip its belt on start-up, leaving the disk stationary. The first indication the operator had that all was not well was when the machine booted the network executive instead of the disk executive. These two resembled one another closely, and it was a frequent occurrence for the user to wonder where all of his files had got to before noticing that the wrong exec was running and that he had no local disk drive. Mr. Protocol is of the opinion that Swiss Army knives first grew screwdriver blades during this era, so that users could take their Xerox computers apart and put the belt back on the disk drive.

This is an important fact. Some folks might believe that BOOTP and DHCP and similar protocols for remote booting and configuration of machines are new, but they're not. They're among the earliest LAN services ever devised.

The fact that a Dolphin with a working disk drive and a Dolphin without so closely resembled each other was no acci-



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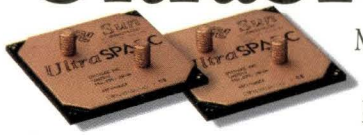

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dent. It represented the early, strong vision that the sharing of an entire software environment across a local network was not only beneficial, it was essential. The ARPANET was designed as a service connecting self-sufficient machines which communicated as peers. The first LANs were designed around the notion of file servers and client machines.

Mr. Protocol thinks that the marketplace is attempting to turn the Internet into a LAN with several million administrators, mostly untrained. He believes this is tricky business.

The main difference between these two environments, of course, is administration. The existence of a network of diverse, independent machines, which is a fair characterization of the ARPANET, was never a serious consideration in the design of a LAN, because if all of the machines on the network share a common administration, then the opportunity presents itself to add immense complexity and expense by trying to run the network as an entity, rather than managing each machine individually.

The notion that centralized services in a network "add immense complexity and expense" is designed to draw at least a wry grin from systems administrators, who nevertheless recognize the practical necessity of things such as file servers and centralized backup systems. Managing a network of 250 machines sharing distributed services is far more complex than managing a single, stand-alone machine. It is far cheaper, and in many ways easier, than managing 250 individual machines, sharing no services but connected by a network. It was this second observation that resulted in the development of shared services from the beginning of the first LANs.

If there is one thing harder than administering a network of distributed services under a single administration, it's administering the same network under a shared administration. The more cooks there are, the more distressing the soup becomes. This situation is so hopeless that all the management consultants in the world making videos with the customer's money to warn of "paradigm shift" cannot save it.

What does this have to do with the Internet today?

Mr. Protocol is glad you asked.

Tricky Business

He thinks that the marketplace is attempting to turn the Internet into a LAN with several million administrators, mostly untrained. He believes this is tricky business.

It should be pointed out here that Mr. Protocol is completely unaware of the species of divine whose pulpit is the television and whose flock consists of people who believe that watching a man of God on television come Sunday morning is a cheap, easy, convenient road to salvation. This is largely because Mr. Protocol is completely unaware of Sunday morning, period. This is regrettable, because if it were otherwise, Mr. P. would be at home with the sort of sweeping generalization that sounds wonderful and has everything going for it except being correct. Some of these are so breathtaking that they convince one that they must be true, without the bother and inconvenience of deductive reasoning. Here's a doozy:

- **The Web has become the Internet!**

Put in a great font like that, with a bullet in front and an exclamation point at the end, it fairly jumps off the page. You might even have read it as soon as you turned to this page. Knocking the stuffing out of it is left as an exercise for the reader. It sounds really, really good though, especially if read aloud in a good Sunday morning-type voice. Try it, but not where children can hear. We wouldn't want them getting the wrong idea. (Just which wrong idea, we'll leave as a further exercise.)

Like many sweeping generalizations, there's a good deal of truth in it. People love the Web. They love having just one interface and, as a matter of fact, generally just one finger pushing a button, as a way of using Internet services.

But the Web was designed as a document browser. The Internet can do a lot more than just browse documents. But the Web is the only thing most people will use. But that's all right, the other services are still there. But people won't use them. But they're so useful we have to get people to use them. But they won't. But they have to.

The quick answer is to patch some sort of Web interface on top of the other services. If the services are all at the remote end, an executable program of some kind can be triggered by the Web server to produce arbitrary results. Hence the ever-popular CGI extension.

The problem is that the user, and everything he brings with him, are on the local machine. The stupid Web browser is only good for painting windows with hypertext and following links. There's no way it can balance his checkbook.

The market loves simple solutions. In this case, the simple solution is, we'll ram executable code down the throat of his Web browser, and before he knows it, he'll be running our software. Ain't life great?

Modified rapture. When Robert Tappan Morris Jr. tried it, they locked him up. When James Gosling tried it, they gave him stock options and an award. I repeat, ain't life great?

Apparently intent counts for a lot.

The Web, by most reports, isn't even close to paying for itself yet, but it remains the hottest new marketing opportunity in existence. It is succeeding on perceived potential and overall coolness alone. The native technology of the Web, though, is just hypertext. People want more. Ideally, they'd like to be able to do arbitrary things on the user's computer.

Life would be much simpler if this were as silly a proposition as it looks. All sorts of potential services would be possible if the Web browser could just load arbitrary software and execute it on behalf of the user, in the user's own environment. Internet banking, specialized database queries, interfacing to odd gadgets like memo watches, you name it. In fact, this technology could be used on today's version of a LAN, namely an intranet, to do distributed office tasks that now require everyone to be running the same version of Lotus Notes or whatever. It would encourage the construction of applications that, instead of being huge monolithic constructs like Word or Lotus 1-2-3, or megalithic

Why UNIX System Administrators Need Internet Standards-based E-mail Integration

The Challenge: You need to integrate and manage multiple disparate mail systems. Your end users demand seamless interconnectivity without loss of functionality. They don't want to give up the many features offered by their various mail interfaces, which often include robust capabilities for handling binary attachments. Time, costs, and ease of implementation are critical factors in building a reliable enterprise-wide e-mail infrastructure. Your strategy must be soundly based on products that use proven standards-based technologies, can be managed with minimal overhead, and are backed by unquestionably strong technical support.

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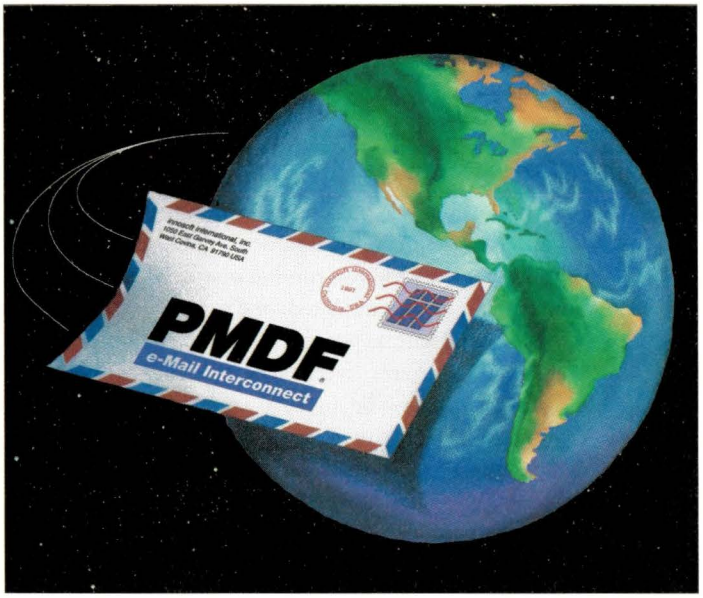

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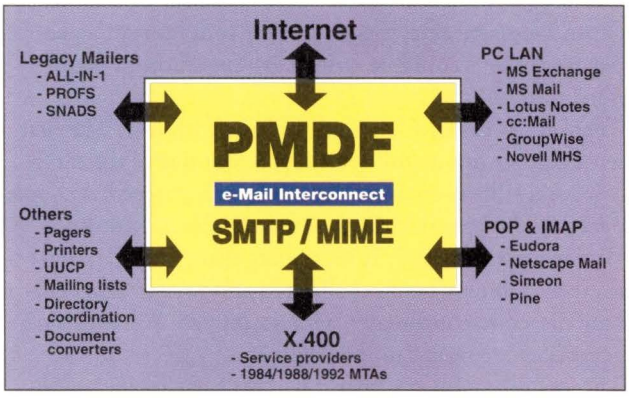

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suites like Office 95 or SmartSuite, would consist of numerous small applications connected in a common, individually tailored framework.

The problem is that intranets exist as instantiations of a single centralized authority, while the Internet at large is pretty much a lawless stretch of country populated by innocents, preachers, bandidos, hucksters, psychopaths, psychopathic hucksters, preaching psychopaths and all the rest of the possible combinations. This is a world where you can create an account, use it to post a single message to a high-volume newsgroup, collect all the spam mail that results over the next month, send a single "REMOVE" mail message back to one of the spamsters, and get another whole month's worth of spam email as a result, even more voluminous than the first month's. (You responded. Silly you.)

If you try to take all of Marx, Engels and Kant and boil it down into something that you can use to scare a seventh-grade American classroom, you come up with the notions of Thesis, Antithesis and Synthesis. Thesis represents a new idea. Antithesis represents (maybe) the societal, or (maybe) the intellectual, reaction against it. Synthesis represents the result, which goes in a new direction and is more powerful than either. Well boy, are we ready to give this a try.

Thesis: The idea of downloading code and executing it on behalf of the user is so mind-bogglingly useful and practical that it is bound to happen. Both of the major Web browsers, representing 98% of the market, are running as fast as possible in this direction.

Antithesis: If someone were to come up to you on the street, hand you an unlabeled diskette, and say "Run this, it's 3n3rJetiK!" you would have to have tapioca for brains all the way down to your spinal cord before you would be stupid enough to do this.

Synthesis: God knows.

The biggies have two different answers to this. On the Java/Sun/Netscape side, they say, "Our code runs in a protected sandbox. It could be written by Yog-Sothoth and it couldn't hurt you."

There are at least two major problems with this. The first is that sand has this awful tendency to leak out of the sandbox. It seems like every time the sandbox is plugged, a couple of Berkeley students demonstrate another hole. Sun is not particularly upset by this. It recognizes that security perimeters are continually being challenged and found wanting, and are therefore continually being improved. What version of `sendmail` are we up to these days?

The second problem is that if you really do restrict applications that come from the Net to your sandbox, then you also have to keep useful stuff in the sandbox, where these applications can get at it. Otherwise, they might as well run on the foreign system–the whole reason they're running on your local system is that your local system has something that the foreign system doesn't. That may be something as simple as a window on the display, or it might be all of your check records. Wouldn't it be nice to run an application downloaded from your bank that balances your checkbook for you? The checkbook has to go into the sandbox first.

On the Microsoft side, we have ActiveX, which is a way of running local programs on your computer. These aren't platform-independent Java applets that play in a sandbox, though. These are C and C++ applications that get sucked over and run on your machine, period. The Chaos Computer Club had a fine time with this one. Setting your browser security to less than the maximum and clicking on their site is a very, very bad idea. They can remove all the viruses from your system in no time. All they have to do is have you click on their magic button and presto! Your hard drive is reformatted. Of course, on the way they can just quickly browse through your entire disk drive, find anything worth keeping, and throw it over to their side of the fence.

The defense here is that it is impossible to completely verify the harmlessness of software at the time of installation. Even if it could be run through a code verification system (and no current application in general use is small enough to be formally verified using today's verification technology anyway), there is no way of guaranteeing that what was verified is identical to what you're about to put on your machine.

There is a cogent counterargument. Because it is impossible to ensure that the code you run, no matter what its source, is nonmalicious and uncontaminated, one should turn one's attention to making it as hard as possible to provide bad code anonymously. Under this scheme, every bit of code that the browser downloads and runs must be digitally signed. This is one better than tagging the explosive used in the bomb. This is getting the fingerprints off the bomb casing. In theory, this makes the online software environment equivalent to the offline software environment. We buy software off the shelf and put it on our computers because we know who provided the software, and if it blows up and takes the machine with it, we know who to go after. So, if all the software that our browser might download is similarly signed, we know whom we trust and we know who wrote the software we're downloading.

Fly in the Ointment

One fly in this ointment was pointed out by a security analyst at Los Alamos National Lab. If we have to rely on signatures to verify every piece of Web we might hit, then we'll only be safe examining the Web pages of major corporations. Mr. Protocol adds that they'll be the only ones who have Web pages anyway, because they'll be the only ones with the liability insurance to back up their digitally signed software.

Ack! Ptooey! As a late lamented cartoon cat once remarked. What's a body to do?

Mr. Protocol is afraid that there will be no knight in shining armor here. People will crowd around the technology, getting bitten with regularity, and there will be some cases so spectacular they'll make the nightly news. This is no great challenge these days. It seems that if the Internet hiccups, the television pundits bray. But as the Java/ActiveX scenario plays itself out, security concerns will eventually become too large to ignore.

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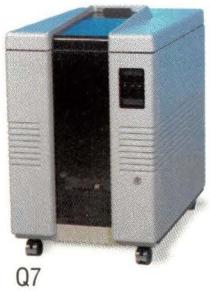

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This may all come to nothing. Java and its runtime environment may eventually be made secure enough for everyday purposes, and the sandbox may be made accessible enough to allow useful Java applets to be written. People may start paying attention to who signs their ActiveX controls (and quit turning off security in their browsers).

It seems more likely, though, that the users' problems may have to be solved by the users. This may be a real opportunity for the "network appliance": the small, cheap computer optimized for Internet access. It could serve as a personal firewall. Who cares if ActiveX scrambles its brains? It hasn't got any to scramble. Who cares if a Java applet starts crawling out of the sandbox and shipping files back to Mama? There aren't any files, except the ones you specifically keep there so they'll be accessible to the network applications that use them.

This isn't to say that you have to use military "air gap" security measures such as bringing the files from your main system to the "sandbox system" via diskette. It would be simple enough to use a file sharing protocol from the main machine over a local net to the sandbox system, which exported only those files suitable for the sandbox. Because the export controls live on the main machine, there is no way that a subverted sandbox system could get at them. And because the sandbox system has almost no permanent state, any subversion can be cured by simply turning the fool thing off and on like a modem. Sandbox systems like this would be engineered for the purpose. Because they're designed to be a "second computer," they could come packaged with Ethernet interface(s) and cable to connect to the main system as well as a modem or frame relay drop. They might not even have their own monitors.

The really interesting thing about this idea is that it puts people in the position of running a LAN instead of a single machine, a LAN using distributed services among special-purpose machines, just the way LANs were when they were first invented.

Who knows? Maybe it could even be used as an email spam filter. Now there's a program worth downloading. ⊷

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 working at an aerospace research corporation.

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

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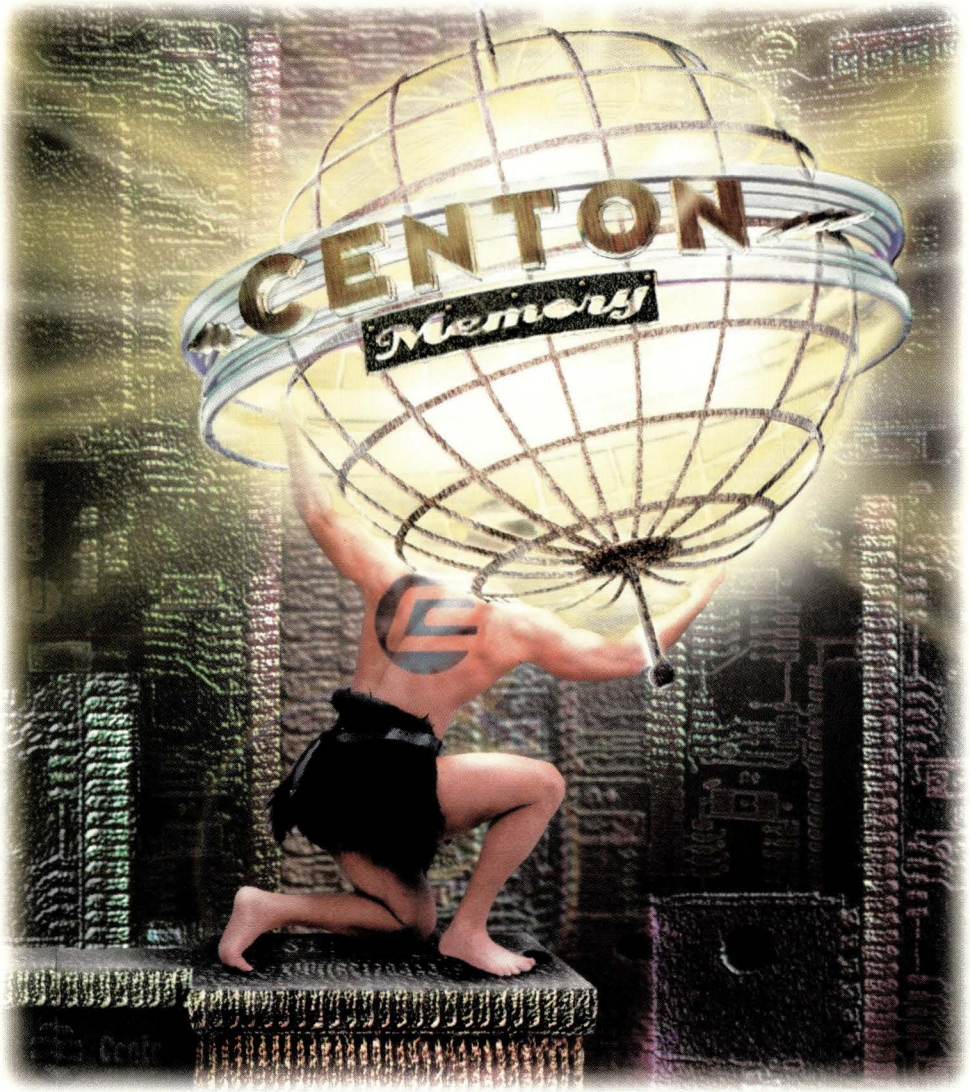

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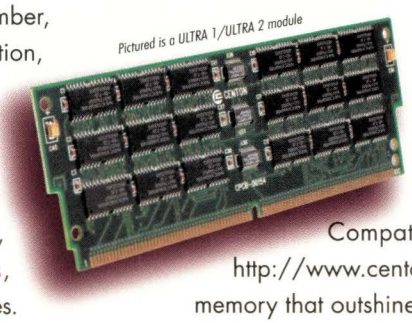

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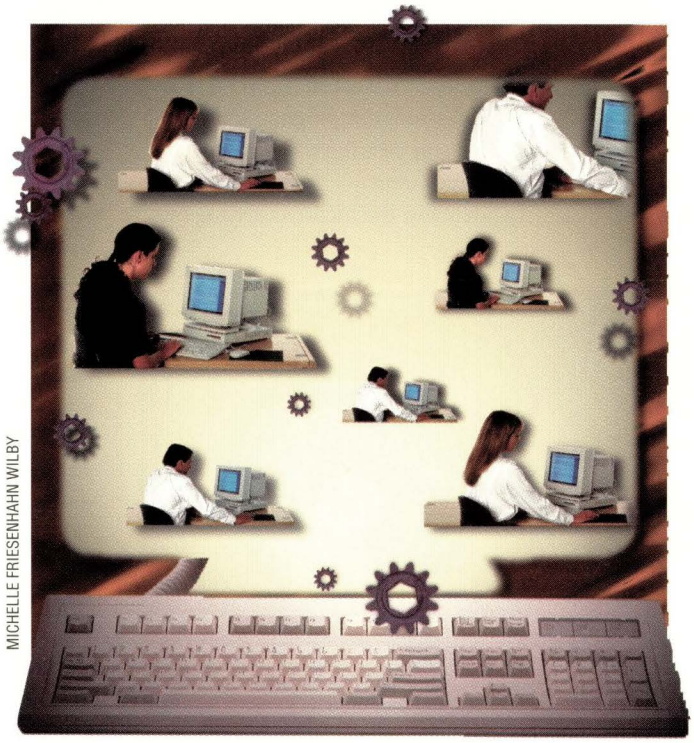

MICHELLE FRIESENHAHN WILBY

Who's Doing What, When, Where?

UNIX was designed to be used in a cooperative environment, so it's natural that it supplies programs that help you to know things about the other users on the machine, if only to identify that idiot who is gobbling up resources. UNIX has always been a system where everyone can see what is happening on the machine and has several tools aimed at providing system and user information. Many of the system tools were originally designed to provide debugging information about resources, but can now be used to investigate the state of the machine, telling you what that idiot is doing.

Perhaps the earliest tool aimed at supplying information about users was the `who` command. The `who` command tells you who is logged onto the machine, which terminal they are using and the time they logged on. These days, logins are mostly done over the network, and the `who` command also prints the name of the machine from which the network connection was made.

The `who` command simply prints data from a file. Traditionally, the file is `/etc/utmp`, but I notice on Solaris 2.5 that things have become more complicated. I'll get to that later. I'll talk about SunOS first. It's a simpler system and closer to the original.

Basics of who

When you log into a machine, the login program writes a record in `/etc/utmp`. The record holds your login name, the name of the terminal line you used to log in, the name of the host that you logged in from and the time that all this happened. The record is fixed length and is written into a known position in the `/etc/utmp` file determined by the terminal name.

On SunOS, terminal access is controlled by the `/etc/ttytab` file. The file acts as a control file for the `init` program, which is responsible for starting up the program (`getty`) that sits on terminal lines waiting for users to log in. When the user logs out, their shell will die. The `init` process is notified and wakes up to start a new invocation of `getty`, listening on the line for a new user.

The `/etc/ttytab` file contains one line for every terminal attached to the system. The line position of a particular terminal in this file is its "slot," and this index is used to provide a unique position in the `/etc/utmp` file.

Incidentally, you'll find that you have to include all the pseudoterminals that you want to use on the system in this file. Their names are not needed for the benefit of `init` because they are mostly used by programs started from the network. However, when a pseudoterminal is used by the login program, it will expect to find a slot in `/etc/utmp`–the slot is provided by an entry in the `/etc/ttytab` file.

You need to be circumspect when editing the `/etc/ttytab` file on a live system. It's OK to change details of a line, perhaps turning a terminal line on or off, and it's also OK to add new terminal lines at the end of the file. But

make sure that you don't change the slot numbers of existing lines. Radical line changes to the file need to be done on a single-user system and followed by a system reboot to resynchronize terminal names to slots.

The entry in `/etc/utmp` that is written by the login program will need to be cleared when you log out. The login program cannot do the clearing because it's long gone. The login program used the `exec` system call to become your shell to allow you to work. One of the jobs of the `init` program is to notice that you have logged out and restart the program that listens for terminal connections on that port, so it's the `init` program that is responsible for clearing the entry for the slot in `/etc/utmp`.

Incidentally, the incorrect setting of the access permissions of the `/etc/utmp` file can supply an interesting security hole. It's sometimes set so that everyone can write to it. Setting global write permission is often done because there are some programs that legitimately wish to write to `/etc/utmp`, but you don't want to give those programs superuser status. Making the `/etc/utmp` file writable by all provides an unwelcome intruder with the ability to use a simple Romulan cloaking device. The intruder can create a tiny program that clears their entry in `/etc/utmp`. They are now cloaked and invisible to the `who` program, and this can be confusing.

Of course, the cloaking is imperfect; you can still see their processes using the `ps` command. I notice that the BSD/OS system places `/etc/utmp` in a special group (`utmp`), with the intention of using `setgid` to enable any program that wants to write to the file. Actually, I can find no program that is set to be `setgid` to the `utmp` group, so it's possible that access permissions on `/etc/utmp` can be established so that only root can write to it.

Solaris who

I said that Solaris is different. Actually, the differences are not fundamental: A record is still being written when you log in and cleared when you leave. The system on Solaris is an evolution of the original one. I suppose I should have said the *systems* on Solaris. There are two parallel `utmp` files on my Solaris 2.5 system: `/var/adm/utmp` and `/var/adm/utmpx`. The `/etc/utmp` file has become a symbolic link that points at `/var/adm/utmp`.

Some of the changes in the system are undoubtedly due to the changes in the `init` program that were made for System V. The `init` process is now a much more general process-spawning program, and its actions are logged into the `utmp` file. I suspect there are System V compatibility reasons that compel the need for two parallel files. This is the penalty for having defined binary file mapping onto a C structure that is pulled "raw" into a C program rather than having a well-defined program interface to read the data. I think that

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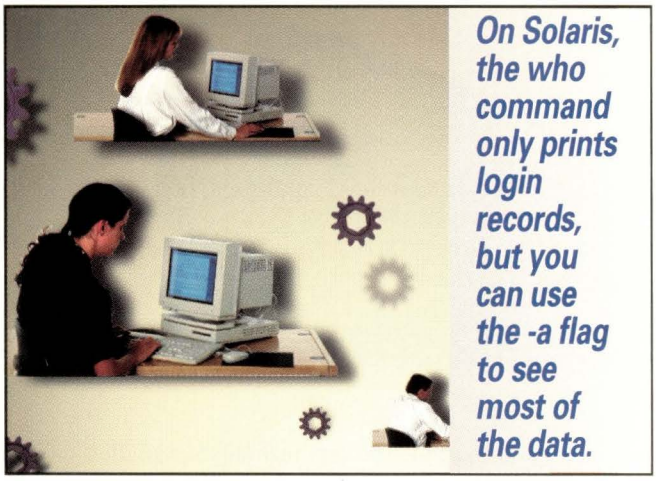
having two files is fraught with danger.

The utmpx file format is different from utmp. The utmp file only contains the user name, the line that was used to log in and the login time. The utmpx file contains much more space for user names (32 characters rather than eight), and also holds a 256-character array to store the host name. It seems that the files are no longer managed using the terminal slot. They are variable-length files, and (I'm guessing) when the login program wants to store a new record it simply finds an empty slot in the file to write the data. The record contains a keyword that is used to relate the actual terminal with the data using a serial search through the file.

Incidentally, when I was looking at the who command, I noticed that it reads both the utmp and utmpx files. The program doesn't need to read both files because all the information in utmp is also present in utmpx. This bug was reported to Sun (in 1993, actually). The alternative version of who, found in /usr/xpg4/bin/who, just reads its information from the utmpx file. Thus, if you are worried about CPU or disk cycles (and you probably are not), then you can find a more efficient version of the who command.



Both utmp and utmpx have extra fields that store new information. I suspect that some of the new information is there to allow the who command to behave like the w command that originated on the Berkeley systems. The w command is useful because it not only tells you who is logged in but also indicates how long their terminal has been idle, the CPU seconds that the terminal has consumed and the current command being executed on the terminal. All this information can help you work out whether the person is actually sitting at their terminal and using the machine, or whether they left the terminal a while ago.

You can see all the new information stored in utmp and utmpx by using some options to the who command:

```
$ who -a
```

This gives you a complete dump. The output will include records that show the start-up of your system, and also empty slots in the file that give you information on past activity. A plus sign next to the terminal name shows active login records. The records that are written on the file are typed using a tag value, allowing various types of activity to be stored. For example, you can get the time that the machine was last booted using the -b flag:

```
$ who -b
      system boot  Jan 31 00:00
```

Giving who an illegal option like

```
$ who -x
```

will print a list of valid options and what they mean.

Login History

The who command only tells you the state of the machine at the moment that you run the command. To provide a history of activity on the machine, the login program appends the same record that it placed in the utmp file to the /var/adm/wtmp file. On Solaris, it also places the utmpx record at the end of the /var/adm/wtmpx file. The wtmpx file is supposed to track the wtmp file, but the file seemed to be garbled on at least two systems I looked at for this article.

You can dump the contents of these history files using the who command. On SunOS,

```
$ who wtmp
```

will just dump the file, giving you a listing of all the activity. On Solaris, the who command only prints login records, but you can use the -a flag to see most of the data. Actually, the best Solaris command to print all the data in the file is part of the accounting suite, fwtmp. Use the command

```
$ /usr/lib/acct/fwtmp < wtmp
```

You will have to look up some values in /usr/include/utmp.h to decode some of the tag values that are used to differentiate the records.

On SunOS, user data in the file will mostly come in pairs. You will see a login record containing a user name, a terminal line name and a time; and a logout record, where the user name is empty, the terminal line is present and, of course, the time is when the user logged out.

Records for users on Solaris come in threes: there's a "system" start-up record, written by the terminal monitor program or perhaps by telnetd, rlogind or another program that handles logins; a user start-up record that indicates that the user name of the person who has logged on; and a "dead process" record, written when the user logs off.

Both systems will have other records written into the file. If you change the clock using the date command, then there's a discontinuity in the time sequence on the machine, and the accounting programs need to know that the clock was reset. A pair of special time change records are written into the file by the date command. The first will give the

time before the change, and the second will give the time after the change. The difference between the two can be used to adjust the login times for people who were logged in when the time was reset. Actually, it's a good idea to avoid setting the date and time using the `date` command when the system is running in multiuser mode.

Also, on both systems, records will be written when the system is rebooted. The times associated with these administrative records can be used to give some idea of the availability of the system. If a clean shutdown is made, then a shutdown record is written. When the system reboots, a reboot record is written. So it's possible to deduce whether the system crashed by noting the absence of the shutdown record.

Actually, deriving system availability figures from the log can be a little hit and miss. The accounting information can give an incorrect picture. If the system crashes in the middle of the night when there has been no user activity, then the accounting programs will only see a reboot record written some time after the last active record on the file. The programs can have no real idea how long the system has been down. If someone is logged in when the system crashes, then they cannot attribute a correct connect time for that user, because it's not possible to know for certain when the system died.

On a clean shutdown, all the users will be logged out before the shutdown record is written. The reboot record will follow the shutdown record and its timestamp can be compared with that on the shutdown record to deduce how long the system was unavailable. However, the reboot record just tells us when the bootstrap happened, it doesn't tell us how much initialization time was used by the system. On Solaris, a record is written when the machine changes from one run state to another, so we can see when the system entered multiuser mode and was offering service to customers.

You'll find that many systems write records into the `wtmp` file (or files). Obviously, user-driven programs like `rlogin` or `telnet` do. Less obviously, you'll find records written by FTP or UUCP.

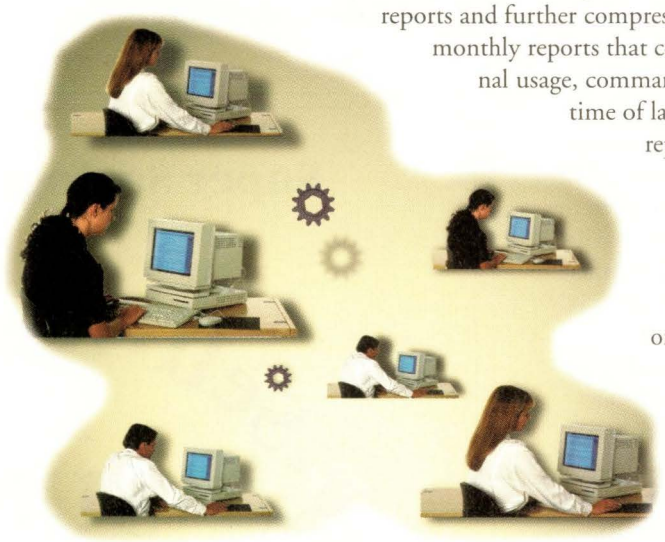
Process Accounting

The `wtmp` file can act as the basis for accounting for the connect time used by particular users on the machine. This perhaps had more relevance in the days before workstations when the user logged in once from their character-based terminal, and that single login was the sole source of their work. Now, users can log in several times to the same system, and connect time accounting is perhaps less relevant.

Both Solaris and SunOS support the logging of every process that has been run on the machine. The kernel has a module that is supplied with a file name and will write a record to the nominated file whenever a process terminates. By default on Sun systems, this file is `/usr/adm/pacct`. It's often called

acct on other systems. You should be aware that the file can grow to mighty proportions on a busy system and you must take the steps that the system provides to control the file size. By default, process accounting is turned off and needs to be enabled. Consult Sun's systems administration documentation.

The record that is stored for each process contains the information on the user who executed the command (the user and group ID); the controlling terminal for the command; the start time of the process; the user, system and elapsed time measured in clock ticks; the average memory usage and the bytes of I/O that the process performed; and a flag that indicates whether the process used superuser privilege or has forked a new process. Finally, the command name is stored as an eight-character string.



Mortals can look at the file with the lastcomm command, so you can find out the commands that someone else is executing. Commands are printed in reverse order of termination, so you can see the recent commands and use ^C to escape when you have seen enough. You cannot see the parameters to the commands. The lastcomm command may be useful when tracking bad guys on the machine, but the command name that is stored is simply the name of the file, and not its path. When the addictive rogue game first came out, we found that many people had private copies named for programs that they were supposed to be using, like vi. This meant that they could sit and play rogue, with the ps command telling the casual watcher that they were using vi to do "real work." It also meant that the accounting information did not track the usage of the program correctly. The moral is, you cannot assume that the name of the command reflects its function.

The pacct file format has remained largely unchanged since the early days of UNIX. The times that are CPU ticks could be immense but are passed over in a 16-bit word as a floating-point number, with a 3-bit octal exponent and 13 bits of fractional information.

There are two sets of programs available on your systems to process the pacct and wtmp data. The older program suite consisted of two programs: ac, which generated connect time accounts from the wtmp file; and sa, which analyzed the pacct file giving per-user and per-command statistics. These two commands were a little rudimentary if you wanted to maintain historical data. I certainly remember us having to write our own package because of these deficiencies, so we could prove who was using the machine.

The alternative to sa and ac is the standard System V accounting package, available on both Solaris and SunOS. Only SunOS supports the older commands. The System V package was written quite early on, perhaps in the early '80s. I think that it was up and running in System III. It's actually quite an impressive bit of work that consists of several programs and shell scripts that are intended to run unattended, recovering from errors without human intervention.

You can find all the programs and scripts on /usr/lib/acct. The central part of the package is the runacct script that performs daily processing, compressing data into (mostly text) summary files that are stored on /usr/adm/acct. Each month, the monacct script is run, and this takes the daily reports and further compresses them to create a set of monthly reports that contain summaries of terminal usage, command usage, disk usage and the time of last login. The format of the reports is self-explanatory.

If you are a student of shell scripts, the runacct command is interesting because it knows that it has several distinct sequential one-way tasks to perform and recognizes that it is possible for the machine to die while one of these states is being executed. It wants to be restartable, but restartable in the current state. To allow this reentrancy, it creates a state file holding a string that names the state and uses this to trigger the appropriate processing that is required.

The whole accounting package is an interesting example of how to construct complex tailorable systems from scripts and small programs. I am dubious that the package deals with the /usr/adm/wtmpx and /usr/adm/utmpx files correctly. I've had no time to pursue this.

Further Information

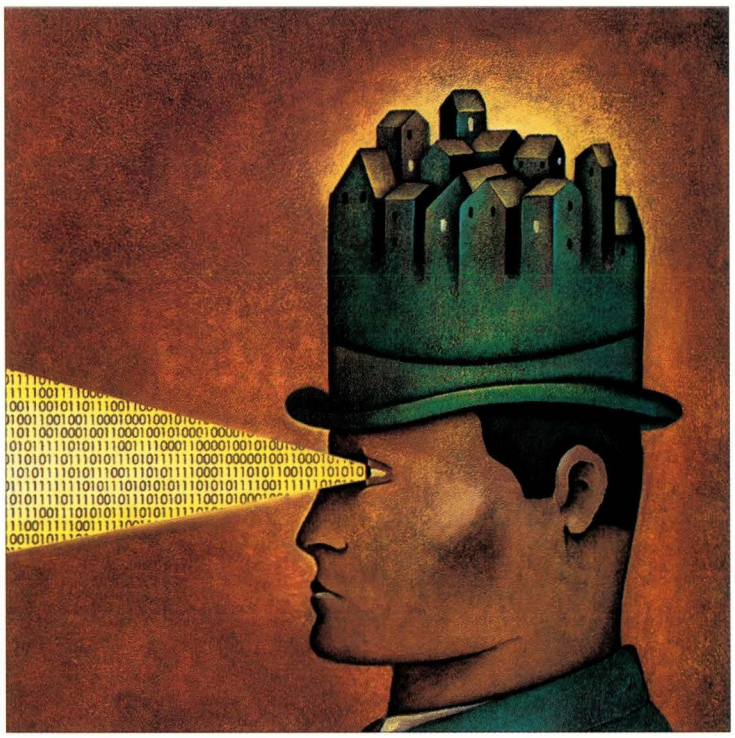
Thanks to Mike Barrow who mailed me from Spain with some suggestions for article topics. I'm not sure this was exactly what you had in mind, Mike.

The accounting system is well documented in Sun's System Administration Answerbook CDs. If you want a printed resource, then I suggest you read *Unix System Administration Handbook* by Nemeth, Snyder, Seebass and Hein (now in its second edition), published by Prentice Hall, ISBN 0-13-151051-7.

Another good book is *Essential System Administration* by Æleen Frisch, published by O'Reilly and Associates Inc., ISBN 1-56592-127-5. This book has a good diagram of the System V accounting system, showing how all the parts fit together and how they are used. ⊸

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

by Richard Morin, Technical Editor



JACQUES COURNOYER

Building Virtual Communities

In "Economics, Virtual Communities and the Internet" (February 1996, Page 32), I explored some of the economic effects of the Internet-based virtual communities that are springing up around us. This month, I'd like to present a primer on setting up Internet-based virtual communities. By way of explication, I'll use Fred Frobisher, a well-known, if fictional, figure in UNIX lore.

Email Lists

The loosest sorts of virtual communities are based on ad hoc email lists. Every email participant takes part in this sort of list from time to time. Fred gets a piece of email (for example, a joke) that he thinks is worth passing on. He resends the item, typing in a set of addresses for other folks who might also find it funny. This method is very flexible, but it can get a bit tedious if used too often.

The next stage involves the use of multiperson aliases. These can be used to set up personal mailing lists (for example, a "joke list"). In the example below, we are using `mail`'s `~/.mailrc` file.

```
alias  jokers        \
       bob    ray    \
       mutt   jeff
```

Fred is a pretty savvy user, so he has set up a number of these aliases, including a few second-level aliases that cover common combinations of tastes. He also uses aliases for his lunch group and party list. Fred doesn't want to bore his recipients with lists of addresses, so he is careful to use `mail`'s `Bcc:` (blind carbon copy) address field, rather than the normal `To:` line, when he uses the alias. In `mail`, this is accomplished by means of the `~b` command.

So far, we've only discussed the use of personal (single sender) lists. If multiple senders are involved, things get a bit more complicated. Because Fred administers his own machine (`frobisher.com`), he can set up an informal mailing list (`jokers@frobisher.com`), using an entry in `/etc/aliases`:

```
jokers:
       bob,   ray,
       mutt,  jeff
```

Alternatively, he could set up a `jokes` account, then use the account's `.forward` file:

```
bob,   ray,
mutt,  jeff
```

This method has the advantage that it can be administered by an unprivileged user. For example, Fred could set up a `joke_adm` group, whose members could edit `~joke/.forward` as desired. This would also be a useful way of allowing otherwise unprivileged users to maintain their own mailing lists.

Manual list management methods work quite well for small lists and for larger lists that are relatively static. The advantages of having a human being in the loop for editing the aliases frequently

outweigh the administrative burden.

Even when a list is maintained manually, some automated assistance can be useful. Prime Time Freeware's mailing list of customers and other interested parties (info@ptf.com), which has several thousand names, uses a special-purpose mailing script. This tool provides logging, restart and selection facilities. More importantly, it sends separate messages to each recipient, allowing us to insert a Sent to: line at the top of the message body:

```
Sent to: fred@frobisher.com (Fred Frobisher)
```

We didn't always use this technique, but a few unpleasant experiences ("GET ME OFF THIS @#$• LIST!!!") showed us the importance of knowing how pieces of mail were actually addressed. Mail headers cannot be trusted, as they are frequently "adjusted" by mail software. Worse, innocent-looking addresses may turn out to be mailing list gateways. The Sent to: information lets us know which entry to modify.

If Fred needs to handle a large and dynamic list, he should investigate a mailing list program such as Brent Chapman's Majordomo (ftp://ftp.greatcircle.com/pub/majordomo/) or Stephen R. van den Berg's Procmail and SmartList tools (ftp://ftp.informatik.rwth-aachen.de/). These programs let participants subscribe and unsubscribe without (much :-) explicit administrative intervention. Procmail is also quite useful for filtering email; see "How to Read 950 E-mail Messages Before Lunch" (Jay D. Allen, *Linux Journal*, February 1996) for a useful exposition on some mail-filtering techniques.

If membership is open to the public, Fred should consider publicizing it. A few notices to appropriate Usenet groups can boost a mailing list's membership dramatically. Fred should also put an entry into the list of "Publicly Accessible Mailing Lists." This compilation is available as a periodic multipart posting on the news.answers and news.lists.misc Usenet groups. It is archived at ftp://rtfm.mit.edu/pub/usenet-by-group/news.lists/ and at http://www.neosoft.com/internet/paml.

Usenet Groups

Because each message on a mailing list is transmitted individually, really large mailing lists are not very efficient users of Internet bandwidth. In addition, mailing lists do not have a built-in structure for browsing, following conversation threads and so on. If Fred's mailing list gets large enough, he should really give some thought to turning it into a Usenet (aka Netnews) group.

My news browser lists 20,865 Usenet groups, with more showing up each day. Fortunately, the names of the groups are arranged as sets of trees (e.g., comp.x.y.z). Unfortunately, there are far too many trees. My browser shows 27 trees, for instance, whose names begin with the letter "a": a, aaa, ab, abg, acadia, acs, adsp, air, ak, alabama, alc, alive, alt, apc, ar, arc, arkane, asia, asu, at, athena, atl, atlanta, ats, aus, austin and az. It wasn't always this way. Several years ago, the net.gods (backbone site administrators) got together and defined a set of top-level hierarchies, including comp, misc, net, rec, sci, soc and talk. They also set up some rules for adding groups and extending the hierarchy. The libertarian wing of Usenet, led by John Gilmore and company, set up an alt tree to handle groups that didn't fit into this master plan. Assorted locales (e.g., aus, ba) and organizations (e.g., su, tamu) then set up "local" trees. Life was good.

Unfortunately, the concept of "local" is somewhat alien to the nature of the Internet. Thus, my Oakland, CA-based news server carries the tamu tree, which hails from Texas. Meanwhile, the ba tree can be found on news servers around the world. Perhaps the net.gods need to have another get-together.

In any case, the current scenario goes something like this:

- Look over the "Full Group List" to see if there is an existing group that looks suitable. If so, join it and start lurking (reading but not posting) for a while. If it really is a good match for your topic, start a conversational thread and see if anyone is interested.
- If there seems to be enough interest, you can ask the other members of the group whether they want a specific subgroup to be formed.
- If you feel there is a consensus, you can hold a vote on the formation of a new subgroup. Basically, this requires you to post some announcements, tally the responses and report. If there are 100 more "Yeas" than "Nays," you will be allowed to form the new group(s). See the informational postings in news.announce.newgroups for more information.

If this seems a bit too restrictive, you may wish to opt for creating an alt group, as follows:

- Join the most appropriate alt group(s), lurk and post, as above.
- Ask the members whether they like your idea for a subgroup.
- If you feel there is a consensus, go ahead and form the subgroup. Actually, you are free to form an alt subgroup without any of this preparation, but there is a slight catch: Others are equally free to remove your subgroup if they don't like it. (Anarchy is like that.) By gathering consensus before you set up your group, you can reduce the chances of a create/delete war.

The Usenet has its own standards of network etiquette, commonly known as "netiquette." Take the time to review these (starting with the material in news.announce.newusers) before leaping into action, lest you create an unnecessary (and unwanted) dispute. Such cautions aside, see you on the Net! ⊸

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

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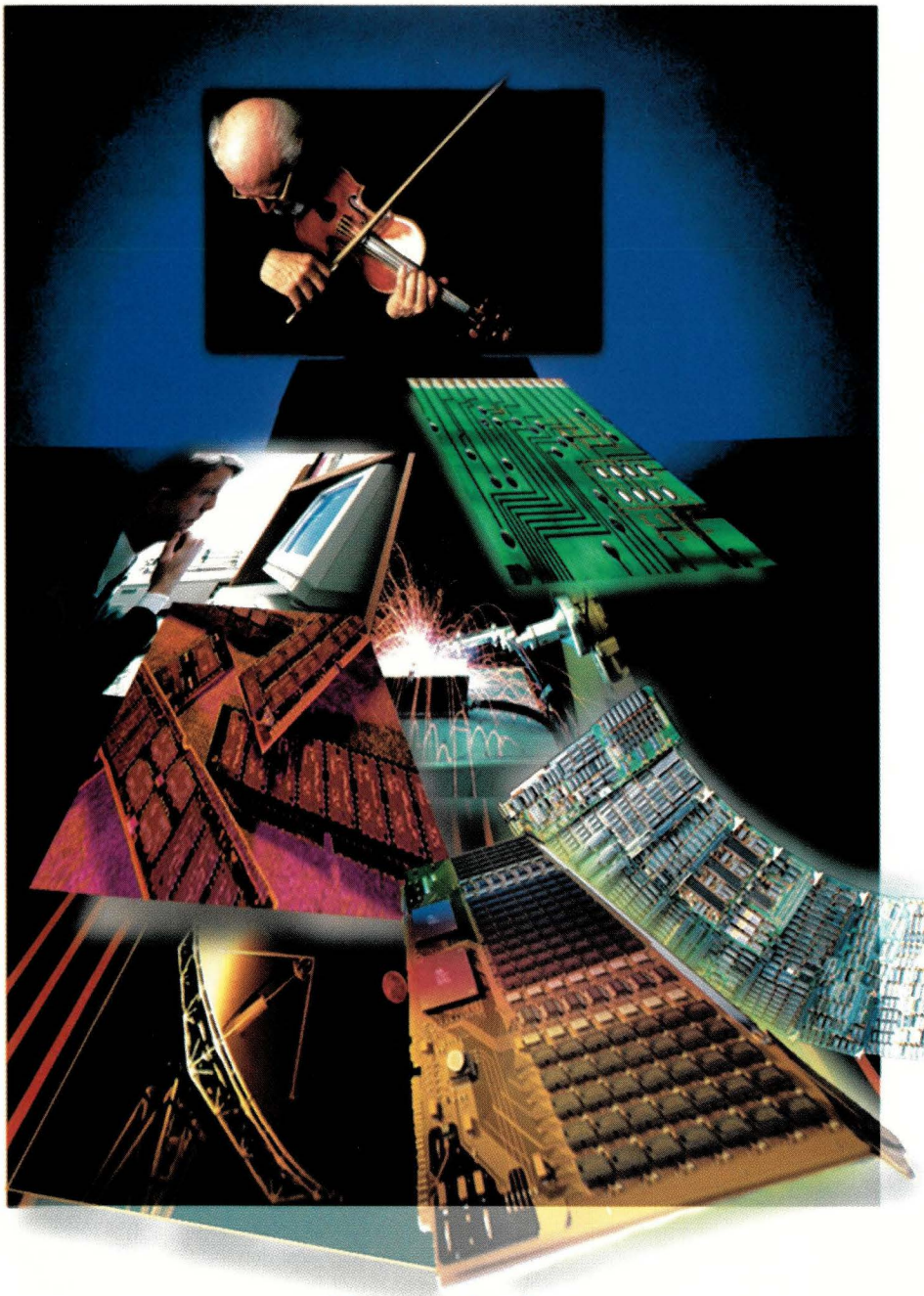

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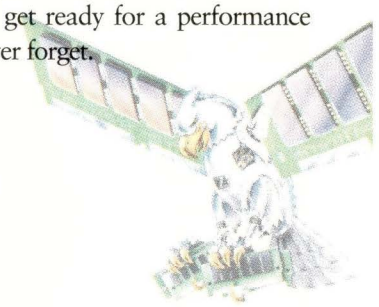

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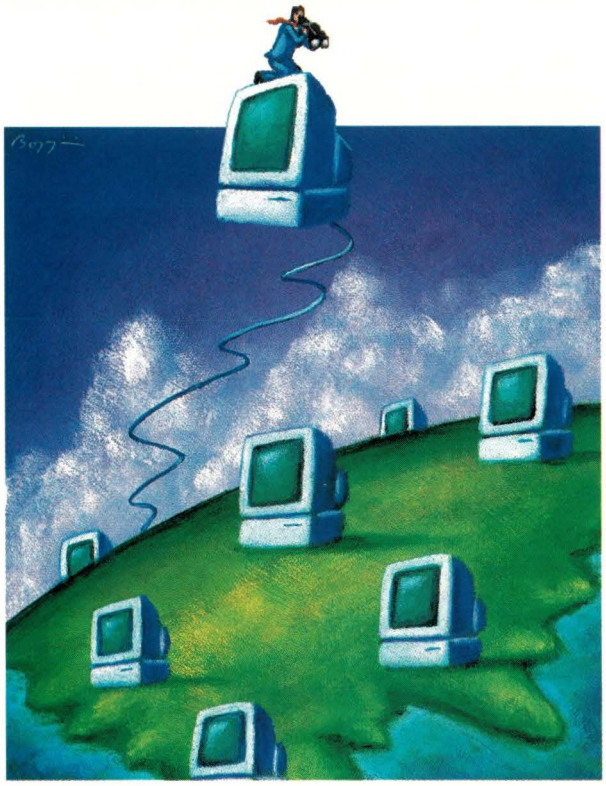
Circle No. 10

by S. Lee Henry



JAMES BOZZINI

The Lay of the LAN, Part 2

When we left off last month, we were using a simple `awk` script to calculate disk capacity on the system we found ourselves standing in front of. We asked ourselves a list of questions that would give us a good base of information regarding the configuration of the system. The questions we didn't get around to answering were as follows:

11. What file systems are being made available for other systems?
12. What file systems are being mounted from other systems on the network?
13. What type of network cable is in use?
14. How heavy is network traffic?
15. Is email generally received directly on this system or is there a mail exchanger?
16. What applications are installed? Do they start up when the system boots?
17. Are disk quotas in use?
18. Who knows the root password?
19. Is the system heavily loaded?
20. What SCSI addresses are in use?

Recall that the fictitious system we were examining was running Solaris 2.5.1 and was a Sun Ultra-1. In addition, it was running both NIS+ and DNS. There were a small number of users with local accounts.

11. What file systems are being made available for other systems?

Because we're looking at a Solaris system, the command to figure out if file systems are being exported and to which hosts is

```
boson% share
```

This command, without arguments, as shown here, lists the file systems that are exported (i.e., shared) along with the hosts (if defined) that have been given permission to mount. If there is no response other than the next shell prompt, no file systems are being shared.

We may not know from the result of the `share` command whether the list of hosts contains any netgroups (groups of hosts) or only host names. We can check by looking at the `hosts` table and the `netgroup` table (if it exists) with the commands `niscathosts.org_dir` and `niscatnetgroup.org_dir`.

While looking at the file systems that are exported for sharing, we might also want to use the `showmount` command to generate a list of the systems that are mounting file systems from this workstation. If we want to know which systems are mounting a file system (e.g., `/export/home`), we can use `showmount a` and pipe the output to a `grep`.

```
boson% showmount
fermion
orchid
```

If no file systems are exported, we'll probably get an error message ending in `RPC: Program not registered`, telling us that the NFS daemons are not registered with RPC.

12. What file systems are being mounted from other systems on the network?

This is easy to answer. We can simply use the `mount` command to view everything that's mounted and then visually eliminate the file systems that are mounted from the local system. Alternately, we can use `mount` and `grep -v` to restrict the display to file systems that are not local. The command `mount | grep -v "/dev"` should give us a list that's a little nicer to look at.

13. What type of network cable is in use?

If we are curious about the type of cable connecting us to the network, we might have to climb behind the workstation or under the desk and take a look at the cable itself. Most of the newer Sun systems will have a built-in UTP port that may or may not be the network connection in use. Further, the cable that attaches this workstation may or may not be representative of the network on a larger scale. It may be that a number of local systems connect to a UTP hub that subsequently attaches to a coaxial (e.g., thinnet) network somewhere beyond our view. The presence of any kind of transceiver will indicate that we are changing cable types.

On the grand scale, the network could be a mix of every variety of legitimate Ethernet cable, and there is now a way to determine this from the local connector.

14. How heavy is network traffic?

One of the best ways to gauge network traffic is to take a look at the number of collisions that are occurring. Because each Ethernet interface only concerns itself with its own packets, comparing the number of output packets with the number of collisions will give us a rough idea of how heavily congested the network is. If we see only a percent or two of output packets colliding with their network brethren, we can conclude that network traffic is fairly light. In heavy traffic, packets from different workstations are much more likely to be sent at the same time. If we see a large percentage of output packets colliding, we can conclude that network traffic is slowing down our system's performance with respect to network-based computing (e.g., resolving host names, updating NFS file systems and so on).

```
boson% netstat -I le0 10
         input   (Total)   output
packets  errs    packets   errs   colls
740730   0       116137    1      25
```

Clearly, in this example, the percentage of collisions (25 out of 116,137) is extremely small.

15. Is email generally received directly on this system or is there a mail exchanger?

One thing we might do to determine the role that this workstation plays in handling email is to take a look at the `/etc/mail/sendmail.cf` file. This file may have a `mailhost` specified. If so, this host is used to send mail out and is likely to be receiving email for the local system as well. Because we're running DNS, we might want to check this file to see if there's an MX record defining a mail exchanger for our domain.

```
# major relay mailer
DRmailhost
CRmailhost
```

If the tag `mailhost` is used, we should check to see if this is the name (or more likely an alias for some host on our network). We can also use `nslookup` as shown here to determine if there is a mail exchanger defined for our domain and display its fully qualified name, if there is one:

```
nslookup
set querytype=MX (or whatever)
> highenergy.physics.com
Server: topquark.physics.com
Address: 192.1.2.3
highenergy.physics.com canonical name=flux.highenergy.physics.com
flux.highenergy.physics com preference=0, mail exchanger=flux.highenergy.physics.com
```

16. What applications are installed? Do they start up when the system boots?

This is a harder thing to determine but, generally, application software will be installed in `/opt` or `/usr/local`, at least on a well-managed Solaris system, or in file systems designated for particular data-intensive applications (you might, for example, find a `/oracle` file system). Perusing these directories will tell you a lot about the software installed on the system.

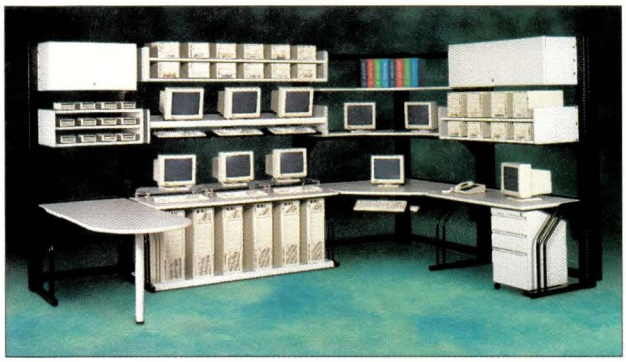
You can also take a look at the `/etc/init.d` directory to see if additional start-up/shutdown scripts have been added to the system. This will also answer the second part of our question dealing with software that is invoked on bootup. We might also look for new entries in files such as `/etc/services` and `/etc/rpc` (or the NIS+ equivalents). Most sysadmins adopt the practice of providing comments when they update these files to indicate the purpose of the added entries (e.g., `# The following lines added to support rblip tools`).

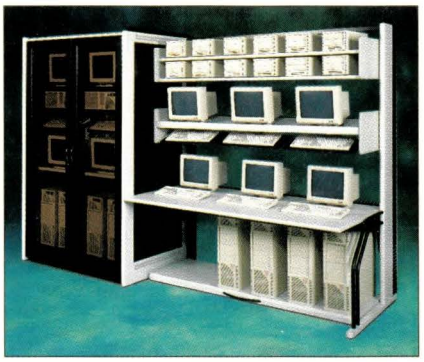
17. Are disk quotas in use?

Disk quotas can be used to limit the amount of space that a user is able to occupy on any particular file system, either by actual disk space used or by the number of files or both. Any file system that is managed with quotas will have a file called `quotas` at its base. This file will have an entry for each user for whom a quota has been established, indexed by that user's numeric UID. The file system must also have the quotas specified within the options field of the `/etc/vfstab` file.

Just knowing that quotas are in use doesn't tell us whether they are used across the board. Because there is no tie between `admintool` and the quota mechanism, new users will not automatically be set up with quotas and will have no quotas applied (i.e., unlimited access) unless a quota is specified.

Over





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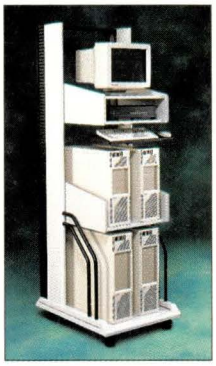

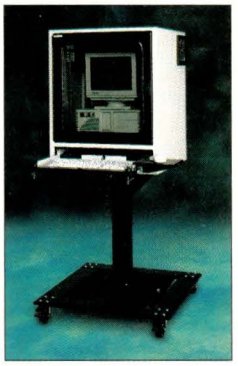

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18. Who knows the root password?

The best way of telling who has the root password is to examine the `sulog` file if it exists–only failures will be captured in the `/var/adm/messages` files.

Indications of successful `su` to root operations tell us these users have the root password. Others may as well, but unless we capture successful switch user operations, we won't know.

19. Is the system heavily loaded?

We can always assume that if the system is slow it is heavily loaded. However, there are so many reasons that a system can be slow that we shouldn't be too quick to blame high CPU demand. Contention for disk accesses and slow network response can slow systems down. So can inadequate swap space or low memory.

If we run something like the `top` utility, we can get a handle on the number of processes waiting for the CPU as well as which processes are using most of the processing power. Alternately, we can take a look at disk performance. We already looked at network response by checking into collisions as a percentage of overall traffic, and we can check into swap and memory use as well with the `swap -l` and `vmstat` commands.

20. What SCSI addresses are in use?

The best source of this information is probably the `/var/adm/messages` file, because we don't want to take the system down to the `ok` prompt just to run `probe-scsi`. Disk SCSI addresses are clearly indicated in Solaris by their device names. The file system, `/dev/dsk/c0t3d0s6`, for example, is clearly on the disk with SCSI address 3. The SCSI targets of tape and other nondisk devices are not quite so obvious. The address `/dev/rmt/0c`, for example, doesn't give us any clues about the SCSI address in use. We can pull SCSI addresses, however, from the `/var/adm/messages` files by grepping on the word `target` as shown here:

```
boson% grep target /var/adm/messages*
May 19 12:28:53 boson unix: sd3 at esp0: target 3 lun 0
May 19 12:28:54 boson unix: sd4 at esp0: target 4 lun 0
```

Questions Answered

We've answered all our original questions. There are still many things that we might want to figure out once we know why our boss sent us here and why everyone who works in this room is taking so long to come back from lunch. Once they've returned, however, we will likely be ready to go to work. ➸

S. Lee "slee" Henry *recently took off from the Washington, D.C., area and headed toward Los Angeles with a trailer full of books, musical "toys" and other personal stuff. Three days and three exploded tires later, she arrived and started working as a security services engineer for Infonet, a global networking company, in El Segundo, CA. You can send email to* `slee@cpg.com`.

by Alex Newman

Computers Are a Lonely Place

I've been hearing a lot lately about the "online community," or (you may remember) the "global village." It's not surprising really; I do run a computer user group. Do computers and the Internet bring people closer together? With apologies to MCI, *Is* this a great time to be alive or what? Lately, I've been thinking the answer is, "or what."

The Internet does allow us to connect to hundreds of thousands of new and different people, but I think there's something inherently dehumanizing about the medium. Something that allows college students to write graphic, violent stories featuring their classmates; something that allows people to be rude to complete strangers in a way that they would never be in real life.

[Author's note: Because this is a family magazine and because I occasionally like to send copies of my column to my mom, the rest of the column will make use of the swearword "cronk," which is extremely rude and obscene, but nobody knows it yet. It's also very versatile. For example, you could say, "Shut your cronking cronkhole, cronkface. Or do I have to come over there and cronk you up?" Of course, that's Bogart to Hepburn in that famous scene from *The African Queen*: "Shut your flapping porthole, dollface. Or do I have to come over there and lift you up?" Anyway, you get the idea.]

I got a piece of email from a stranger. We'll call him Hank, although that's not his real name. Hank was unhappy about a Sun User Group CD-ROM that came with a book. He starts off well enough ("I bought the book on Fooble that came with your CD.") but slides into cronk-mouthing almost immediately. The second sentence is, "I started looking through the CD, which cronking sucks by the way, and it had a link to download the Foo."

His tone and manners continue pretty much in that vein. I wrote back to him, explaining that, unfortunately, the Web was a fluid medium and CD-ROMs were static. Sometimes links get changed on the Web, and there's no way we can change them on the CD (the link in question was at Sun, not at the Sun User Group Web site). I suggested that if he were really dissatisfied, he ought to return the book and get his money back (which he had threatened to do).

Then I turned my attention to his language: "This may surprise you, Hank, but there are people who receive the email you send. People who deserve to be treated with the same respect and courtesy that you would treat someone face-to-face....The fact that you feel that you've been wronged doesn't give you the right to go off on other people."

To be honest, I didn't expect to hear back from him. I figured he was just having a bad day. I was wrong. Hank fired back (typos and such are his): "I dont give a CRONK! Ever heard of free speach? Give me a ticket why dont you! Send me another letter like that and I'll file a law suit for false advertising! I'm not cronking around! Believe me when

I say that I'm not to be cronked with! You cant sit there and say that you'ld be calm and collect if you had just be cronked out of $54!! This was a bad mistake on your part and I asure you it will be a costly one! Not only am I returning the book but I'm gonna make a whole web campaign based on banning false advertisers like you! Your a shame on industry as we know it!"

Now, maybe this is the way Hank reacts to every setback. I don't know. Maybe this is the way he talks to everyone, friend or stranger, in person, over the telephone or over the Internet. I don't know, but my guess is he doesn't talk (by which I mean face-to-face conversations) to people like this. Either that, or he gets punched in the nose a lot.

What's your Cronking Point?

A fair question. Why did I risk sounding like Lenny Bruce at the end of his career (he would spend all his time reading his court transcripts to his audience)? It's pretty simple. I don't like what the Internet is doing to some people–or what those people are doing to the Internet.

If someone attacks you on the Internet, either in a newsgroup or in private email, it's a fact of life. It happens. In fact, it happens so often that we have special terms for getting these little parcels of vitriol. I don't know what I find more disturbing about the terms "flame" and "flamewar":

the fact that these personal attacks happen or that they're 0 so common that we have terms for them. Even the least experienced Internet user knows what a flame in a newsgroup is. And it's not the girl you went to high school with who you're still kind of sweet on.

The fact that flames are an everyday occurrence on the Net shows a clear division between online life and real life. If someone sends you email that questions your lineage, challenges your intellectual capacity and calls you a cronking cronkhead because you think U2's new album isn't as good as some of their earlier material, it's all in a day. Contrast this with Real Life. If you were at a cocktail party and mentioned that you thought *X-Files* was overrated, and if the person you were talking to suddenly started screaming at you, and told you that you had no taste, your tie was ugly, and there ought to be a law preventing people like you from having opinions…well, that'd be something to talk about for weeks. You wouldn't shrug it off and say, "Well, I've been flamed," and you probably wouldn't flame back. Outside of some daytime talk shows, people generally behave better face-to-face.

What the Cronk Can I Do About It?

Get out of cyberspace and into real space. Meet some real people face-to-face. Share a cup of coffee with someone instead of a byte of Java. Remind yourself and other computer professionals that somewhere behind that screen is another living human being.

One of the major functions that The Sun User Group serves is to connect people with people. Not just electronically. We manage local user groups, run local seminars and hold two large events each year. The next big event happens in Boston, from June 2-4, 1997.

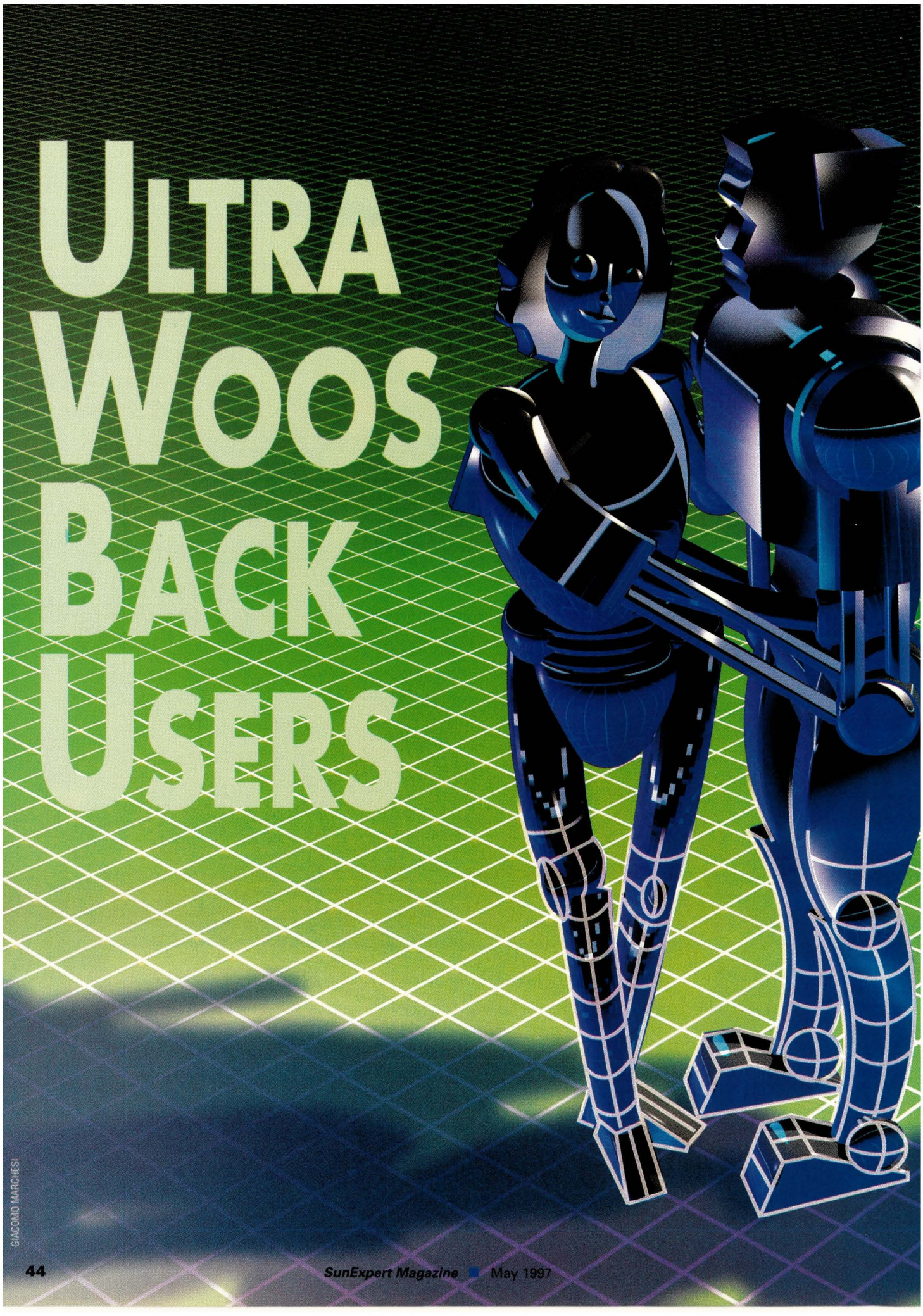
The Sun User Group East Coast Conference and Exhibition includes a day of tutorial workshops and two days of conferences. It also features dozens of speakers from Sun Microsystems and other industry leaders, as well as an exhibit hall with hundreds of vendors. You can find more information about the conference at `http://www.sug.org/Sug-east`.

Events like this one are few and far between. Not just because there aren't any other Sun-specific events (and if you're not interested in Sun technology, why are you reading this?), but because of the style and structure of Sun User Group events. Our conferences aren't about our speakers talking at you or trying to sell you something. Yes, we have classes–what kind of conference would it be without classes?–but more importantly we're creating an environment where you can put faces to names, and people to email addresses. There's a synergy created by a roomful of people that can't be matched by email, USENET, IRC or CU/C-ME.

Do I think you should go to this conference and trade show? Cronk yes, you've been a little cranky lately. ⊸

Alex Newman *is the executive director of the Sun User Group and Java-SIG. He is also the author of* Special Edition: Using Java, *published by Que Publishing, and an upcoming book on the history*

ULTRA WOOS BACK USERS



GIACOMO MARCHESI

Creator 3D and high-performance servers and workstations renew technical users' respect for Sun.

by John S. Webster, Senior Editor

Sun Microsystems Inc.'s recent relationship with technical users has had as many ups and downs as the sappy plot line from an old Hollywood movie: Girl #1 gets boy; girl #1 loses boy to high school prom queen (girl #2); girl #1 thinks fickle boy has abandoned her forever for the much flashier girl #2; boy has some sort of epiphany and comes back to girl #1 with renewed fervor, conviction and dedication. They marry and live happily ever after.

This hackneyed plot line has been playing out in real life for Sun and its technical users, including those in the CAD/CAM business. In the above script, replace "girl #1" with "CAD user" or "CAD software developer," swap "boy" with "Sun," and replace "girl #2" with "commercial desktop." What you get is the mise-en-scène describing Sun's hot-and-cold-and-hot-again relationship with technical users.

Just a year and a half ago, Sun was battling its rivals, including Hewlett-Packard Co., Digital Equipment Corp., Silicon Graphics Inc. (SGI) and IBM Corp. in an effort to get technical users to view the Sun platform in the same light as the others, rather than as a low-cost, easy-to-configure, performance-impaired system

with a strong presence in the commercial server market.

However, at the end of 1995, Sun introduced the UltraSPARC architecture and began to launch a range of UltraSPARC-based workstations and servers, as well as marketing programs, software products and graphics subsystems. These, coupled with Sun's strengths in multiprocessing and server technology, pushed Sun to the front of the pack in terms of units sold among workstation vendors shipping technical workstations to CAD/CAM users. For the sake of brevity, the phrase "the CAD/CAM market" encompasses MCAD, EDA, PDM and other subtechnologies.

CAD software vendors in all segments of the market practically gush with enthusiasm when they discuss Sun's turnaround in the performance derby.

"Sun was not up to par two years ago, particularly in high-end modeling. The prices were low, but they simply didn't have the horsepower. That's why they were bigger in banking and software development," says Bob Brandenstein, platform marketing manager at EDS Unigraphics, a developer of CAD/CAM/CAE and PDM software based in Maryland Heights, MO. "Now, their performance is second to none, and their pricing is still very aggressive. We definitely have seen a change since they announced the UltraSPARC."

Other prominent CAD independent software vendors (ISVs) concur that until the Ultra architecture came into being, Sun was struggling in terms of performance.

"Sun was definitely lagging in compute performance a couple of years ago. They were the price leader, so people were buying them for that reason, and also for their servers. But the Ultra lines and the Creator 3D placed them on par with the competition with respect to performance," says John Kundrat, manager of business partner relations at Structural Dynamics Research Corp. (SDRC), Milford, OH.

Sun's success, or lack thereof, in the technical space a few years ago caused a self-perpetuating sequence of events, says Kundrat. Sun was not a performance leader, so it lessened its focus on the technical market in favor of the commercial enterprise network. This caused the technical product line

SGI Promotes CAD-Specific APIs for OpenGL

Last July, Sun Microsystems Inc. announced it would finally ship Silicon Graphics Inc.'s OpenGL graphics library for Solaris, and a whole host of software vendors applauded. Yes, it was belated (Sun was the last of the big UNIX systems vendors to endorse the API). This implied a begrudging acceptance of SGI's ubiquitous set of graphics programming interfaces by Sun, which had continued to offer its XGL API as a means for CAD software developers to support Sun hardware. But once it began to license OpenGL, the task of porting graphics applications to the Sun platform became much easier for independent software vendors (ISVs).

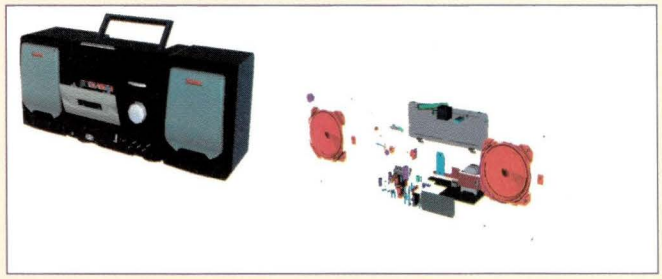
As a result of a cross-industry standards initiative and Sun's continued efforts to improve hardware performance and work with the CAD software community to help establish its Ultra architecture as a premium graphics platform, the ISV community is sitting up and paying even closer attention to the Sun platform as an attractive graphics workhorse.

The initiative, announced in February after a so-called "industrywide summit" in January, aims to establish a de facto standard object-oriented API for rendering CAD and analysis data based on OpenGL, according to Janet Matsuta, manager for emerging markets and technologies at SGI, Mountain View, CA. It's spearheaded by SGI, along with Dassault Systèmes, Parametric Technology Corp., Prosolvia Clarus AB and Structural Dynamics Research Corp. (SDRC). The idea is to yield faster graphics performance and greater interactivity for users, as well as make it easier for software vendors to develop CAD applications for disparate hardware platforms. The API will run on a range of desktop machines that now support OpenGL, including most UNIX workstations, as well as Microsoft Corp. Windows NT and 95 environments.

The next step will be to form a committee to evaluate the critical components of the API, which is supplied as C++ code. The list of interested parties includes those at the initial meeting, as well as Sun, EDS Unigraphics, Hewlett-Packard Co. and IBM Corp.

SGI's submission to the group of vendors is called the Optimizer, and it's the front runner (actually, it's the only proposed API at press time) for consideration by the committee. SGI's Matsuta says the OpenGL review board already exists, and on that board sits Microsoft, Intergraph Corp., Evans & Sutherland Computer Corp. and Digital Equipment Corp., in addition to the litany of marquee names stated above. The CAD-specific review board will probably be a subset of the OpenGL endorsers.

Matsuta explains the value of the review board like this: "The OpenGL review board tries to maintain software compatibility by adding graphics functionality with extensions. For example, if Sun adds hardware features, we'll write an extension. The software developer sees that as a call routine. With the review



The above images, courtesy of SDRC I-DEAS Master Series, illustrate the benefits of occlusion culling. The image on the left is the final image that the user sees. The image on the right is composed of all the objects that the OpenGL Optimizer API is not rendering for this view. Depending on the model, complex assemblies could remove 50% or more of their data as a result of occlusion culling, thus improving interactivity.

to suffer even more, so people perceived Sun as even less of a player in the technical market segments that were once its stomping ground.

"Sun's level of enthusiasm is in direct proportion to the level of competitiveness of their systems. At one point, Sun's dedication to the CAD/CAM market was in question. Accordingly, with the introduction of the UltraSPARC, touted as a performance leader, there was legitimate market skepticism," Kundrat says.

But my how things can change. With the advent of the UltraSPARC architecture came a feeling among technical users that Sun wanted to pay more attention to them and back up its upbeat CAD-oriented marketing programs with products that measure up to, and even surpass, the cream of the crop from HP, IBM, DEC and SGI.

"The success of the UltraSPARC has thrust Sun back into the market as a major player, and gives them a solid foundation on which to base future products," Kundrat says.

According to analysts, Sun's recent arrival at the top of the technical workstation pyramid is partly attributable to tumultuous times among its competitors. While IBM is very strong in MCAD, DEC is barely keeping up during its current internal turmoil, and SGI keeps leaking information that hurts its revenue, says Peter ffoulkes, director and principal analyst for workstations at Dataquest Inc., San Jose, CA.

Adding his perspective on the shape of the high-end UNIX CAD/CAM marketplace, ffoulkes says, "Overall, HP and Sun are the biggest players right now. When Sun brought the Ultras out, that pushed HP on the defensive, and that's when Sun started to regain its market share. Sun is now claiming that it is number one in MCAD, and it's a reasonable claim, although HP is still stronger on the CAE side."

The UltraSPARC platform breathed new life into Sun's presence in the CAD/CAM market, offering the processing power Sun was lacking, especially in 3D graphics processing.

The UltraSPARC line of workstations now ranges from the Ultra 1, available with or without the Creator or Creator 3D graphics subsystems, to the Ultra 2 line, which includes a

board, there's a mechanism to share that extension with other hardware vendors. If another hardware vendor supports that extension, the software vendor sees it as .ext, instead of .sun. Then, the architecture review board votes on the adoption of the extension. The benefits to the software community are that they only need to write to a single API, rather than maintaining separate versions of their software, so they can have a stable, standard software revision."

SGI has proposed several core extensions to OpenGL, which should speed performance of graphics applications and make it easier for ISVs to port 3D applications to hardware platforms that support the additional APIs.

Karen Seymour, a senior analyst at International Data Corp. in Mountain View, CA, sees more than just OpenGL flag-waving in SGI's Optimizer proposal.

"It's a great extension set, and it really provides a speedup in 3D operations, and 3D is becoming much more pervasive in graphics applications. Everyone [who supports it] wins in the long run. Without a cross-platform API, ISVs have to write separately to each platform."

With OpenGL, of course, ISVs still need to recompile their software for each platform, but they don't have to rewrite large chunks of code to support different hardware architectures.

Because the Optimizer is still under the scrutiny of the OpenGL-related committee, ISVs have little to say about it at this time, except that it can only speed up software response when users are manipulating data-intensive CAD imagery.

"The OpenGL CAD initiative is an expansion of the API to represent large models in an efficient way," says Bob Brandenstein, platform marketing manager at EDS Unigraphics, Maryland Heights, MO. "For example, you'll get better performance when you're viewing fly-throughs, or if you want to interchange that type of image between hardware vendors. You will also be able to more easily transmit these large images over the Internet."

And the evolving API will draw more CAD-oriented applications to those platforms that support it, says Bruce Boes, vice president of marketing strategies at Matra Datavision, Andover, MA. "The standard CAD/CAM API will be an excellent enhancement to OpenGL. It appears that it will be the graphics standard a lot of ISVs have been looking for, and it's encouraging to see that there's a lot of cooperation between Sun and SGI."

The Optimizer framework includes the following specific APIs, among others:

- Data simplification, which takes advantage of the fact that distant objects don't need the detail that up-close objects require.
- View frustum culling and occlusion culling, two functions that involve the removal of objects that are not in view or are positioned behind other objects.
- Advanced tessellation, which determines the amount of polygonal data that gets rendered onscreen, reducing the number of polygons for flatter surfaces, and increasing the number for curved surfaces.
- A multiprocessing "harness" to let developers more easily take advantage of multiprocessor hardware, such as Sun's Ultra series of workstations and servers.

Adds SGI's Matsuta, "With Optimizer, you can draw not only faster, but also smarter. A scene manager lets developers select only the transmission parts or only the electrical parts of an engine for viewing. It's a spatial organization. In addition, developers don't have to worry about multiple processors. We will let them more easily take advantage of SMP architectures. The OpenGL Optimizer has solved the CAD/CAM piece of the hardware platform support puzzle for developers."–*jsw*

JAVA 3D ADDS TO JAVA'S CAD UTILITY

Sun Microsystems Inc.'s "write once, run anywhere" maxim has not been lost on CAD software developers, many of whom are preparing products that take advantage of the Java programming language for distributed access to CAD files residing on a server. And at April's JavaOne Developers Conference, Sun detailed Java 3D, a graphics API for Java that adds support for 3D objects.

The groundwork for Java 3D was laid last year, when Sun announced The Java Media Framework, says Bjorn Andersonn, product line manager for the graphics and multimedia desktop systems group at Sun Microsystems Computer Co. (SMCC). Announced in May 1996, The Java Media Framework gave independent software vendors (ISVs) a way to deal with multimedia, including 2D images, telephony and speech. Java 3D will add support for three-dimensional objects to the mix, says Andersonn.

"With Java 3D, we will have a 3D graphics API for the Java language, and this adds support for a richer media environment on top of Java," he says.

Andersonn says the first implementation will run on top of Silicon Graphics Inc.'s OpenGL graphics API, which Sun ships for Solaris, to allow graphics programmers to focus on higher-level components in the course of developing Java-based applications. For example, instead of having to work with the geometry that makes up the 3D image of a steering wheel, they'll be able to manipulate a 3D steering wheel as a complete object.

Even before the official unveiling of the 3D API for Java, many CAD software developers were looking at the Web as a way to let users view data without editing the files. In this scenario, a Java-based satellite application provides file viewing for project managers, for example, while designers themselves work with the fully featured core application, Andersonn says.

Right now, five of the largest CAD-related ISVs–Parametric Technology Corp., Dassault Systèmes, Computervision Corp., EDS Unigraphics and Structural Dynamics Research Corp. (SDRC)–are taking advantage of Java and the thin-client model, says Warren Mudd, group manager for technical market development at SMCC. "There are some hot development sites in MCAD today that will leverage Java and the thin-client paradigm to both differentiate their offerings and add value for end users. All of these sites are actively engaged in some sort of Java development project."

According to Sun's Mudd, Dassault is using Java to develop a product line that will enable data browsing across much of the enterprise, combining both the "write once, run anywhere" concept with Java's three-tier computing paradigm, wherein Tier 1 includes large vault data storage with high availability; Tier 2 is made up of departmental application servers; and Tier 3 is the user's workstation or data access terminal. The data browser will allow any type of user terminal, including notebooks, to access processes on the Tier 2 server, which provides viewable data or processes data as the client application requests.

Mudd presents the following example: "A field engineer could manipulate 3D viewer files of subassemblies at a remote site to debug an early shipment problem. Using a notebook with a wireless modem to access the server, he searches for the relevant data set, downloads the view files, locally manipulates the data to find an area of interest, and sends more data processing commands back to the server via the client user interface (such as asking for the minimum distance between two mating parts). The Tier 2 server calculates a new data set and resends the viewable data and report to the field engineer. This provides almost instantaneous access to data, as well as instantaneous feedback on the quality of that data, linked to the 'webtop' running on the nomadic device. The same scenario works on the factory floor for the inspection and resolution of geometry problems during early fabrication of components."

Even before the official unveiling of the 3D API for Java, many CAD software developers were looking at the Web as a way to let users view data without editing the files.

Computervision is currently building a base-level architecture using Java that will host new applications for data access, creation and browsing. This infrastructure will contain "plug-ins" that will allow end users to create custom software objects to further customize the Computervision application and give them a competitive edge, Mudd says.

EDS Unigraphics is using Java to make client applications for its IMAN PDM software, and SDRC is doing the same for its Metaphase product. Parametric Technology is developing Java clients for its PDM products, including Pro/PDM, and is studying the development of 3D data browsers using Java.

"We envision people starting to use Java as a front end to a PDM system," says Bob Brandenstein, platform marketing manager at EDS Unigraphics, Maryland Heights, MO. "In this situation, the outside application would be written in Java to get to the PDM database. If I'm on a browser, and I get an email to look at a part that's in the IMAN database, I'd be able to pull that part off the database, translate it to VRML [Virtual Reality Modeling Language], and see it in the browser."

He envisions using this capability for collaborative design reviews, for example, where not everyone needs the full-blown Unigraphics CAD application.

Sun's Andersonn adds that not only will Java 3D run within Java-enabled browsers, it will also have its own user interface. In late March, JavaSoft sent initial developer versions of Java 3D to its licensees and partners. A prototype of the API is due out this summer.–*jsw*

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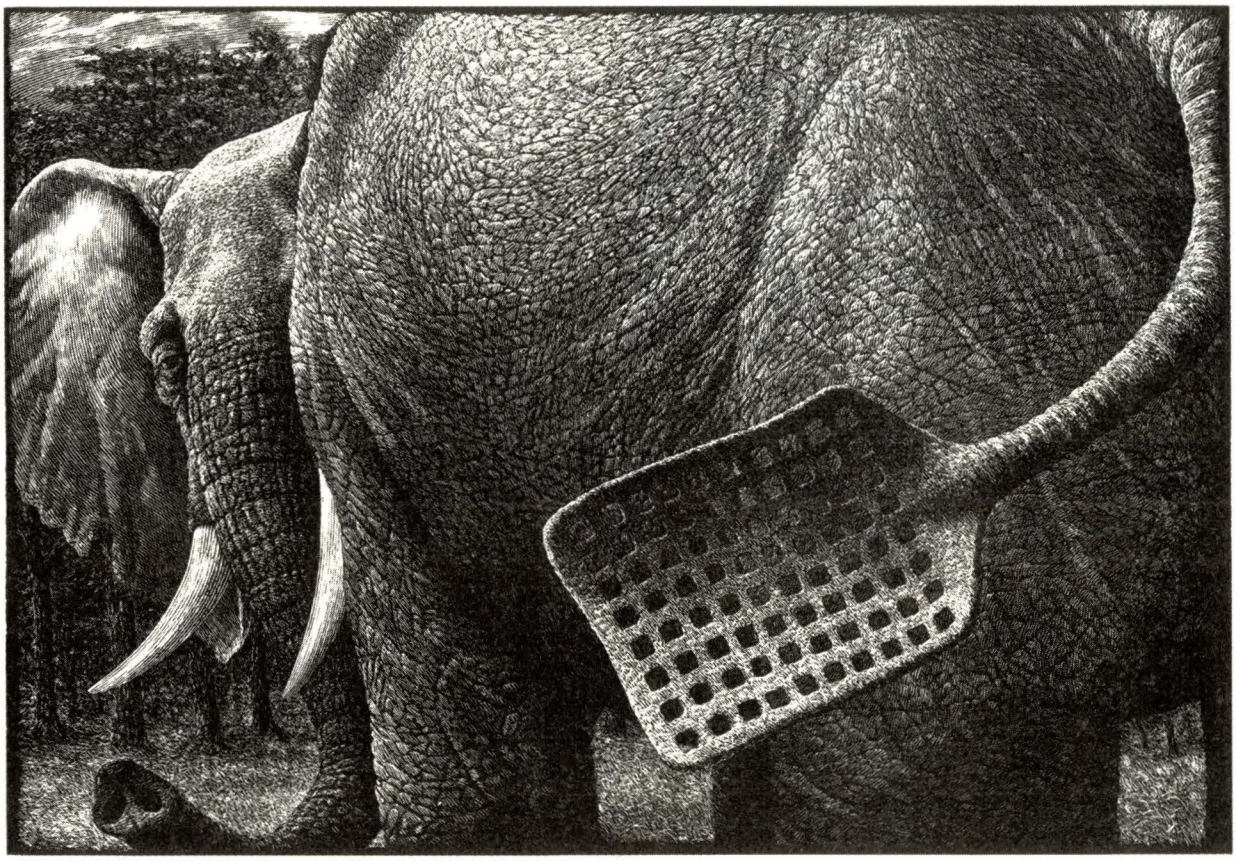

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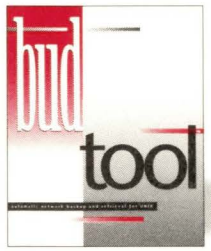

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Sun's Ultra workstations (shown here, Ultra 1, left, and Ultra 2) combine the UltraSPARC processor and its on-chip multimedia with a crossbar-switched interconnect for multiple, simultaneous data transfers.

range of processor configurations. The Ultra 2 also ships with or without Creator graphics. At either end of the spectrum sit the Ultra 1 Model 140, which includes a 143-MHz UltraSPARC CPU, up to 32 MB of memory and two SBus slots ($7,995), and the Ultra 2 Model 1200, with two 200-MHz, 64-bit UltraSPARC CPUs, up to 2 GB of memory and four SBus slots ($26,495).

Currently topping off the Ultra workstation line are the Ultra 3000 and Ultra 4000 Creator 3D servers ($80,000+), which Sun aims squarely at the high-end graphics market and industries such as manufacturing process control, oil and gas, and entertainment.

The introduction of the Creator graphics subsystems in November 1995 gives the company graphics processing power that draws the attention of technical users who two years ago might not have considered Sun because of its lack of compute power. With the Ultra line, Sun improved processing power, I/O and disk performance, says Chris Scheufele, senior product manager for workstation product marketing at Sun Microsystems Computer Co., Mountain View, CA.

With increased performance and lower prices due to robust shipments of the Ultra platform, Sun has begun to enter new segments of the CAD/CAM market, with the low-end Ultra 1 Model 140, for example.

"With the Model 140E, we took the Ultra Creator 3D and brought it down to $11,995, almost halving it from its original $22,000, due to the volume of shipments. This has allowed us to move into the Pro/Engineer market, for example," Scheufele says.

The Creator 3D graphics system is a frame buffer with 3D RAM, a total of 96 planes, including 24-bit double-buffer planes, 28-bit Z-buffer and eight-plane overlay support. Its Ultra Port Architecture (UPA) memory interconnect, featured across the Ultra line, provides a high-speed connection between the system CPU, memory and the graphics subsystem.

"The UPA is the key for us to be able to achieve a balance between graphics processing on the graphics card and processing on the motherboard. Things like floating-point operations and pixel manipulation can be moved over to the Creator 3D, and we have a mix between the CPU and the graphics board," Scheufele says.

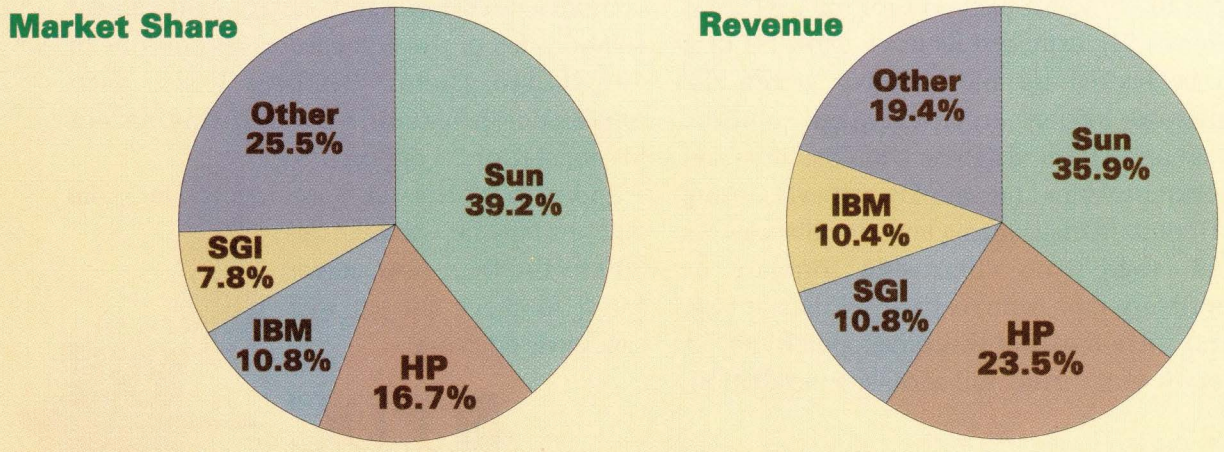
Still Some Compatibility Problems

Even though Sun's workstation line boasts some heavy graphics processing artillery, some users still find incompatibilities between the new hardware and high-profile software applications. Sun has worked hard to provide a platform that supports as much software as possible, according to ISVs, but there are a few exceptions.

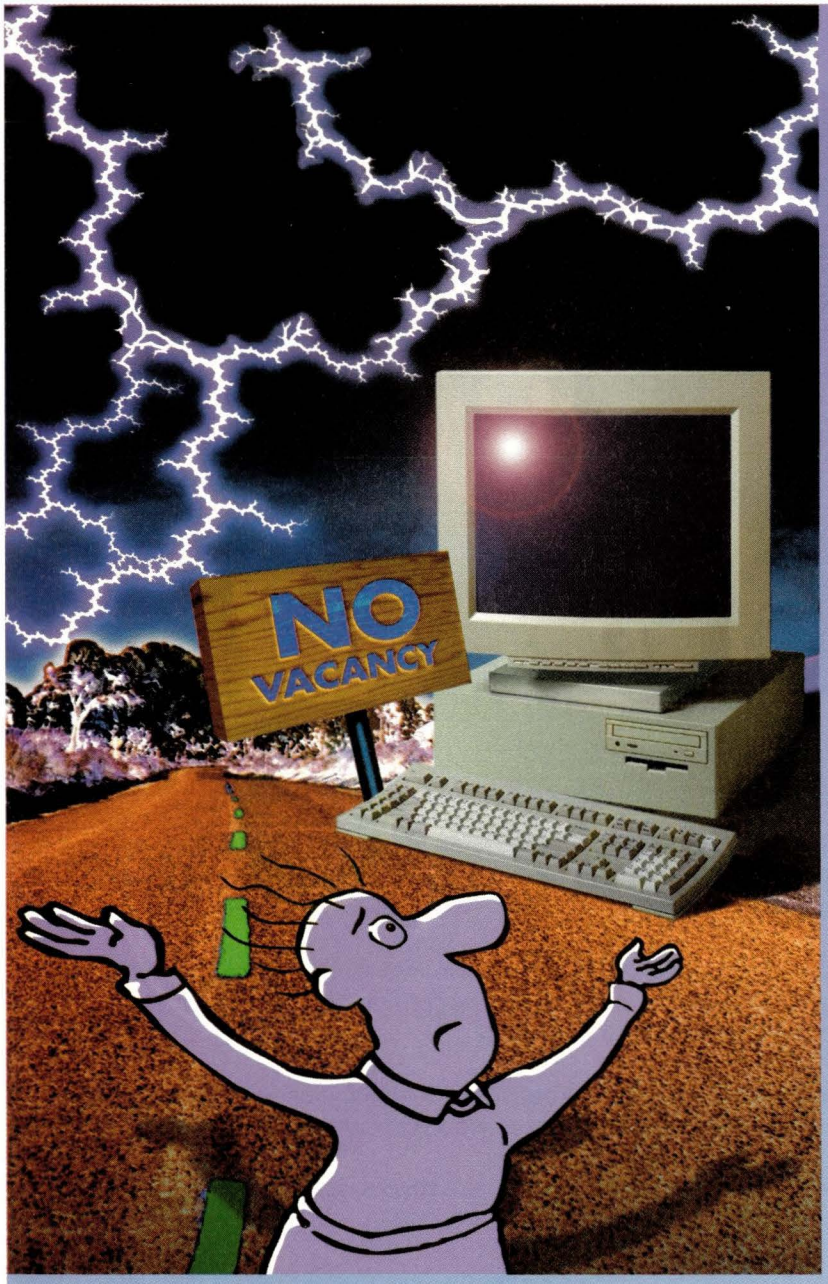
At one large Sun installation (a federal government facility with 121 Sun machines), the CAD manager reports that Matra Datavision Inc.'s Euclid 3.0 software doesn't run in the Creator 3D's 24-bit mode.

"We're creating envelopes of objects, and we do quite a bit

Top Four Vendors in the UNIX CAD/CAM Market (1996)



Sun's market share and revenue both increased from 1995 to 1996. In 1995, the company claimed 36.1% of total market share among UNIX systems vendors, and 31.1% of revenue. The other three vendors shown here have all seen these numbers decrease over the same period, with the exception of IBM's market share, which grew by only 0.3%.



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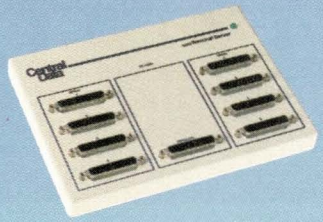

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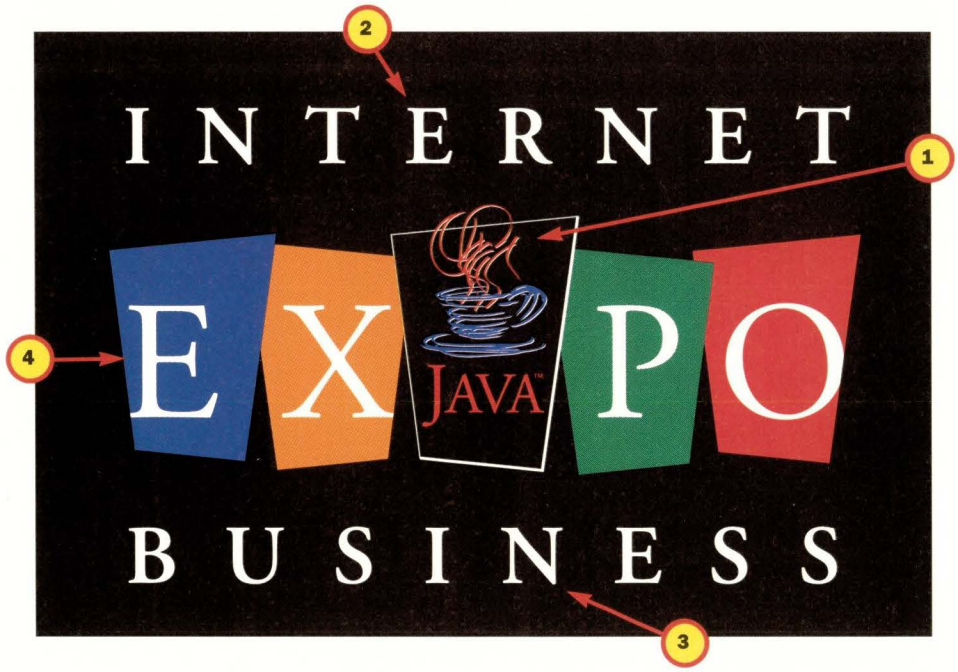

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of shading in 24-bit mode. We haven't been real successful with the Ultra and Matra. After creating a 24-bit model, we put the dimensions on and try to slide it around, but the software can't always keep up with the hardware. So we have to get out of that session, and then go back to 8-bit mode," the CAD manager says.

Such incompatibilities are the exception, however, and most large ISVs, including EDS, SDRC and Mentor Graphics Corp., say that Sun has worked closely with them to ensure smooth operation on the Ultra platform.

Garnering good reviews from its software developers has helped Sun reestablish itself as a worthy alternative to HP, IBM and the other big suppliers of technical workstations. Making OpenGL, the widely used graphics application programming interface (API) from SGI, available on Solaris last year further bolstered Sun's standing among technical users and software developers (see "SGI Promotes CAD-Specific APIs for OpenGL").

"In the last few years, Sun has done a nice job of getting to where they want to be in terms of competitive products, market presence and understanding how to work with ISVs," says SDRC's Kundrat. "In general, they have made significant progress but they still have more work to do. HP, SGI and, to some extent, IBM have been focused for some time on a broad-based approach to the CAD/CAM market that involves product, technology, distribution, services and relationships. The introduction of the UltraSPARC seemed to serve as a catalyst for Sun, prompting their adoption of similar proven business models. They are finally on the right track and should be considered in the same light as HP or SGI when evaluating comprehensive CAD/CAM solutions."

Wowing the Engineers

One developer on the Sun platform, Exa Corp., Lexington, MA, which sells fluid-flow analysis software, tells the tale of an engineer who couldn't contain his enthusiasm upon booting up and testing a new Ultra Creator 3D machine.

"We received an Ultra with Creator 3D and, at the time, our principal engineer also had a brand-new [SGI] Indigo. When he saw the performance of the Ultra, people in the next room heard him let out a resounding 'Wahoo!,' he was so impressed. Later, he said it was the first time he could say a Sun machine is the fastest on the street," says Steve Weinberger, vice president of business development at Exa.

As developers noted the UltraSPARC's performance gains over the SuperSPARC and other previous SPARC architectures, users began to put them to the test in a variety of settings, including EDA and other CAD disciplines. Xerox Corp., for example, uses an UltraSPARC 2000 server and a mix of Ultra 1s and Ultra 2s in its microprocessor design work, and although the EDA space has been Sun's forte in the technical workstation arena, users involved in electronic circuit design still took notice.

"We've seen a significant increase in performance with the Ultra architecture, upwards of four times the performance of the

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SPARCstation 20s we have here. Sun's previous performance increases were incremental, but with this one, our engineers are telling us that they no longer have to wait for a simulation to run," says Tony Frumusa, ASIC design manager at Xerox, Rochester, NY.

Sun Always EDA-Friendly

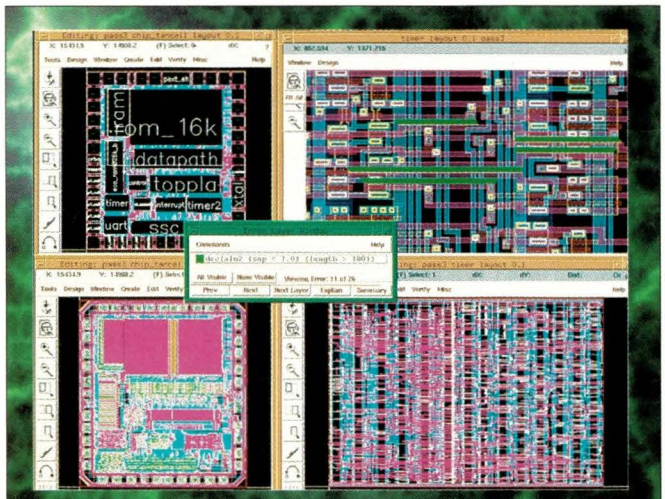
Even before the Ultra appeared on the scene, however, Sun had maintained a strong grip on the EDA market, which, with an emphasis on 2D design work, is not as compute-intensive as MCAD, for example, where 3D modeling is a central component to applications.

EDA software developer Cadence Design Systems Inc., San Jose, CA, attributes as much as 80% of its new license revenue for any given quarter to Sun users.

"They were always dominant in EDA, and it's really hard to knock down a Goliath. Historically, the market has reacted more strongly to Sun's lack of graphics performance in the mechanical world, which is drastically different than in the electrical world. In mechanical, 3D graphics are very important, and HP and SGI were eating away at Sun's base; with the Ultra line, Sun is no longer deficient in this area," says David Milam, group director of marketing programs at Cadence.

Sun's traditional strength in the computer-aided software engineering field has also helped it keep its spot at the forefront among workstation vendors selling to electronics design users. A significant factor is that all the major semiconductor companies, including Texas Instruments Inc., Lucent Technologies Inc., NEC Corp. and Motorola Inc., all developed specialized code on the Sun platform and, therefore, they also chose to run commercially-available software on Suns. All of their CASE-oriented development projects are on Suns, using Sun-based tools, Milam says.

Sun has not forgotten its roots in the server market, either.



Cadence's Vampire product is an automated IC verification application, falling into the EDA market, a longtime Sun stronghold.

The Ultra Enterprise line of servers, developed in parallel with the Ultra workstations, has continued to evolve in terms of processing performance, storage options and management software. The latest additions to the family are called the Ultra HPC servers. In its marketing literature, Sun clearly states that EDA and MCAE are the primary target markets for these new servers, aimed at high-performance computing.

Market research firm International Data Corp., Framingham, MA, divides the so-called high-performance computing market four ways: supercomputers, high-performance midrange computers (HPMRs), technical massively parallel processors (MPP) and strategic business analysis. In 1995, the entire market for these systems produced revenues of almost $3 billion. In the year 2000, that figure is expected to swell to more than $5.6 billion.

HPMRs form the largest segment of the high-performance computing market, accounting for 46% in 1995 and an expected 56% in 2000. It's the only portion of this market where IDC predicts growth, and Sun positions its Ultra HPC servers solidly in the HPMR space.

The Ultra HPC servers range from the Ultra HPC 2 (two CPUs, 2-GB memory) to the Ultra HPC 10000 (64 CPUs, 64-GB memory). The HPC servers essentially build upon Sun's existing Ultra server line, with the addition of bundled management software such as Platform Computing's Load Sharing Facility (LSF), workload monitoring, management and accounting, and job scheduling.

The HPC server announcement underscores Sun's mantras since the beginning: scalability over a broad range of processors and a solid, mature operating system in Solaris, with long-time support for multithreaded applications. While Sun has been advocating multiprocessing hardware architectures and the multithreading properties of Solaris for years, CAD packages are now beginning to take advantage of multiprocessing and multithreading.

Multithreading + Multiprocessing = Speed

Cadence has been taking advantage of Sun's multiprocessor architecture and multithreaded OS for a few years. Although the benefits in performance are great, adding multithreading capability to existing applications can take a serious toll in coding time, Milam says.

"We've supported multithreading for the last three years with Vampire. To do that, you have to take the software's execution code and break it up into threads, and run those across multiple processors or across networks. Multithreading is very disruptive to the software because you have to find out the best places to break the code to spin off a thread to process elsewhere, and then have it come back. It's almost like a rewrite," Milam says.

That said, the real benefits of multithreading are achieved when underlying algorithms are "spun off" to other processors, so compute-intensive math calculations are broken up and distributed across two or more processors. For example, Cadence has experienced up to 75% improvement in throughput by scaling its software across eight processors, Milam says.

If developers are not taking advantage of multiprocessing and multithreading yet, Sun is urging them to do so.

"Sun is definitely a leader in multiprocessing architecture, and they're hounding us to do more to take advantage of it by developing versions of our software that support multiprocessing," says EDS' Brandenstein. "They've been on the forefront of the multiprocessing race, as well as scalability. At the same time, the number of patches to Solaris has come way down."

Solaris has been around long enough to provide troublefree setup and installation, as well. The Gap Inc.'s CAD group designs about 80% of the company's retail stores using Arris software running on 121 Sun workstations, including some Ultra 2s and an E3000 server. The Solaris environment has proved to be stable and easy to manage, says John Young, CAD manager. In fact, he says, he has a far easier time setting up new Sun workstations than the managers who use PC NT networks.

"We have a lot of people running Novell and NT, and they're dealing with a lot of crashes. These Sun machines don't go down, and they scale up through the entire line. The sysadmins on the PCs screw around with new PCs to be added to the network for six hours, but with Suns and Solaris, I can install them in one hour, and that includes not only the OS, but also all the network extras. And the scalability of the hardware is great," Young says. ⊸

Companies Mentioned in this Article

Cadence Design Systems Inc.
2655 Seely Ave.
San Jose, CA 95134
Circle 150

Computervision Corp.
100 Crosby Drive
Bedford, MA 07130
Circle 151

Dassault Systèmes
1935 N. Buena Vista St.
Burbank, CA 91504
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Digital Equipment Corp.
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Maynard, MA 01754
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Silicon Graphics Inc. (SGI)
2011 N. Shoreline Ave.
Mountain View, CA 94043
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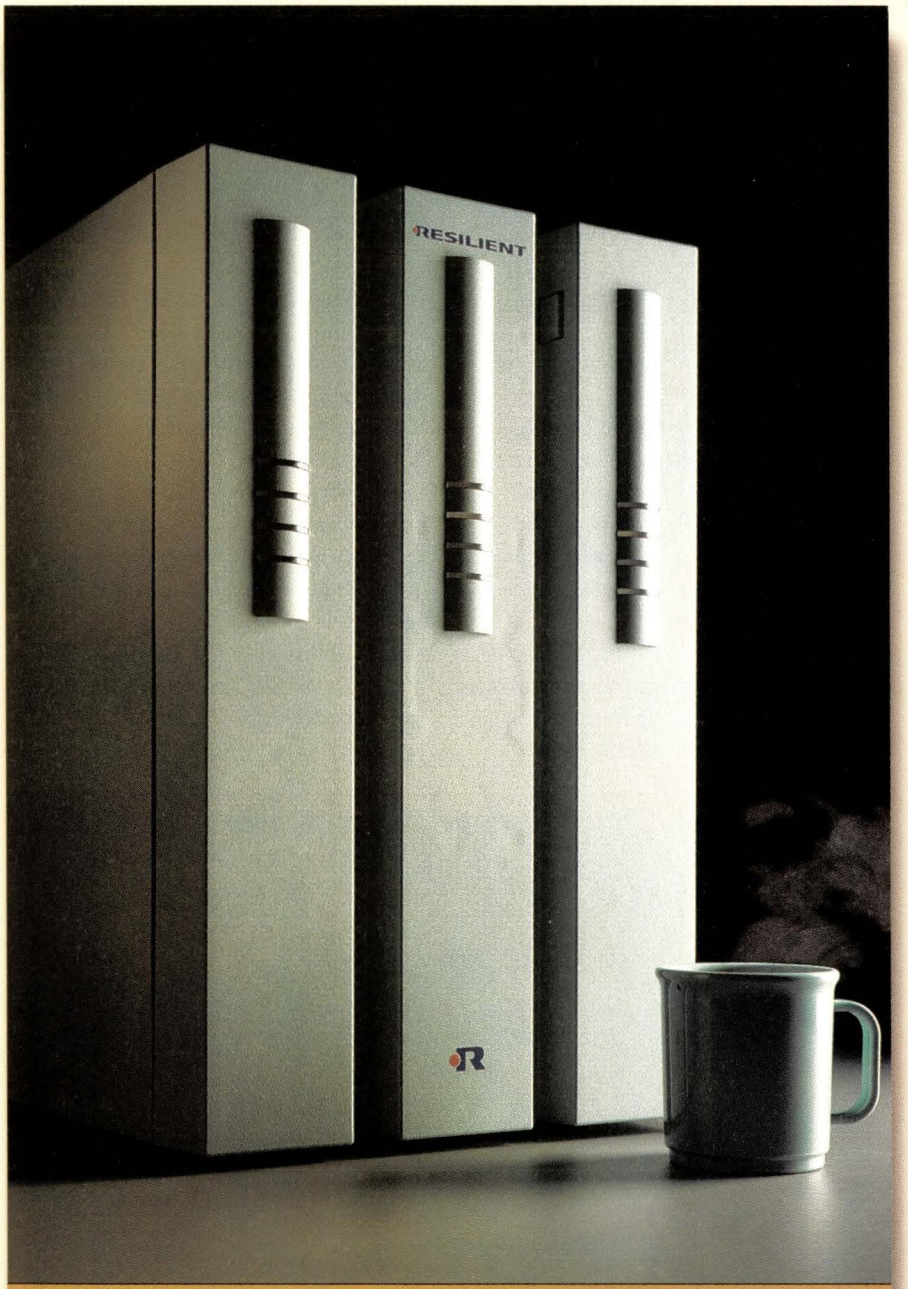

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PixelVision PV116sx Flat-Panel LCD Monitor

by **IAN WESTMACOTT**, Technical Editor

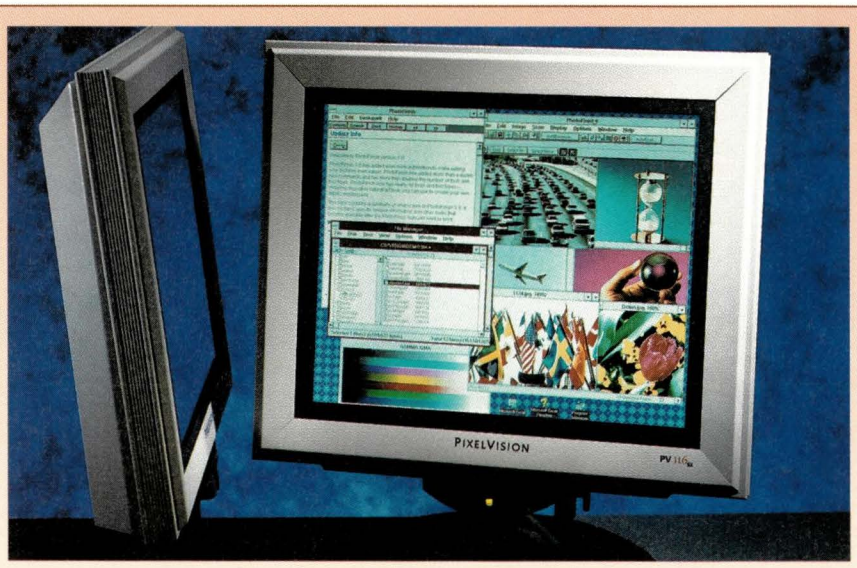
An active-matrix color LCD monitor is a must-see for anyone considering flat-panel displays.

Although the evolution of computer hardware at times seems blindingly fast, one component that has not kept up with the high-paced development is the computer monitor. We have thumb-size gigabyte storage devices, CPU units complete with I/O and storage devices smaller than a toaster. Yet, as soon as you connect a monitor, you must relinquish 25% or more of your desktop to the computer. This anomaly is even more pronounced when you realize the enormous effort concentrated on monitor technology not only from the computer industry, but other large industries as well, such as television and heads-up display applications.

There are three flat-panel technologies that aim to replace the large, cumbersome cathode ray tube (CRT) technology of today's monitors. These include liquid crystal display (LCD), in which a layer of color-filtering material allows, or blocks, light from a source to pass through a matrix of tiny cells; field emission display (FED), in which a layer of phosphors gives off light when excited by electron emissions from tiny emitters; and plasma display, in which phosphors give off light when excited by electrically charged gas.

The problem with these technologies is high cost and low production yield, particularly with larger displays. While LCD technology has been used quite effectively for portable computer displays, these are generally smaller displays. In the desktop arena, where larger displays are often required, the cost of LCD monitors runs in the range of $3,000 to $10,000, which is decreasing but still out of reach for many installations.

The PV116sx from PixelVision Technology Inc. is an active-matrix color LCD monitor with a 16-inch display area (12.5 by 10 inches). It supports resolutions up to 1,280 by 1,024, a 75-Hz vertical refresh, .28mm dot pitch and up to 262,000 colors. The monitor comes with a 15-pin video cable, but an adapter for the Sun 13W3 BNC connector is available separately. There are no special display requirements or driver software, and PixelVision claims plug-and-play compatibility with any system. VESA DPMS backlight control offers power-saving capability and extends the life of the monitor.



The PixelVision PV116sx 16-inch monitor is the best flat-panel display based on LCD technology that we've seen for desktop applications, with its solid construction, wide viewing angles and fast response time.

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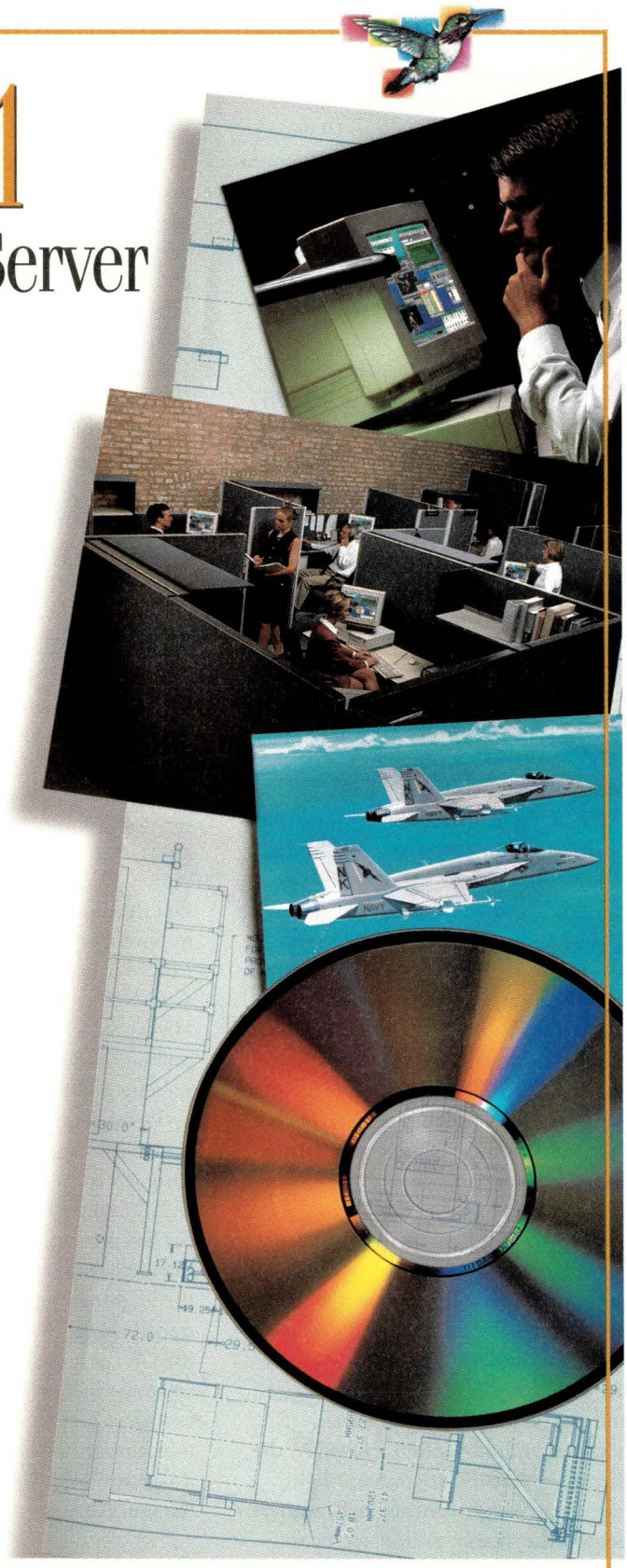

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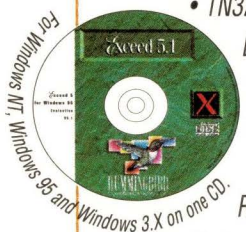

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The monitor measures 16.7 inches wide by 14 inches high and 3 inches deep. It weighs 19 pounds. However, the monitor is seated on a circular base unit (deskmount) with a 12-inch diameter, bringing the overall height to 19 inches. There are also fixed-base and wall-mount options available, and PixelVision performs custom installations.

Once I was used to it, the monitor was comfortable and more than satisfactory for my work, except for the brightness gradation problem.

When installed on the base, the monitor's tilt and swivel are adjustable, but not its height. The tilt can be adjusted by loosening a screw with a provided wrench. The video and power ports are located on the bottom of the monitor, so these cables fall vertically from the unit. The design is solid, with an aluminum casing and protective glass covering the LCD.

Six buttons are located on the front of the monitor: power, two brightness adjust, two contrast adjust and a menu button. The menu button brings up a graphical menu on the screen, which allows you to adjust brightness, contrast, image stability, vertical and horizontal positioning, black level and width. Some of the adjustments, such as black level and image stability, are rather touchy. Adjusting for optimal image quality takes some time, but once completed the settings remain stable.

Performance

The overall image quality of this monitor was very impressive, though not perfect. With its high brightness (150 nits) and 100:1 contrast ratio, the monitor is both bright and legible and has good color separation, even with very muddy colors. However, the display is sensitive to ambient light, particularly high-contrast light sources behind the viewer, and in such conditions produces a high glare. Our unit had a backlight adjustment defect that caused the monitor to exhibit a brightness gradation of dark to light from the top of the screen, which caused the top of the display to be too dark while the bottom was washed out. This occurred from any viewing angle and in all lighting conditions. PixelVision tells us this is a rare problem that is factory-fixable.

The monitor has a very good response time, and we could not produce any significant ghosting or skipping effects. There are no mouse "trails" or choppy motion such as is often experienced with LCDs. The manufacturer claims viewing angles of up 10 degrees, down 20 degrees, and left/right 40 degrees. Our experience found these numbers to be underestimates; for example, we found the display satisfactory to 60 degrees in the horizontal direction.

The unit is very sensitive to input signal, which makes calibration difficult. PixelVision has developed an interface board capable of accepting and processing a wide range of computer and broadcast signals, giving the monitor plug-and-play compatibility with a range of systems.

In order to test plug-and-play functionality, we connected the monitor to a range of systems, including UNIX workstations, X terminals and PCs. We found that the monitor always operated correctly, but that extensive calibration was needed in each case. In some cases, such as an Network Computing Devices Inc. HMXpro24 X terminal, no amount of calibration could completely eliminate stability problems and distortion.

I used this monitor exclusively for several days and had several of our designers use and evaluate the unit as well. I found that, once I was used to it, the monitor was comfortable and more than satisfactory for my work, except for the brightness gradation problem mentioned above. I did find myself missing my CRT at times, but the thought of regaining half my desktop quelled these feelings. Our designers, however, felt the monitor was inadequate for their detailed image and color work, though they liked the unit's design.

Summary

The PV116sx is the best flat-panel display based on LCD technology that we've seen for desktop applications. Solid construction, wide viewing angles and fast response time make this unit a must-see for anyone considering flat-panel displays.

While image quality is not perfect, it is more than satisfactory for most applications, as long as care is taken in monitor placement. Image calibration was difficult for some systems, but on our primary testing platform, a Sun Microsystems Computer Co. Ultra 1 Creator, excellent quality could be produced easily.

A height adjustment would be nice (and easy to implement), and a thumbscrew would be preferable to trying to find a misplaced wrench, but, otherwise, the ergonomics of the monitor were good.

The price is prohibitive for simply replacing large CRTs, but, where flat panels are required, this one shouldn't be missed. ⊸

PV116sx 16-inch Computer Monitor

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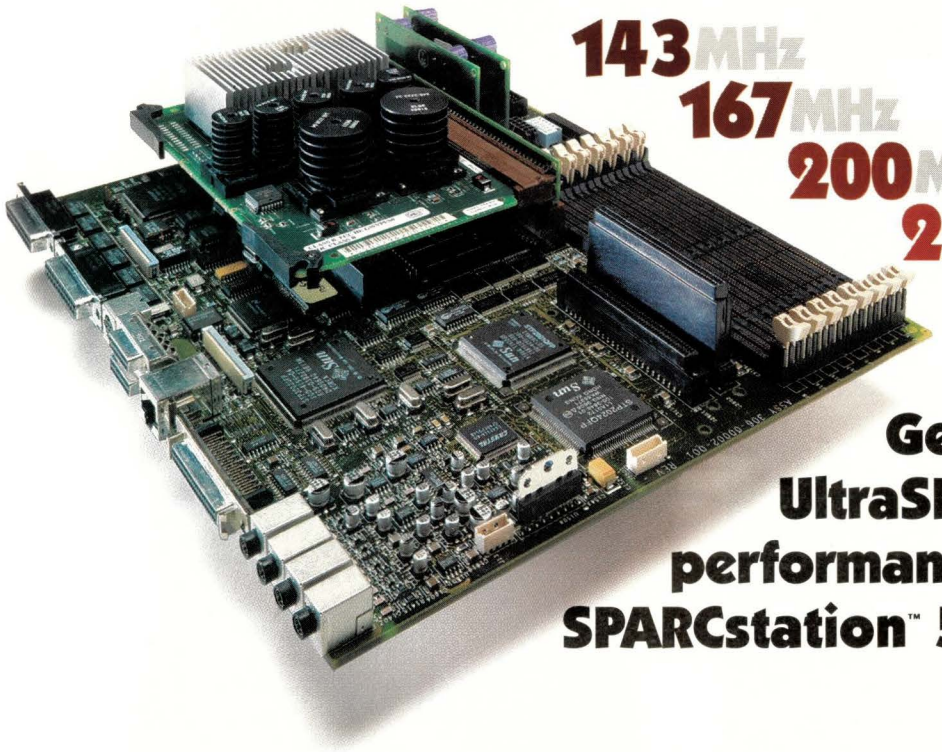

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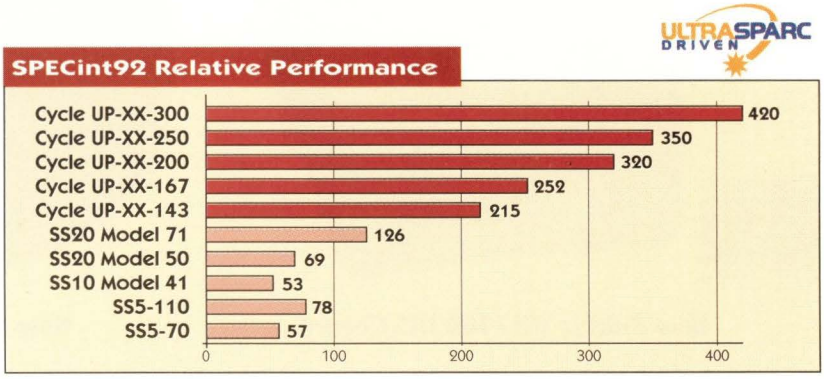

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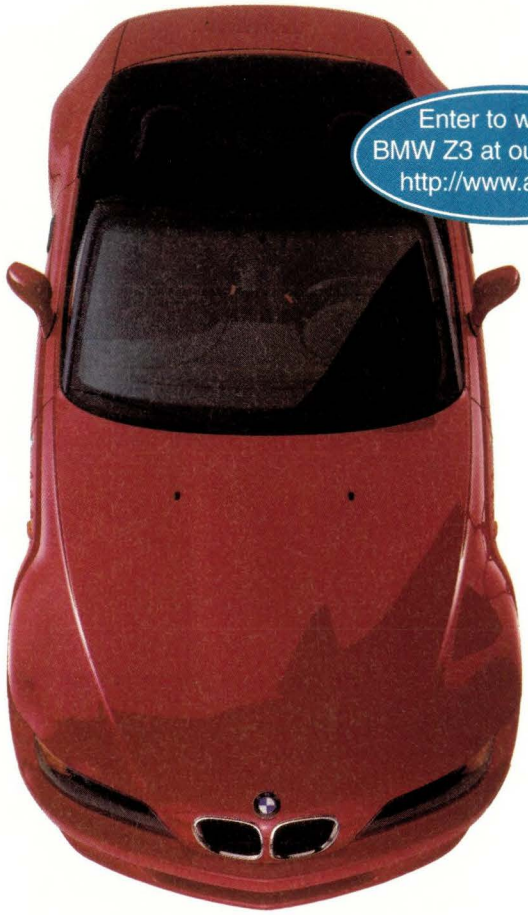

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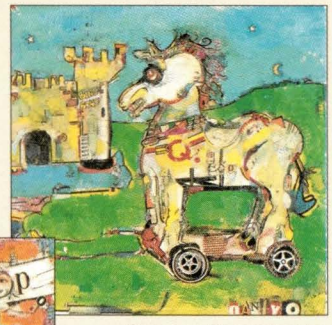
Feature

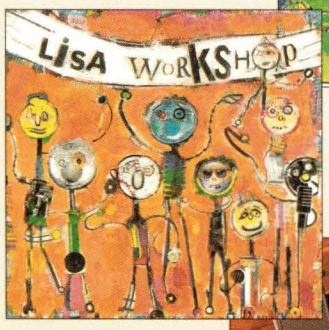
96 Full Speed Ahead

IBM's Internet technology is rocketing out of its labs so fast it's hard to keep up. Here's a starting place for those users who want to jump on board.

Karen Watterson

Columns





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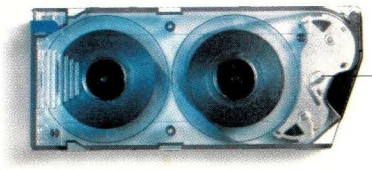

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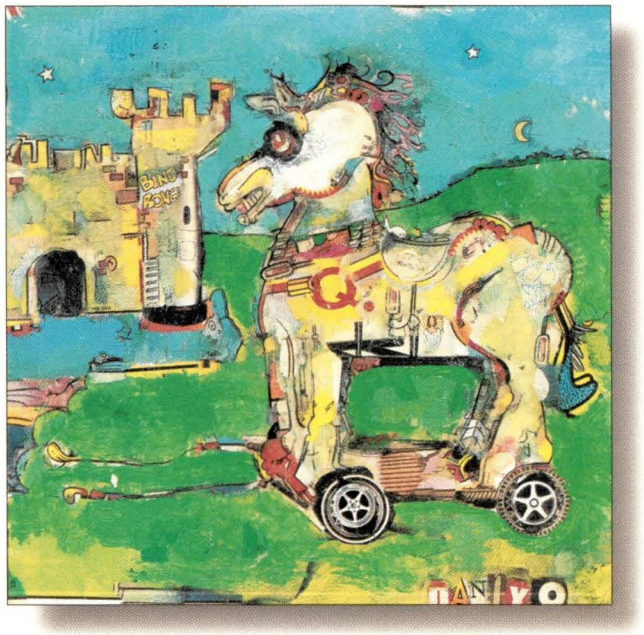
by Jim Fox



setuid Dangers

Jim Fox *works as a systems programmer for the University of Washington. He writes and maintains distributed applications that run on a variety of UNIX systems–and some non-UNIX ones. He is also the deputy manager for the Interoperability Project for SHARE's Open Systems Group. Email:* `fox@cac.washington.edu`.

Q: In your article "Parsing Permissions" (*RS/Magazine*, December 1996, Page 18), you said that setuid executables "can act as Trojan horses, allowing a hacker to return to your system and become superuser." I do not understand how this can be accomplished with a setuid executable. Also, why is it dangerous for setuid programs to be owned by root?

P. Newman
CAE Electronics

A: A setuid program runs with the privileges of its owner, rather than those of its user. This is useful whenever it becomes necessary to grant limited privileges to otherwise unprivileged users. The password changer, `/bin/passwd`, is an example. It needs superuser privilege to update the password file.

The problem is that setuid programs, especially those owned by root, must be perfect. If a normal program breaks, because of outrageous input, an unexpected signal or any of a thousand other causes, it just crashes or loops or something. No harm is done to the system as a whole. However, a program running as root can take the entire system with it. When you hear about a UNIX security problem, it most often has something to do with a program running as root that fails because of some unexpected, improbable, but possible, condition.

But I had a different trouble in mind. Potential hackers can be divided into two categories: those who have a legitimate purpose on your system (users); and those who have no right to log into your system at all (intruders). At the University of Washington, we have about 50,000 of the former and about 200,000,000 of the latter. Your systems and ours must be protected from within and without.

Suppose you have unprivileged users, other employees, for instance. One of these users (Bud Ding Hacker) finds a way to be root for a short time, possibly by finding a terminal left open and logging into a root shell. Bud writes this C program

```
main()
{
    execl("/bin/sh","/bin/sh",0);
}
```

and stores the executable in `/etc` with some nondescript name like `ytab` (or `" "`) that

no one would ever notice. Bud then sets ytab's ownership to root and permissions to 4055. Now, until you discover and remove the file, Bud and any other user can run /etc/ytab and gain a root shell.

This is why you must be on the lookout for new setuid programs. It's not the most common way for intruders to enter your system, but it is one of the sure ways for a normal user to become a superuser.

It's also an easy path to defeat. Allow setuid programs in only a few, monitored file systems. Generally, only the /, /usr and /usr/local file systems have legitimate setuid programs. The password changer, /bin/passwd, in the /usr file system, is an example. /bin/passwd has to be setuid to allow a nonprivileged user to modify the password file. Use SMIT to set the nosuid option for all file systems other than the three mentioned above.

As for monitoring, let's look at that setuid finder script from December again.

```
#!/bin/sh
# Look for setuid programs
for i in "/" "/usr" "/usr/local"
do
    echo Scanning $i
    find $i -xdev \(-perm -4000 -o -perm -2000 \) \
      -type f -exec ls -lc {} \; > /var/suid_chk.log
done
```

Each find command starts at the base of one of the file systems (/, /usr or /usr/local) and searches for, and lists, any regular file on the same file system (-xdev) that has either the setuid or setgid flag. Modification times of the inode are displayed, not the file's normal modification time. Remember that the latter can easily be manipulated using touch.

Most legitimate setuid programs are installed at system maintenance and are unchanged otherwise, so you could just scan the log for recent dates. A more automatic approach would compare the daily log to your standard one, created just after maintenance was applied.

For more tools like this, check the old standby COPS at ftp://ftp.cert.org/pub/tools/cops. It is still in distribution and can help you watch over your system and protect it from local hackers. COPS hasn't been updated for several years, so don't worry if your copy seems old.

Network Attacks

The more insidious danger, and the hardest to guard against, is attack from the Internet. This is where the busiest and most clever hackers will come from; and they have sophisticated tools. Your best defense is not a good offense. We live on a civilized Internet, after all.

Try seeing your systems as others see them. For this you can use the Security Administrator Tool for Analyzing Networks (SATAN). Using SATAN is much like walking around your

building looking to see if all the doors and windows are closed and that there are no ladders positioned up against the wall. It runs on a remote site and probes your system from the network. Of course, you need more than one host for this approach to work, and it's most useful if you have many hosts.

There's a nice reference document on SATAN at `http://inthedrk.fast.net/satan_html/docs/satan_reference.html`. One place to find SATAN is at the source. The FTP site `ftp://ftp.win.tue.nl/pub/security` has not only this package, but also the current versions of COPS and tiger, another COPS-like package. These packages aren't very big, so you might just do all your security shopping in this one spot.

Your next duty is to keep up-to-date on security matters. SATAN is old enough that it won't find the latest threats. For that you'll need other tools. There are some Web sites, newsgroups and classes that come in handy.

Subscribe to the Computer Emergency Response Team's (CERT) mailing list for security alerts. Send an email message to `cert-advisory-request@cert.org` with the word `subscribe` as the message text. For online information, CERT tends to make its material available through FTP rather than HTTP. You can still use your Web browser. Check out the files and directories at `ftp://cert.org/pub/`. The `cert_advisories` apparently has an archive of every posting it has ever made.

IBM has a Web site with security alerts and responses directly relating to IBM equipment, see `http://www.ers.ibm.com/tech-info/advisories/sva/`. It is a good site to check on, especially after you get an announcement from CERT.

In addition, read these security-related newsgroups:

- `comp.security.announce` – This is where you find CERT's advisories. The group doesn't otherwise get many postings, so you can easily have your newsreader keep an eye on it.
- `comp.security.unix` – This one gets a lot of postings. Even if you don't read them all, you do at least get an idea of what's being discussed.
- `alt.security` – This is an unmoderated and more disorganized version of `comp.security.unix`.
- `rec.gardens` – This has nothing to do with computer security, but after spending time reading those other newsrooms you might need a break from the hackers, crackers and cybercops.

CERT sponsors seminars for systems administrators. The one-day courses are offered several times each year, mostly on the East Coast, but at least one is offered in the West. For information, send email to `customer-relations@sei.cmu.edu`. I have not attended one of these courses so I can't attest to their utility. However, if you're a systems administrator worrying about those hackers scratching at the gates, maybe this is just the right potion.

by Æleen Frisch

Yet Another Security Wake-Up Call

Æleen Frisch *is Systems Wrangler for a very heterogeneous network of computers and workstations. She is also the author of the book* Essential System Administration *(O'Reilly & Associates Inc., now in its second edition). In her spare time, she enjoys painting and lounging around with her cats, Daphne and Sarah. Email:* aefrisch@lorentzian.com.

It's not often that I get to deal with topical information in this column; systems administration is seldom a newsworthy subject. On those rare occasions when it becomes one, the focus is almost inevitably on computer security. This time is no exception.

I am writing this column a few days after a Texas newspaper, *The Dallas Morning News*, published an article about one of the men accused of bombing the Federal Building in Oklahoma City. The article was based on confidential documents belonging to the legal defense team. How the newspaper obtained the documents in question is still far from clear at this point. By the time you read this column, more detailed information may have come to light.

The defense team claims that the documents were stolen from their computer system and that some sort of fraud was involved. They have implied that all of their files–some 40,000-plus pages, which would correspond to about 100 MB of data–were taken in a single incident about two months before the article was published. *The Dallas Morning News* has denied that the documents were acquired by theft or any other illegal act on its part.

Whatever the truth of this incident turns out to be–and it's likely we will never know the truth–it can nonetheless serve as a useful pop quiz on system security for systems administrators everywhere.

Let's consider the security implications of the story we have at this point as if it were the whole truth and make the additional assumption that the computer system in question is running some flavor of UNIX (something that is not in fact very likely). We'll also assume that the computer system was not connected to the Internet (this is a safe premise, because if it had been, *The Dallas Morning News* probably wouldn't have been the only one to obtain the documents), and that the individual computers in the law office were connected via a local-area network.

The question we need to consider then becomes: How was the data stolen without detection and what could have been done to prevent its theft (if anything)? If you'd like to test your own security awareness, take a moment to list all of the ways the deed could have been accomplished before reading further. Keep in mind that members of the press

frequently visited both legal teams in the case and that the defense team was in the process of setting up a second office in Denver, the site of the trial (their home office is based in Oklahoma City).

The various ways of obtaining the data that occur to me fall into four distinct areas: breaches of physical security, unauthorized access to a valid user account, problems with file and data protection, and inappropriate behavior by legitimate users. Lack of proper protection in each area alone might be enough to allow an intruder to obtain the data, but actual instances of data theft usually involve several security failures working in combination with one another (scientists call this destructive interference).

Physical Security

Given how small current computer systems are, stealing the whole computer itself is often the easiest way of stealing data. Clearly, this is not a possibility here because a stolen computer would be missed. However, this does not rule out a breach of physical security.

Physical security encompasses all aspects of physical possession of, and access to, private computer systems and their data. There are at least two other breaches of physical security that could lead to the loss of data:

• An unauthorized person could have copied the data using an unattended workstation while in the office on other business. It would take only a few minutes to copy 100 MB of data to a tape or other removable media such as a Zip disk. (One could even add a Zip drive brought for the purpose to a computer with little trouble.) Careful, habitual use of screen-locking programs with passwords and enabling password protection on bootup can make such opportunistic breaches much more difficult and less likely.

• An unscrupulous person could have stolen a backup disk or tape while visiting the office. Backup media for sensitive data should be stored in a locked location rather than on an open shelf near the computer, which provides easy access for both ad hoc file restoration and would-be thieves.

One thing that both of these scenarios highlight is the extent to which data security is inversely proportional to convenience. When there is very sensitive data to be protected, then a certain amount of convenience and casualness toward security must be given up. Every user has to be constantly aware of the routine actions that are necessary to prevent the loss of data and be willing to perform them. It only takes one person who is too lazy to log out or lock his screen when he goes to lunch to provide an access point for someone with nefarious intentions.

The defense team has not stated the location from which the information was stolen, but the new office in Denver would make unauthorized access easier because many unfamiliar people would come and go in the office regularly. A potential thief could probably pose as a worker and escape detection fairly easily.

Account Access Security

Protecting user accounts from unauthorized access takes many forms. One subset of these activities involves preventing the sorts of breaches of physical security that we just considered. There are also user account-level controls that you can enable and configure to protect against user forgetfulness, or laziness to some extent. These include setting valid and invalid days and times of day for users to be logged in, and enabling automatic logouts of idle accounts after a specified period of time.

Another possible way someone could have stolen the data would have been to gain access to the system by breaking into a user account, possibly via a dial-up connection. Passwords are the primary means of protection against such attacks, and selecting hard-to-guess and difficult-to-crack passwords is essential.

In the situation we are considering, the ways that poor passwords could have contributed to a successful theft include the following:

• Someone could have written down her password in an obvious place that was easily discovered.

• Someone could have chosen a password that was easy to guess (such as his own or a family member's name).

• The thief could have obtained the file containing system passwords from an unattended login session (it would have to be a `root` session on an RS/6000 because AIX uses a shadow password file) and run `crack` against it at his leisure.

• Someone's password could have been discovered by peering over her shoulder as she typed it in.

AIX and other UNIX operating systems provide a number of mechanisms for mitigating some of the risks inherent in passwords, including password expiration facilities (to force users to periodically change their passwords, which will eventually take care of the case of someone learning it unknown to the user, although not necessarily before any damage has been done); minimum password length and other password selection controls; and automatic account locking after some number of unsuccessful login attempts (which can prevent educated guessing from succeeding).

The break-in may not have occurred at the law office at all. Instead, it could have occurred via a dial-up connection, the existence of which is likely given that the law firm has two geographically separated offices. With a high-end modem, it would take less than eight hours to download the 100 MB of data.

Some operating systems offer additional password protection for dial-up connections via dial-up passwords, but AIX is not one of them. In any case, these passwords are set on an essentially systemwide basis, so they offer only modest protection.

Much better dial-up password protection is provided via smart cards: credit card-size devices that provide a number for the user to use as an additional password when she logs in. Sometimes, the user enters a number presented by the target computer into the device and types in the number the card displays to her in response; other schemes involve cards that are synchronized with software running on the target computer and provide passwords as needed. In any scheme, passwords are good only once and are generated by a strong cryptographic method.

Smart cards are generally a highly effective yet relatively low-cost method for providing additional security for dial-up access. When such a system is in operation, merely discovering someone's password is not enough because you still require their smart card.

Dial-up access itself may also be restricted to certain users

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by limiting the terminal lines through which they may connect. Under AIX, this is specified via the SMIT `Valid TTYs` or the `ttys` attribute of the `chuser` command. For example, setting this attribute to `"!/dev/tty0,!/dev/tty1,ALL"` would prevent a user from logging in on serial lines zero and one but would allow him to log in on all other lines (including via the network). If dial-in modems were available only on these two lines, such a setting would remove dial-up access for that user.

File Access, File Contents Security

File ownership and protection provide a different sort of defense against the loss of sensitive data than user account protections and controls. Ideally, they provide a way to restrict access to only that subset of users that actually needs to use the confidential data. That way, vulnerabilities in random accounts on the system are not as much of a risk; the would-be thief must target specific accounts for break-in, which can make the task substantially more difficult.

Similarly, if file ownership, file permissions or even the structure of the system's groups are not planned and implemented carefully, potential risks are magnified rather than minimized. In our case, the files in question will probably have to be shared among several users, which probably means that at least group read access will be enabled (which is all an intruder needs anyway).

For such a site, it is imperative that groups be designed with security considerations in mind from the beginning, even if they conflict with traditional organizational structures or practices. For example, users who do not need to access the sensitive data should not be placed into the group that owns the files. Ideally, they should not share any groups in common with users who do access the data so that security problems in unrelated accounts (for example, a group- or world-writable home directory) have no chance of compromising the sensitive information. (The `kuang` module of the freely-available COPS security checking facility is designed to detect such interactions.)

AIX's access control lists provide a still better mechanism for controlling file and directory access in that they allow an administrator to specify exact file access on a per-user basis, overriding any group privileges. Setting up careful access control lists for the files and directories in question–and updating them frequently–might have further limited a potential thief's points of attack.

For very sensitive data, encryption offers another level of protection against even breaches in user account security. Accessing encrypted files involves another key (password), which is yet one more item that the potential thief must discover. It also ensures that even if the files are stolen, reading their con-

tents will not be a simple matter. Unfortunately, encryption makes it substantially harder for the files to be used regularly in a normal manner, and the few law firms I am familiar with are generally neither patient enough nor technically sophisticated enough for encryption to be a practical solution.

Social Engineering

The term *social engineering* refers to deceptive techniques and tactics for getting computer users to give you access to something that they shouldn't. This can range from information about the computer system to passwords to the sensitive data itself. People are always the first, last and most important line of defense in computer security because even the best security systems can be compromised by an ignorant, naive or malicious person.

In our case, the security breach could easily consist of, or partially involve, the action of one or more of the legitimate users of the system. For example, a user could have revealed his password to someone claiming to be working on installing the computer system in the new office, an act probably based on ignorance but not malice. At the other extreme, someone in the office could have made unauthorized copies of the sensitive files and given them to someone from *The Dallas Morning News*.

There's not much a systems administrator can do when a user with necessary and legitimate access to sensitive data deliberately decides to reveal it to someone he shouldn't. However, an administrator can, and should, try to protect against users' error in judgment. The following steps can be helpful in this regard:

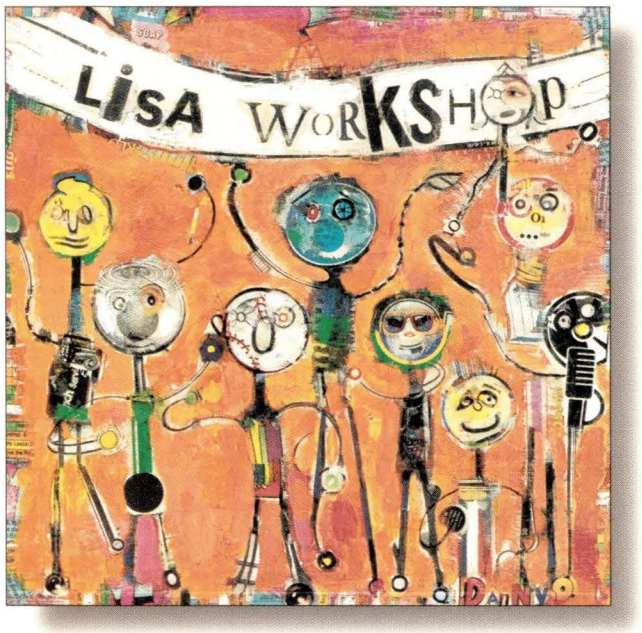
- Users need to be educated about security principles and their importance, including the rationale behind them.
- Most sites will benefit from developing a written security policy to be used as part of user orientation.
- Whenever a user leaves the site or the company, permanently or for an extended absence, proper account termination procedures should be followed. This will minimally include disabling the user's accounts and changing all passwords that the user knew.

Tell Me What I Missed

The space available for this column really only allows us to scratch the surface of this interesting and complex security problem. I'd be interested in hearing your thoughts on the matter. Feel free to send me email, pointing out things I've overlooked or items with which you disagree. If there is enough interest, I'll summarize our collective wisdom in a future column.

For more information about the security issues raised in this column, consult Chapter 6 of my book *Essential System Administration* (O'Reilly & Associates, 1995, ISBN 1-56592-127-5) for an overview, or pick up a copy of *Practical UNIX and Internet Security* by Simson L. Garfinkel and Gene Spafford (O'Reilly & Associates, 1996, ISBN 1-56592-148-8).

by John S. Quarterman



UNIX Systems Administration as Politics

John S. Quarterman *is president of Matrix Information & Directory Services Inc. (MIDS), which publishes* Matrix Maps Quarterly, Matrix News *(monthly) and the* MIDS Internet Weather Report *(daily). John has written or co-authored seven books, but the best known one is still* The Matrix. *For more information, see* `http://www.mids.org`. *He can be reached by email at* `jsq@mids.org`, *by voice at (512) 451-7602 or by fax at (512) 452-0127.*

Last month, I discussed the USENIX association, but I didn't mention SAGE. That's because SAGE, LISA and UNIX systems administration in general are enough for a whole column by themselves.

Large Installation Systems Administration

LISA sprang from the fertile brain of Rob Kolstad, much like Athena from the head of Zeus. Back when Rob was working for Convex, a supercomputer vendor, he saw a need for administrators of large installations to discuss issues. He proposed a workshop to the USENIX board of directors and, thus, the Large Installation Systems Administration (LISA) workshop series was born. As near as I can recall, the vote was unanimous, and the year was 1987.

LISA grew into a full-fledged conference, drawing 1,700 people to Chicago in the fall of 1996, which was more than the 1,400 attendees at the 1997 USENIX Conference that was held in January in Anaheim, CA. The Chicago conference was actually expected to draw fewer people than the average LISA, because it was not taking place on either coast. Attendance was low, but not nearly as low as expected. Chicago is thus considered a successful experiment.

LISA has the whole panoply of conference services, including a refereed technical program, invited guest speakers, preprinted proceedings, attendee lists, Work-in-Progress sessions, birds of a feather meetings (BOFs) and a terminal room. LISA normally has three days of tutorials (more than USENIX's usual two days), and tutorials are not only of great use to the attendees, but are also the main source of conference income.

LISA is still formally organized by USENIX, and the same person, Judy DesHarnais, plans both the LISA and USENIX conferences, as well as all the other USENIX workshops. The terminal room is also traditionally organized by the same person who runs the USENIX room; this has been Gretchen Phillips for the last few years.

However, the LISA technical program is the responsibility of a program chair who is appointed by the SAGE board of directors. Actually, it's a little more complicated than that. A joint committee of four (two select-

ed by the SAGE board and two by the USENIX board) reviews proposals sent in by prospective program chairs. A proposal generally includes a list of proposed program committee members. In addition to the usual tasks of reviewing papers and the like, the program committee also selects the coordinator for the invited talks.

The System Administrators' Guild

SAGE is the System Administrators' Guild. The "E" is there merely to avoid the acronym reading SAG and connote wisdom instead. Or is it? Folklore on that subject abounds. The most popular seems to be that the letter is the missing "e" from the UNIX _creat_ system call. Other, e-less, UNIX names, such as _resolv.conf_ also get mentioned here. Anyway, the official purpose of SAGE is that it "will engage in education, develop standards of excellence, recognize those who attain such standards, and will promote work and propagate knowledge that advances the systems administration profession."

The current officers are Hal Miller, president, Tim Gassaway, secretary, and Barb Dijker, treasurer; and the other directors are Pat Wilson, Amy Kreiling, Paul Evans and Helen Harrison. Former board members and officers don't usually just vanish, either. Paul Evans is a past president, and Elizabeth Zwicky, although she won't admit it, is known as "permanent past president" or "president for life," which some even say is an official title. She does admit to being zeroth president, i.e., the one who was appointed before one could be elected. Steve Simmons was elected first president of SAGE in 1993.

SAGE is formally a Special Technical Group (STG) of USENIX. What is an STG? It's similar to the old idea of a Special Interest Group (SIG), except it's technical and more formal. There has been talk of some sort of Linux STG, although the USELinux track at the 1997 USENIX Conference was apparently just that: a track, not an organization. However, the PERL Institute is collecting signatures on a petition for a Perl STG, so one is more likely in the immediate future.

To be a member of SAGE, one must first be a USENIX member and then pay an extra $25 fee for SAGE membership, but one doesn't have to join SAGE to join USENIX. USENIX membership itself costs $60, which has recently been lowered from $70.

Without counting Uunet's donation of a number of stock shares matching the original USENIX funding of Uunet (shares now worth a couple of million dollars), USENIX is solvent, although like any trade or professional association, it is only the members and participants who keep it that way. SAGE is similarly solvent, thanks to LISA being the biggest USENIX conference and a dependable cash cow (all those tutorials), although SAGE only gets 20% of LISA revenue. As Barb Dijker puts it, "The sacred cow is essential for the whole village." LISA revenues also support smaller workshops that may not produce positive cash flow. And the cow needs the village to support it; SAGE, in particular, subsists mostly on membership revenues.

SAGE pursues other activities in addition to LISA. It has a SAGE members-only job posting service, for example, implemented as both a mailing list and a private set of Web pages. The Web pages are authenticated by SAGE membership number.

In addition to its work on LISA in conjunction with USENIX, SAGE cosponsors the Systems Administration, Networking and Security (SANS) conference with FedUNIX, which runs annually in Washington, D.C., in the spring. For more information, contact `sans@clark.net`. SAGE involvement helps to ensure a quality technical tutorial program.

SAGE Publications

SAGE contributes many pages to the regular SAGE section in *;login:*, the UNIX newsletter. SAGE publishes a series of pamphlets, including to-date policies and job descriptions. So, for example, if you want to specify what kind of systems administrator you need to fill an opening, you can look in the job descriptions pamphlet and say, "I want a SAGE level 3 systems administrator." There are four levels, with level 4 being

the highest. They're working on similar publications, including ethics, hiring, legal issues, education/curricula, security for managers and site audits, plus some kind of certification.

Hmm, I see that the code of ethics (`http://www.usenix.org/sage/hypertext/code_of_ethics.html`) is already available on SAGE's Web page, although as of this writing the SAGE board has only elected to treat it as advisory and under review. It's an interesting document. There is some similarity to the Hippocratic oath for doctors, in its insistence on integrity and confidentiality. Many moons ago, Doug Gwyn (who wrote the Ballistic Research Lab's System V emulation for BSD) made such a comparison to me, and I laughed at him. I laugh no longer.

One reason it's not funny anymore is the strange case of Randal Schwartz, in which Schwartz was convicted of criminal charges for doing his job as he understood it (for more details about the case, see `http://www.mids.org/mn/604/remerlyn.html`). He also made some big mistakes, which he might not have if both he and his employer, Intel Corp., had been familiar with this code of ethics. SAGE is thoroughly familiar with Schwartz's case. A LISA conference was being held while the original police investigation was going on, and it was in a LISA security session that Tanya Herlick, systems administrator for the publisher O'Reilly and Associates Inc., asked for advice, as described in our first story on the subject.

Schwartz was a guest speaker at the most recent LISA conference, giving his usual talk about how not to make the same kinds of mistakes that he did. Systems administrators have to deal with the same kinds of problems daily and would prefer to avoid the same kind of criminal penalties. So it's no surprise that the first canon in the SAGE code of ethics is: "The integrity of a systems administrator must be beyond reproach." And it's no surprise that it suggests that systems administrators should use industry-accepted practices to determine security. It doesn't name such practices, which would be a bad idea if this code is intended for long-term use, but, for example, the `crack` program (a password checking program that Schwartz helped debug and that is available from the Computer Emergency Response Team, through `ftp.cert.org`) would most likely fall into this category.

The other canons are about users' rights, communications, education, work ethic and professionalism, and are all equally important. Unlike the medical doctor's ancient code, this one is not an oath, as its introduction makes clear, but it is something every systems administrator and every employer of systems administrators should examine and consider.

Other SAGE Activities

Like Athena in the Odyssey, SAGE now takes the role of Mentor, in starting the proactive development of local SAGE groups, for example, in and around Baltimore, Boston, Research Triangle Park, New York, Minneapolis, San Diego, Vancouver, Houston, Seattle and the San Francisco Bay Area. Some of these groups existed before SAGE did, and they cannot be created by anyone not local. But SAGE is doing what it can to promote them, starting by establishing guidelines for what a local SAGE must be and do, and also spelling out what formal affiliation with the larger group would require. SAGE already has mailing lists set up to help organizers of local groups.

SAGE accepts and encourages members from anywhere, yet it has relations with other groups in other countries; well, so far, only SAGE-AU in Australia, but other alliances would be welcome. SAGE is not a separate corporation, for that matter; it falls under the USENIX 503(3)c corporate umbrella.

SAGE originated with people who were organizing LISA conferences. The specific impetus was to gain recognition for systems administration as a professional field.

Both SAGE and USENIX are actively looking for new things to do to benefit the UNIX, computing and larger communities. K-12 educational computing or networking activities are of particular interest, for example.

SAGE isn't even just for UNIX, for that matter. SAGE is also holding a Windows NT systems administration workshop. This is not to be confused with the USENIX Windows NT R&D conference, even though the workshop will be held right after it.

And I can attest that some SAGE board members and participants have good taste in food, and I can now advise you on which Thai restaurants to avoid in Anaheim.

SAGE Origins

SAGE originated with people who were attending and organizing the LISA conferences. The specific impetus was to gain recognition for systems administration as a professional field. Systems administrators are to some extent programmers, to some extent managers and to some extent teachers, not to mention electronic janitors, as much of the world views them, but they don't completely fit in any of those separate categories.

So some systems administrators decided to formalize their own category. They chose to do this by creating an organization, much like teachers have professional organizations, or like UNIX developers have USENIX, for that matter. The original proponents of SAGE came from BayLISA, the San Francisco Bay Area local group, although the idea of a professional organization was quickly adopted by other LISA participants. In this method and this goal they have been quite successful.

Acknowledgments

I usually write these things from personal observations, but in this case I have used a great deal of input from several people, especially Gretchen Phillips, Barb Dijker, Bryan McDonald, Pat Wilson, Elizabeth Zwicky and Rob Kolstad. This is still a column, collated from my personal point of view, as you can tell from my usual overuse of assonance and my regular repetition of alliteration. Although LISA participants and SAGE board members have like Athena been my guide, all errors are my responsibility.

Information on almost all the topics mentioned here is available on the SAGE Web site, `http://www.usenix.org/sage/`. Questions about SAGE may be sent to `office@usenix.org`.

Modern Client/Server

Client/server in its most simplistic form allows developers and application architects to split the processing load between two distinct processes: the client and the server. This model allows both processes to operate independent of the other, performing specialized tasks, and to share the processing load. The idea is to increase processing capacity through distribution rather than increasing processing power in a single machine.

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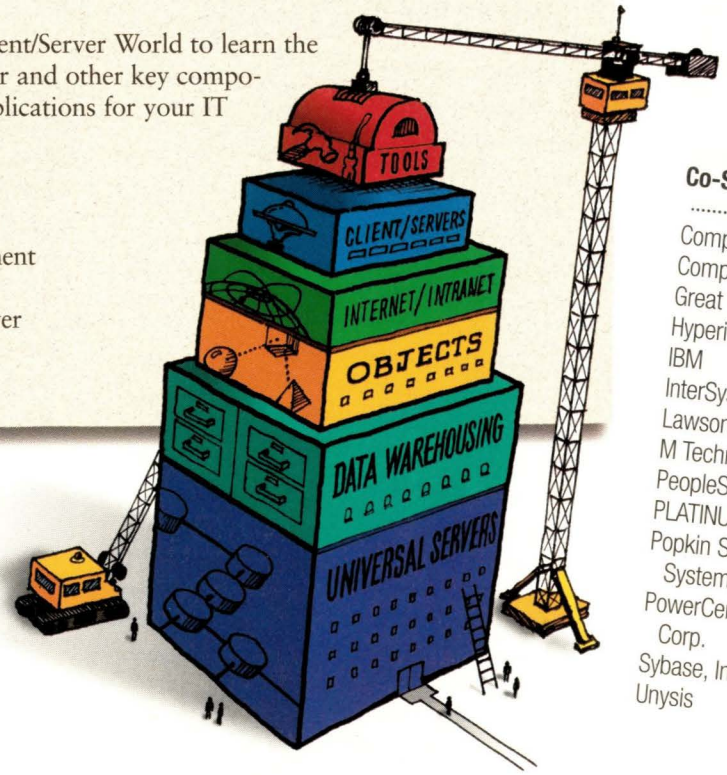

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by Jim DeRoest

Internet White Pages

Jim DeRoest *has been involved (for better or worse) with IBM UNIX offerings from the IX/370 days, through PC/IX, AIX RT, AIX PS/2, AIX/370, PAIX, AIX/ESA and AIX V3. He is employed as an assistant director supporting academic and research computing at the University of Washington, and is the author of* AIX for RS/6000–System and Administration Guide *(McGraw-Hill). He plays a mean set of drums for the country gospel band Return. Email:* `deroest@cac.washington.edu`.

Who's who on the Internet and how do I find out? This is often the first question asked by new Internet users. The situation is akin to having a brand-new telephone installed in your home and discovering that you don't have a telephone directory. What good is a $20 per month connection to the world if you don't know how to contact anyone. Not to mention the fact that a brand-new PC and modem are a few orders of magnitude more expensive than the good old telephone you've been using for years. At least the phone company left you a 50-pound phone book when it installed your telephone.

Trying to find a user's mail address on the Internet is not a new problem. It has been around since the advent of electronic mail in the mid '70s when a store-and-forward protocol called UNIX-to-UNIX Copy Program (UUCP) was used to route mail around the network. Sure, you remember UUCP. To send a mail message, you had to include the names of all the machines that made up the "hop" path between you and the recipient in the mail address.

As UUCP was augmented by other network technologies, it resulted in some very strange-looking mail addresses. For example,

```
rita::IN%"beaver!lumpy!deroest@
uwavm.u.washington.edu"
```

Unfortunately, some of these nightmare addressing schemes are still with us. Try to explain an address like this to someone whose greatest technical accomplishment is mastering the television remote control.

Nobody wants a 50-pound email white pages directory to supplement all the other hard copy documents that came with the computer, telephone and microwave oven. Just give us Web-based tools that will allow us to do online searches using strings like "Jim DeRoest, Seattle, WA, USA" to locate a user's mail address, public key or Web page URL. The directory servers operating in the back room behind these tools should be able to intercommunicate to resolve information that may be located at some remote site. Resolving a directory request should work much the same way that the Internet Domain Name Service works when trying to resolve a domain

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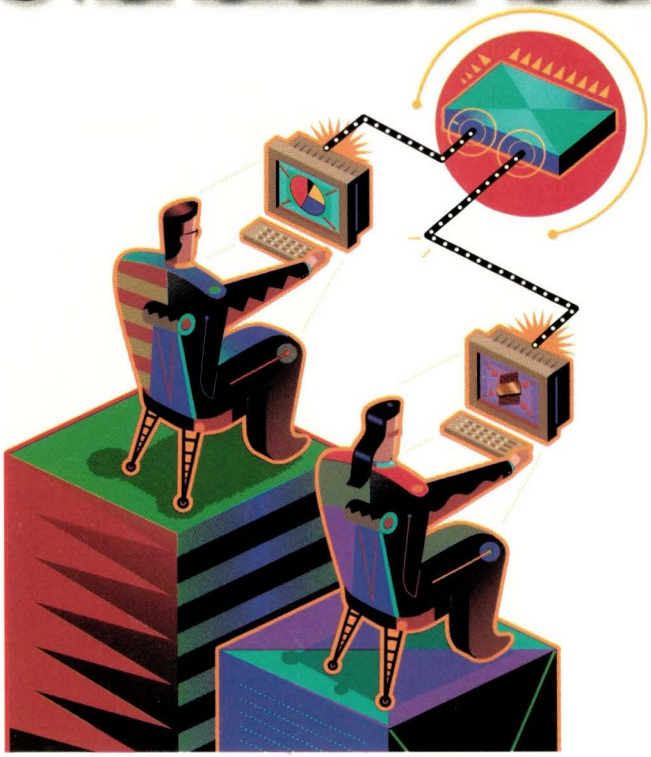

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name to a particular IP address.

Over the years, a number of notable applications have been developed to address these requirements. You might be familiar with tools like `finger`, `ph` and `whois`. The latest white pages protocol craze being touted by Web application players such as Netscape Communications Corp. has its roots in the X.500 specification and is dubbed Lightweight Directory Access Protocol (LDAP).

Lightweight Directory Access Protocol

Like its predecessors, LDAP provides a means for locating directory information about people, applications and services. Although somewhat open to interpretation, the specification is directed at providing white pages-type information as opposed to files and documents that are better suited to technologies such as Application Configuration Access Protocol (ACAP). I say "open to interpretation" because LDAP is easily extensible to serve additional data types and content.

The LDAP protocol (see RFC 1777) is based on the X.500 Directory Access Protocol (DAP) but does not incur the complexity or resource requirements inherent in X.500 DAP. Although streamlined, LDAP is interoperable with X.500 DAP clients and servers. LDAP runs over any TCP-based network.

As a directory protocol, LDAP defines a structure for accessing and managing a hierarchical database of attribute/value pairs (see RFC 1778). The LDAP directory hierarchy reflects the geographical and administrative structure that makes up the name space of a represented organization. LDAP directory attributes are descriptive objects associated with each object that make up the information hierarchy. Objects are content typed to support data interchange with external clients and servers.

Currently, there are two contenders for type representation in LDAP, Multipurpose Internet Mail Extensions (MIME) and Versit Personal Data Interchange, formerly eCard (see Table 2). Each technology has a number of proponents. The good news is that work is under way to promote interoperability between the two types.

Distinguished Name

The group of attributes that make up an entry are collectively know as a Distinguished Name, or DN (see RFC 1779). A view of an entry at some subtree in the name space hierarchy is called the Relative Distinguished Name (RDN). The syntax that describes a particular DN in the name space is called the LDAP Data Interchange Format (LDIF), which looks very X.500-esque (see Table 1).

For example, my DN would look something like this:

```
"DN:CN="Jim DeRoest"
    OU="Computing & Communications"
    O="University of Washington"
    C=US
    UID=deroest
    EMAIL=deroest@cac.washington.edu
```

I know what you're thinking: To the end user, this syntax is about as pleasant as the ugly email address I showed you earlier. The idea here is that an LDAP client will hide this syntax from the end user. For example, a Web browser client might collect search strings from an HTML form, bundle it into LDIF format and append it to a URL that identifies an LDAP HTTP server (see RFC 1959):

```
ldap://ldap.washington.edu/O="University of Washington", \
    OU="Computing & Communications",CN="Jim DeRoest"
```

Another option discussed in Netscape's white paper, "An Internet Approach to Directories" (see Table 2), describes an extension to the Internet Domain Name Service (DNS). A new DNS resource record called "DX" could be implemented to support mail client directory queries for email addresses. The DX record would function much like the current mail handler MX record by identifying the LDAP server that held the directory entry for the requested site.

Table 1
X.520 Distinguished Name Keywords

Key	Attribute
CN	CommonName
L	LocalityName
ST	StateOrProvinceName
O	OrganizationName
OU	OrganizationalUnitName
C	CountryName
STREET	StreetAddress

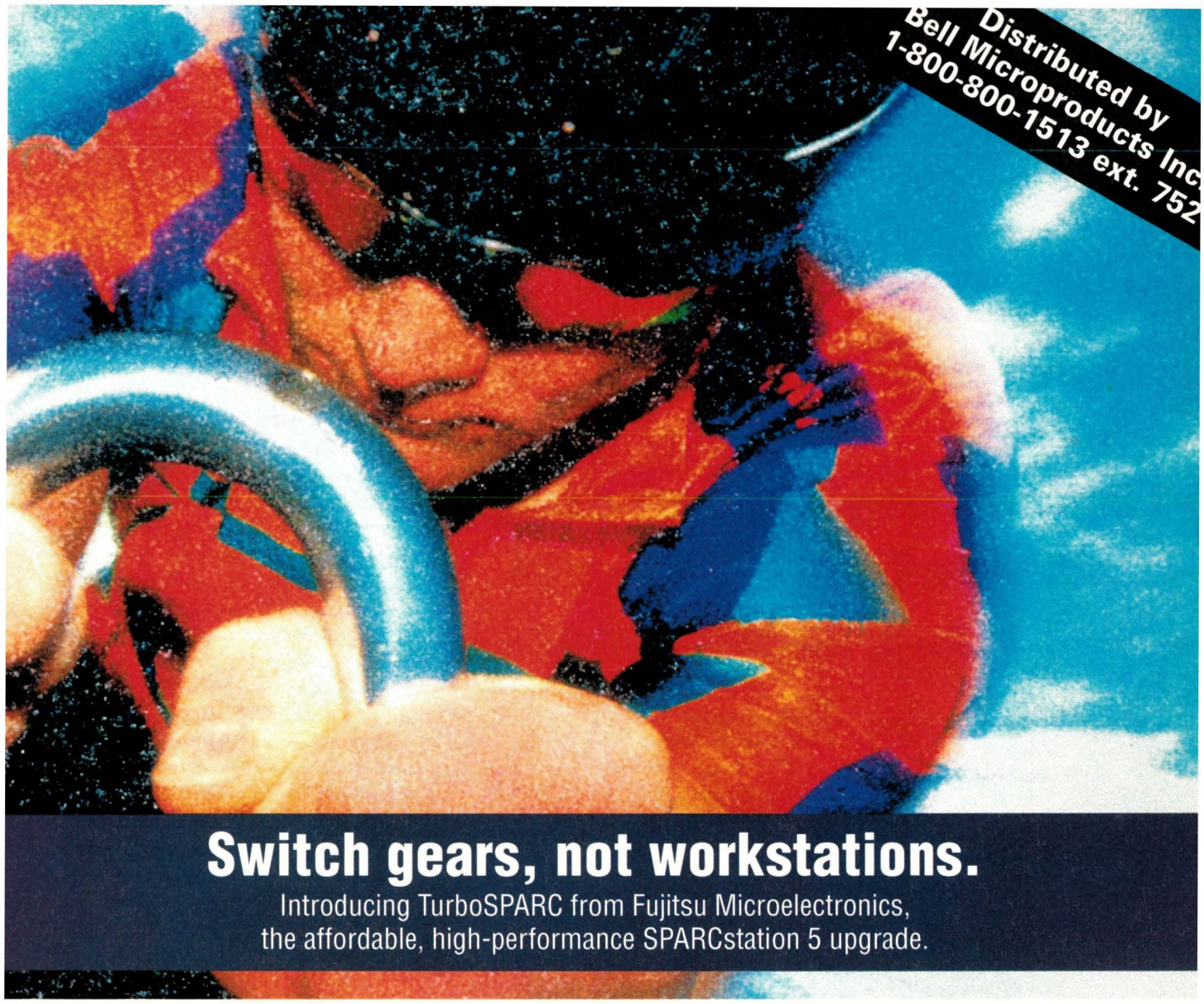
LDAP Security

One of the nice features in LDAP is its adaptability to access control mechanisms for governing access rights to entries and attributes in an LDAP database. These mechanisms can include public key, X.509 certificate validation, SSL V4.0 access controls and Kerberos authentication. The LDAP implementation from the University of Michigan provides support for authentication via Kerberos V4.

LDAP Authentication and access control could be used to distribute administrative tasks for managing a directory name space to the various groups that make up an organization. One might also envision allowing individual users to update their common name information, address or store a public key.

Version 3 of the LDAP draft specification is looking into the issues required to support X.509 certificates. This includes string encoding for DN information embedded in a certificate and extensions to support certificate revocation lists (CRLs).

The Internet Engineering Task Force (IETF), although not working directly on X.500 issues, is addressing X.509 certificate infrastructure related to LDAP. Much of this work is



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being done by the Access, Searching and Indexing of Directories (ASID) working group in the IETF (see Table 2).

Directory API

RFC 1823 describes a C binding API called LDAP Application Programming Interface (LAPI), which is used to query and bind directory architectures. An LDAP implementation from the University of Michigan uses its own internal API called `slapi` to provide back-end interfaces to external databases. These include a UNIX shell interface (SHELL), which can be used to invoke custom shell scripts, a DBM interface (LDBM) and an interface for UNIX password files (PASSWD).

The LDBM interface can be used to access data sets implemented in `btree`, `hash`, GNU `dbm` or UNIX `ndbm` formats. These back ends facilitate layering LDAP over existing directory data sets. We are currently using the SHELL back-end interface here at the University of Washington in a pilot project to provide LDAP access to our locally developed accounting database, which comprises a name space of more than 70,000 user entries.

Distributed Architecture

LDAP can be deployed within an organization as a set of master and slave servers to support replication for fault tolerance and to improve access performance. Each server runs a local `slapd` daemon to service LDAP client requests. A `slurpd` daemon is run to replicate the name space in distributed environments.

Subtrees that represent administrative subsets of the organization's name space can be distributed among master servers to provide local administrative control. Note that all updates to a subtree are handled by the master server that controls that portion of the name space. Writes are centralized, and reads are distributed among the servers.

A problem in current LDAP implementations is that there is no mechanism for referring directory queries to servers that represent the particular subsets of the name space designated in a request. A general request for "Jane Doe" could end up searching every server on the network. To address the problem of fixed referrals, a new system of "Forwarding Indexes" is being architected to refer non-local name space queries to the appropriate remote servers that administer requested portions of the name space. Each server makes a compressed version of its local index and makes it available to other servers to support these types of referrals. Note that these indexes require filtering support to facilitate those organizations that do not want to make their full directory space available to external searching.

Implementations

As I mentioned earlier, Netscape is a proponent of LDAP. It has a very informative white paper that describes the protocol along with product devel-

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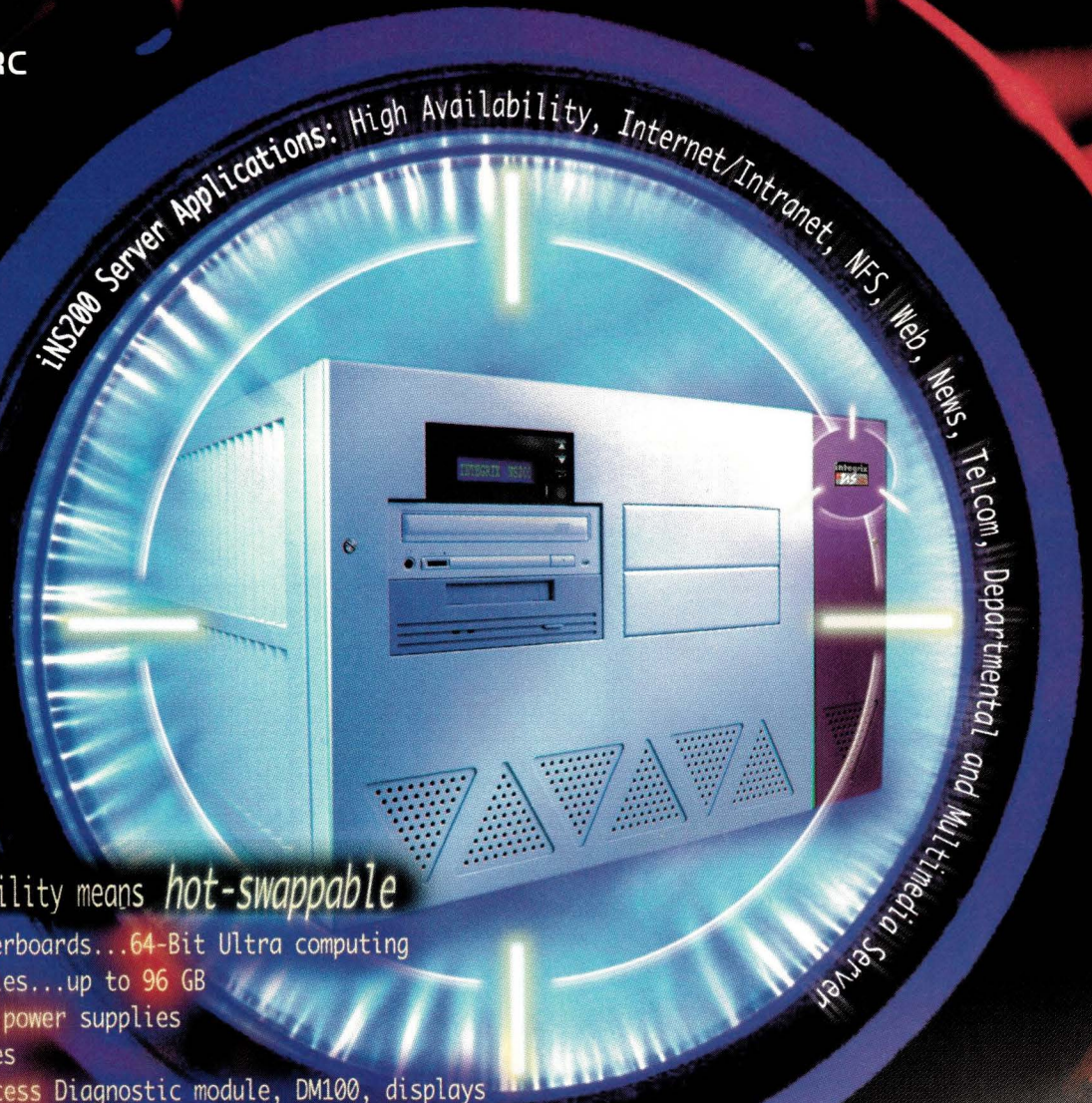

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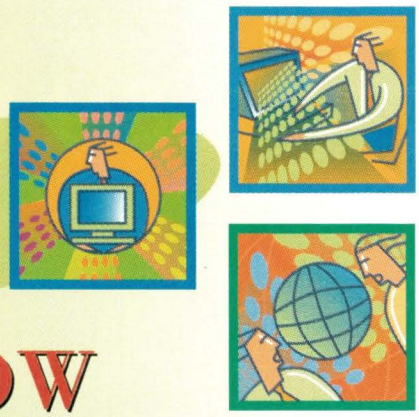

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Table 2. LDAP Information

Netscape Directory Server
http://partner.netscape.com/newsref/ref/ldap.html

University of Michigan
http://www.umich.edu/~rsug/ldap/

Stanford University
http://www-leland.stanford.edu/group/networking/directory/x500ldapfaq.html
http://www-leland.stanford.edu/~bbense/Inst.html

IETF ASID Charter
http://www.ietf.cnri.reston.va.us/html.charters/asid-charter.html

MIME FAQ
http://phonebk.duke.edu:8001/clients/mimefaq1.html

Versit Personal Data Interchange
http://www.versit.com/
http://www.imc.org/pdi/

Relevant RFCs
RFC 1777 "Lightweight Directory Access Protocol"
RFC 1778 "The String Representation of Standard Attribute Syntaxes"
RFC 1779 "A String Representation of Distinguished Names"
RFC 1823 "The LDAP Application Program Interface"
RFC 1959 "An LDAP URL Format"

opment directions, available from its Web site (see Table 2). The Netscape Directory Server implementation closely follows the LDAP work done at the University of Michigan. This is not entirely surprising in that Netscape employs most of the original University of Michigan LDAP development team.

Take a look at the University of Michigan's Web site to see how LDAP is used to support browser access to white pages information (see Table 2). The directory name space is made up of more than 115,000 entries. This number is likely to be out of date by the time you read this so visit the University of Michigan's home page to get the current statistics on its LDAP configuration.

Another interesting use of LDAP can be found on Stanford University's Web site. The university is using LDAP query capabilities in `sendmail` Version 8.8 to resolve mail forwarding for its `sendmail` servers. The Stanford Web page describes the architecture along with a general FAQ and tutorial on LDAP (see Table 2). Note that these are just a few of the production LDAP implementations currently running on the Internet.

It's probably still a little early to see if LDAP will sweep the Web as the directory service of choice. There's a fair amount of work to be done in the specification, and there are other contenders that can provide this type of service. However, it's worth considering that LDAP does have some significant commitment from large players like Netscape, Novell Inc., Banyan Systems Inc. and IBM Corp. It never hurts to have some big sticks when negotiating new protocols in the Internet community. ⊸

by Jeffreys Copeland and Haemer

We Use vi to Edit Web Pages

Jeffrey Copeland (copeland@alumni.caltech.edu) *is a member of the technical staff at QMS' R&D group in Boulder, CO. He's been a software consultant to the Hugo award administrators for several years. He spends his spare time raising children and cats.*

Jeffrey S. Haemer (jsh@canary.com) *now works for QMS, too, and is having a great time. Before he worked for QMS, he operated his own consulting firm, and did a lot of other things, like everyone else in the software industry.*

We're going to show you how to turn vi into a WYSIWYG HTML editor. WYSIWYG, for those of you who aren't veterans of the editor or word processor wars, stands for "what you see is what you get." We think it was our friend Mark Kampe who originally used the old Flip Wilson line to distinguish between embedded-directive and keyboard-command word processors.

Our friend, Tom Schneider, at the National Cancer Institute, has been hard at play again. Longtime readers will recall that Tom is a fellow who keeps prodding us into thinking about problems that end up as columns.

Typically, the way this works is that Tom has an idea, writes a script to implement it that doesn't quite work, sends it to us with a request for help, and we get sucked into working on it. Of course, most of Tom's scripts work; if they don't have problems, he doesn't send them to us. What keeps turning the things he sends us into columns is that they are *interesting* ideas.

The most recent of these columns evolved from Tom's desire for a watchdog that would monitor files for changes. Beginning with Tom's first-cut shell script, we wrote a replacement script in Perl that solved his original problems and showed him how to refine it into an interpreter for a small, but real, programming language, `atchange`, all in about 50 lines of code.

A simple invocation such as

```
atchange foo date
```

will print the date every time the file `foo` changes. This is useful, for example, if you're monitoring a slow process that only provides occasional output.

At the other end of the scale, Listing 1 shows an example `atchange` program that watches a variety of files and takes different actions when each file changes.

Tom has posted a copy of our original column at `http://www-lmmb.ncifcrf.gov/~toms/atchange.paper/atchangepaper.html`. If you're in a browsing mood, we encourage you to go to Tom's home page and look at some of the other stuff he's doing.

Listing 1

```
#!/usr/local/bin/atchange
#
# Here's a program for atchange

      HELLO="hello world"  # set a variable
      echo $PS1

/tmp/hello  echo $HELLO  # all one script

      datefn() {      # define a function
          echo the date: $(date)
      }

/tmp/date datefn
      echo -n "$PWD$"

      counter=0

/tmp/counter      # commands can span multiple lines
      echo $counter
      let counter=counter+1

      CLEARSTR=$(clear)

/tmp/iterator
      echo $CLEARSTR
      let iterator=iterator+1
      echo $iterator | tee /tmp/iterator

/tmp/zero_counter
      let counter=0
      touch /tmp/counter
```

Tricks with Netscape

Last month, Tom dropped us a note that builds on `atchange`. We're not the only folks Tom talks to, of course. Recently, Stephen Eglen, at the University of Sussex, pointed out to Tom that he was able to send instructions to a running invocation of Netscape from the command line. For example, `netscape -remote 'openURL(http://www.qms.com/)'` will cause the Netscape you're currently running to go to the QMS home page. (If you're not running Netscape, the command will just print an error message and fail.) The folks at Netscape explain other commands that you can give Netscape from the command line at `http://home.netscape.com/newsref/std/x-remote.html`.

This seemed perfect. Tom reasoned that he could tell `atchange` to watch an HTML file he was editing in `vi`; each time it changed, `atchange` could tell Netscape to redisplay it. Listing 2 shows the code to do exactly that.

Exegesis

Let's go through the code in Listing 2 line by line. Line 1 is the "shebang" (`#!`) line that tells the system what interpreter to use. We use `bash`, but another POSIX-conforming shell, like `ksh`, should work fine, too. Line 2 is our RCS ID. Yes, we really keep our shell scripts under source code control.

Lines 3 to 7 are comments, including a comment about how to install the code if you're putting it onto a new system. We try to make our code as portable as we practically can, but there are often problems with portability around the edges, and documenting them in the code helps whoever's trying to get it to run.

Line 8 is safety netting that we put in reflexively. In theory, this line is there to guard against Trojan horses. In practice, it's mostly valuable as a guard against unusual individual `PATH` settings. In other words, it helps us catch instances where we depend on particular versions of programs being in our `PATH` settings in preference to the standard versions.

Lines 9 to 27 are a shell function that prints out a usage message. If this were a Perl script, we'd just have a simple usage message and construct a full-blown man page, integrated with the code, using Perl's "pod" facility, for more complete documentation. (See the perlpod(1) man page for details.) For tiny shell scripts like this, however, we tend to be lazier. In this case, we've created two kinds of usage messages: a typical UNIX one-line synopsis of the proper invocation, and a longer help message, which isn't really a man page, but will do until we write one.

If you're not used to shell parameter expansion, line 11 will look mysterious. This statement trims the directory information from `$0`, the name of the script, and puts the result in `$ARGV0`.

We could have used `basename` to do the trimming, but parameter expansion lets you do the same job in the shell itself, without the cost of spawning a new process.

We challenge the reader who wants to learn more about parameter expansion to try to figure out why this statement

```
: ${PERL5LIB=/usr/local/lib/perl5}
```

sets the value of `PERL5LIB` to `/usr/local/lib/perl5` if, and only if, `PERL5LIB` isn't already assigned a value. (N.B.: The initial colon is important. Don't leave it out!) We use this trick to provide default values inside shell scripts that can be overridden by environment variables.

By the way, as you can see from lines 11, 12 and 19, we *never* hard-wire the name of the program into the program itself. It's too easy to rename the executable but forget to change it within the code. As an example, this program, which we now call `eh`, had at least three different names while we were developing it.

Note also, in lines 12 and 14, that we make sure to send error messages to standard error, not standard out. This is the sort of care most programmers take with their C programs but often neglect to take with their shell scripts.

Lines 28 through 50 encapsulate a template HTML page. We've spent a fair amount of time tinkering with our template, and we expect we'll continue to do so as our tastes change. If

Listing 2

```
1  #!/usr/local/bin/bash
2  # $Id: eh,v 1.2 1997/03/26 16:10:42 jeff Exp $

3  # edit an html file while you watch the results in Netscape
4  #     Netscape will refresh every time you write the file

5  # INSTALLATION:
6  #     - fix the shebang line and the PATH
7  #     - make sure atchange is installed

8  PATH=/usr/local/bin:/bin:/usr/bin

9  # Print usage message and exit
10 usage() {
11     ARGV0=${0##*/}
12     echo "usage: $ARGV0 [-l|-h|-help] filename|filename.html" 1>&2
13     test "$1" = "long" || exit 1

14     cat <<-__EOD__ 1>&2

15     Netscape will display the indicated html file
16     and the editor will be invoked on it simultaneously.
17     Whenever you write out the file in the editor,
18     Netscape will update.

19     $ARGV0 will create a template if the named file doesn't exist,
20     and will add an .html extension to the filename
21     if you don't type it.

22     For further information, see
23     http://www-lmmb.ncifcrf.gov/~toms/atchange.html
24     or write to Tom Schneider, <toms@ncifcrf.gov>.
25 __EOD__
26     exit 1
27 }

28 # Make a template html document
29 html_template() {
30     cat <<-__EOD__
31             <html>
32             <head><title>
33                     FIXthisTITLE
34             </title></head>

35             <body
36                     bgcolor="#EEFFFA"
37                     text="#000000"
38                     link="#CC0000"
39                     alink="#FF3300"
40                     vlink="#000055"
41             >

42             <center>
43             <h1>
44                     FIXthisHEADING
45             </h1>
```

your taste in Web pages is different from ours, here's where you tinker.

For colors (lines 36 to 40), we follow David Siegel's recommendations, which he discusses in detail at `http://www.dsiegel.com/tips/wonk2/background.html`.

Line 51 brings us to the main body of the program. We begin by checking for proper invocation in lines 51 to 54, and then use parameter expansion again to put the file name into a standard form. After lines 55 to 60, `$html` will hold the absolute path of a file whose name ends in `.html`.

Line 62 checks to see whether the file already exists. If not, it creates the file, using the template we specified earlier. The trick of using `||` and `&&` to implement simple conditionals is a little confusing at first, but it's a common idiom in shell scripts. We could have written lines 57 to 60 as the single command

```
test "${html#/}" = "$html" &&
  html=$PWD/$html
```

but we left it as four to present a contrast of the two forms for you.

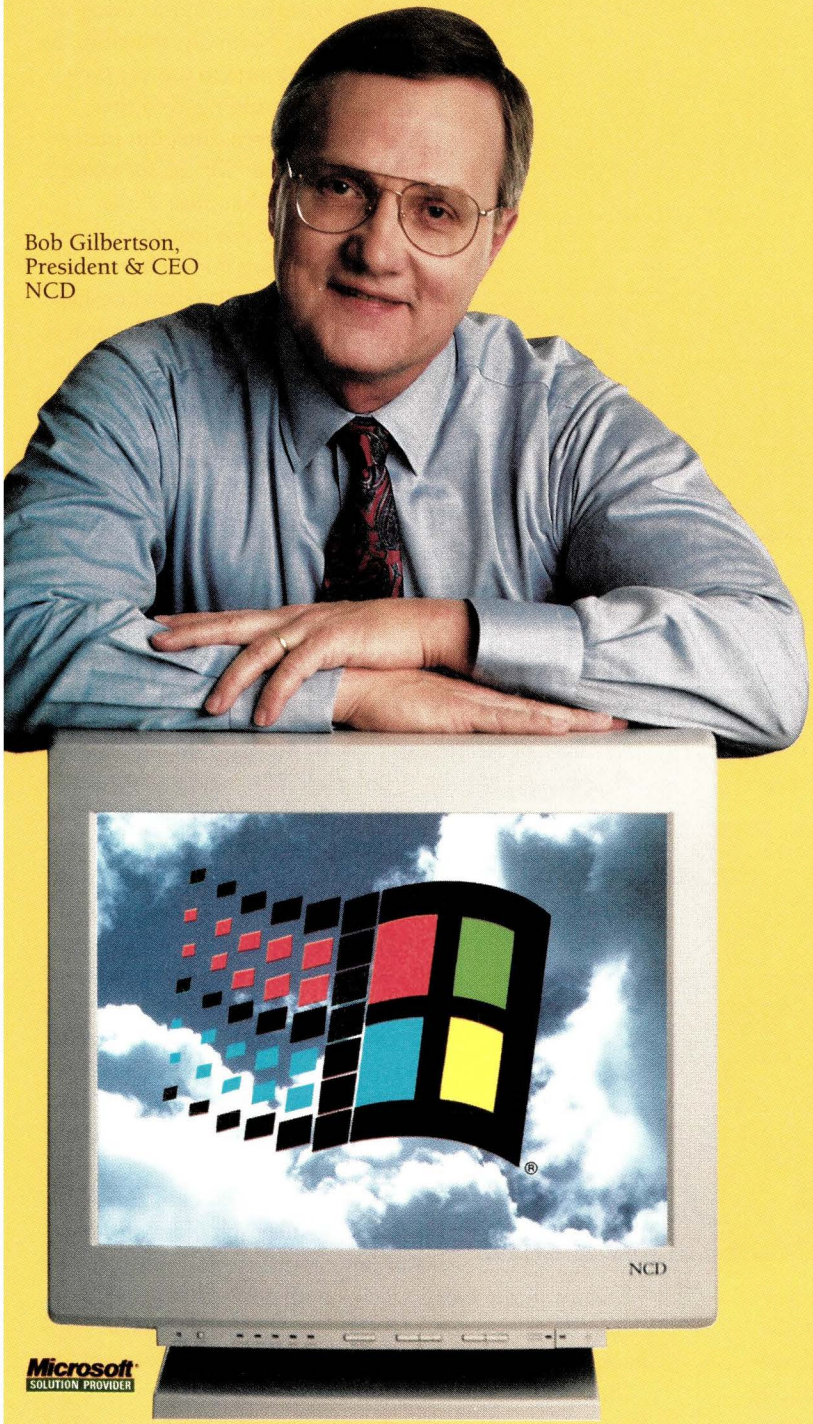
Line 62 tells the Netscape browser you're running to display the current version of the file `$html`. We follow this immediately with an `atchange` command that will tell Netscape to redisplay this file whenever it changes.

Finally, we start up the editor, once again using parameter expansion. This time, we start up `vi` unless the variable `$EDITOR` is set in the environment, in which case we use the editor it names. This lets you use `ed` as your editor if you really want to. (This line is really for the benefit of our boss, Steve, who decided he didn't like `vi` *or* `emacs`, and wrote his own screen editor: se–Steve's Editor.)

Lines 66 and 67 provide us with a gracious exit. `kill 0` kills off the `atchange`, and `wait` waits for it to finish before the script exits, to avoid creating a zombie.

Last, but not least, line 24 illustrates a small but useful design principle: Always point complaints at someone else.

"Hi, I'm Bob. How would you like 60,000 Windows apps on your UNIX desktop?"



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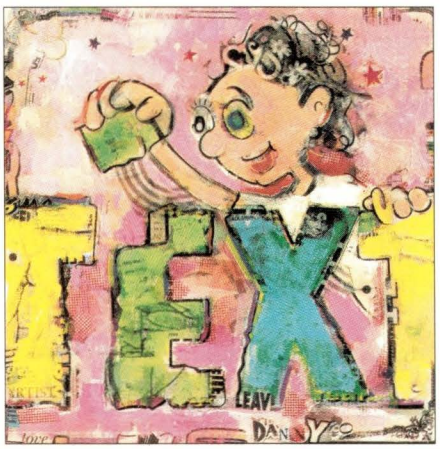
Listing 2 (continued)

```
46              </center>

47              PUTsomethingHERE

48              </body></html>
49  __EOD__
50  }

51  case $1 in
52     -l|-h|-help)  shift; usage long ;;
53  esac
54  test $# -eq 1 || usage

55  # Add .html if necessary
56  html=${1%%.html}.html
57  if test "${html#/}" = "$html"
58  then
59     html=$PWD/$html
60  fi

61  test -f $html || html_template > $html

62  netscape -noraise -remote "openFile($html)"
63  atchange $html "netscape -noraise -remote 'reload'" &

64  # Finally, invoke the editor:
65  ${EDITOR:-vi} $html
66  kill 0
67  wait
```

Sows' Ears and Silk Purses

OK, so we now have something that lets us use vi as a WYSIWYG HTML editor: So what?

First, we've thrown in a lot of little tips, and we hope even those readers who don't want to use eh itself will have picked up a trick or two. If you've been reading this column for a while, you'll know that's our normal approach: create something useful, but make getting there half the fun.



Second, we confess that we use vi all the time. Any flavor of vi–vi, nvi, elvis, vim, viper–you name it.

Yes, we've used a lot of other editors. There are even tasks for which we routinely use (gasp!) emacs–especially debugging with gdb–if only to keep our control, alt and escape keys from getting lonely.

Still, for garden-variety editing we always seem to come back to vi.

We can rationalize this by saying that it's a standard (POSIX 1003.2), or by arguing that it's small and well integrated into the rest of the UNIX tool set, or by pointing out how beautifully ergonomic its cursor-motion sequences are. Really, we suspect that it's mostly because we've been using it for so long that its commands are wired into our fingers.

This preference is pervasive. Our .profile files contain the line set -o vi, to let our fingers use vi commands to search and edit our shell command histories, and our .emacs files contain the lines (require 'viper) and (setq vip-always t), so that we can use vi commands inside gnus, the emacs newsreader, when replying to Usenet postings.

We write our columns using vi and troff. Naturally, therefore, we want to continue to use vi, even when we're building Web sites.

We don't even think our preference is unusual. We are, for example, willing to bet that most of the columnists for this magazine also write everything from columns to email with a simple text editor like vi, rather than WYSIWYG versions of some damnfool what-you-see-is-not-necessarily-what-you-want word processor.

Putting our money where our mouths are, we bet our editors a nickel, hard cash. Lisa and Lisa: Put up, or shut up.

(Actually, Lisa and Lisa already know better, and declined to take the bet. Their exact response was, "What kind of Rubes do you take us for?" Any other takers?)

A Side Note

A couple of months ago, ("Counting on the Net," RS/*Magazine,* February 1997, Page 29), we discussed errors in some order-of-magnitude numbers people have been throwing around while discussing IPv6 and competing Internet addressing schemes. We did this by deriving things like the number of protons in the Earth from stuff we learned in high school geometry and chemistry classes. Since then we have read Bruce Schneier's *Applied Cryptography*, Second Edition, Wiley, 1996, ISBN 0-471-12845-7 (hard cover) or 0-471-11709-9 (paperback). We discovered that for comparison purposes, Schneier provides a whole list of large numbers in Table 1.1. His 10^{51} atoms in the Earth nicely compares with our order-of-magnitude calculation of 3×10^{52} protons in the Earth. Check out the table for some other interesting numbers.

Until next month, happy trails. ⊸

The Daytona RAIDarray
Storage that gives you peace of mind

The Daytona RAIDarray is welcome news if storage problems have been weighing on your mind. That's because the Daytona gives you peace of mind both during and after installation. The Daytona takes just thirty minutes to install and is so reliable, once you're up and running, you can forget it's there.

The Daytona comes complete with everything you need right in the box. Just add drives and the installation is done. The Daytona's intelligent SCSI backplane even eliminates cable and terminator integration problems, raising reliability to new heights.

- High availability RAID
- Cache memory for performance
- Redundant, fault tolerant power supplies
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- Operating system independent; no drivers required

And talk about peace of mind – with the Daytona, you can swap drives, power supplies, or fans without taking it off-line, so you can perform maintenance during "normal" hours and not interrupt data availability. For even more peace of mind, you'll appreciate knowing that CMD technical support is available 24 hours a day, seven days a week, 365 days a year.

Daytona RAIDarrays come in several configurations, with support for up to 64 MB of SIMM-based data cache for higher performance. Each Daytona features environmental monitors with alarms that tell you when something needs attention, so you can address the problem before data goes off-line. The Daytona is platform and operating system independent – so you don't have to bother with drivers – and supports RAID levels 0, 1, 1+, 4 and 5 with single ended or differential host interfaces.

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Circle No. 13

FULL SPEED AHEAD

BY KAREN WATTERSON

IBM's Internet technology is rocketing out of its labs so fast it's hard to keep up. Here's a starting place for users who want to jump on board.

Without much fanfare or embarrassing about-faces, IBM has delivered solid–sometimes innovative–Internet products and services. In one key arena, e-business, IBM has established several important beachheads.

As you might expect, IBM has developed software that lets you use any of its hardware platforms as Web servers. What you may not know, however, is that most of it is free. You can download free IBM Internet Connection Servers for AIX, OS/2, Windows NT, Solaris, HP-UX and OS/390. An Internet Connection Server for the AS/400 is included with Version 3, Release 2.

If you're in charge of multiple Web servers and want to take advantage of the load balancing and management software used during Virtual Lotusphere '97, the Deep Blue vs. Gary Kasparov Chess Tournament, the 1995 and 1996 Wimbledon and U.S. Open Tennis Championships, and

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the 1996 Atlanta Summer Olympics (where NetWork Dispatcher handled a peak of 18 million hits in 24 hours without error), consider Interactive Network Dispatcher for AIX at only $1,500 per server.

IBM has also made it easy for RS/6000 customers to use the Netscape Communications Corp. FastTrack Server, thanks to an enhanced Internet PowerSolutions for AIX bundle that now includes Netscape's Directory, Catalog, Mail and News Servers as well as LiveWire Pro.

The free Internet Connection Servers aren't your only option, however. IBM subsidiary Lotus Development Corp. offers a multiplatform Domino 4.5 Web server that is probably better suited for high-end, interactive, workgroup-type applications. Domino can use DataBolt components (either in applet or ActiveX control format) and includes built-in broadcast functionality that works with Marimba's Java-based Castanet "push" technology, for example. In January, IBM announced a programmer-oriented server package based on technology acquired from the Taligent group: Visual Age WebRunner Server ($249). WebRunner Analyst and WebRunner Distributor versions are free from `http://www.taligent.com`

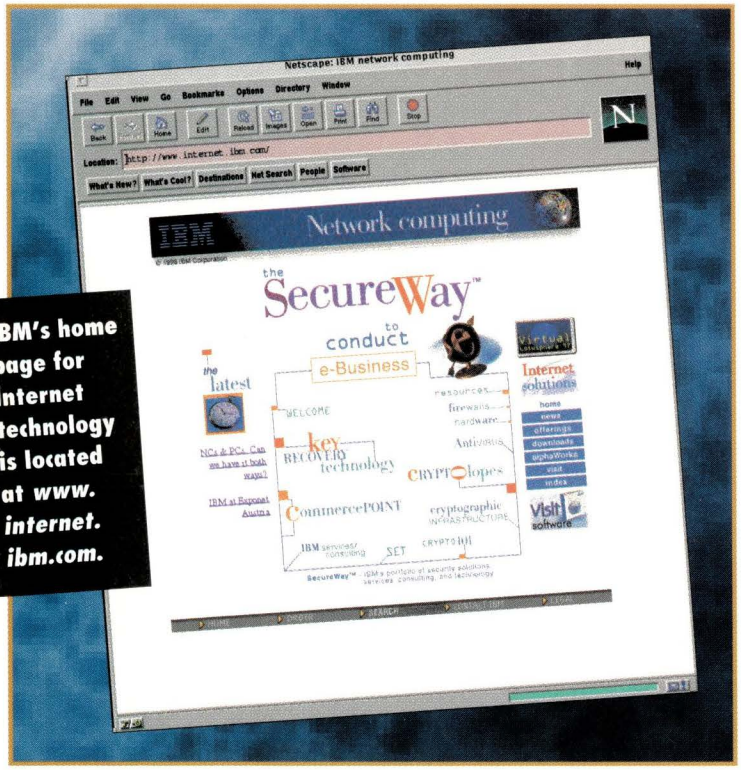
RS/6000 users are undoubtedly familiar with IBM's Secured Network Gateway, which runs under AIX, but may not know about IBM's new video servers. The IBM MediaStreamer, a hardware/software bundle designed to transmit analog and/or digital video for the broadcast media, includes an RS/6000 Model 39H or Model R20 server, Magstar tape drive and Tivoli Systems Inc.'s TME 10 NetView management software with prices starting at $129,000. IBM's software-only solution for enterprise delivery on-demand video is the new VideoCharger Server for AIX, which costs $11,995.

There's more. Isis, for example, is a new Java-based technology available from IBM's AlphaWorks research/experimental site (`http://www.alphaWorks.ibm.com`) that enables Webmasters to add a time element to the presentation of multimedia content. And AlphaWorks isn't the only place to find innovative technology from IBM, tools that in the past often languished in research labs.

Isis is a new Java-based technology available from IBM's AlphaWorks research/experimental site that enables Webmasters to add a time element to the presentation of multimedia content.

Multimedia gurus should also explore `http://www.software.ibm.com/data/mediaminer` for a collection of tools, including IBM's Query by Image Content (QBIC), ImageMiner, TextMiner and related text search and retrieval components. The current MediaMiner site postings support text and image only, but audio and video are under development. MediaMiner also provides a link to another experimental product, Web Browser Intelligence (WBI, pronounced "webbie"), available from the AlphaWorks site. WBI acts like an intelligent browser buddy, graphically alerting users about unusually slow link speeds, noticing patterns, suggesting shortcuts and so on.

IBM's Digital Library is a high-end asset management solution that creates and stores digital copies of multimedia content, including photos, art and/or audio and video clips for distribution over intranets or the Internet. Digital Library uses IBM's relational database management system, DB2, for data storage and retrieval. The FDR New Deal Network Web site at `http://newdeal.marist.edu` is an excellent example of Digital Library at work.



IBM's home page for Internet technology is located at www.internet.ibm.com.

Databases

DB2 is not just a big, expensive, complicated program that runs on a mainframe–today's DB2 runs under AIX, on the AS/400, under HP-UX, Solaris, OS/2 and even Windows NT. IBM provides access to DB2 via its free Net.Data (formerly known as DB2 WWW Connection). Starting with DB2 2.1.2, IBM includes JDBC as part of DB2 Client Support.

But IBM has other database systems: the high-end, hierarchical OLTP IMS system, Lotus Notes/Domino and Approach, all of which are Web-enabled. IBM doesn't lock you into IBM databases. Many of its tools, including the Visual Age programming line, support ODBC. Sophisticated warehousing and heterogeneous database support are also available in products like DataJoiner and Visual Warehouse. And because Visual

Anything this fast should come with safety belts.

Speed. That's what the new **Chaparral N-300** library system is all about. With the ability to accommodate up to four **3590** compatible drives, each with a 9MB/sec transfer rate (uncompressed), Chaparral has what it takes to easily handle the biggest, baddest applications, like video and graphics. But while it's chock full of speed, it's also full of value. The N-300 is so economical, you can own a complete library solution for what you'd probably expect to pay for a single, stand-alone DST drive. **Speed and Value.** That's what the Chaparral is all about. Oh, and **Reliability**. Based on the proven IBM **3590** architecture, Chaparral uses advanced engineering and Reed-Solomon Error Correction for reliability you can trust your job with, day in, day out, year after year. Speed, value, and reliability. About the only thing the Chaparral N-300 doesn't come with is a safety belt.

- One of the fastest robot handler exchange rates in the industry
- 9MB/sec transfer rate (uncompressed)
- 300 cartridge capacity
- 540 cartridge expansion cabinet available soon)
- 10GB per cartridge (uncompressed)
- Daisy chain capability allows up to 40.8TB of storage and 4,080 3590 cartridges
- Industry standard SCSI-2 differential interface
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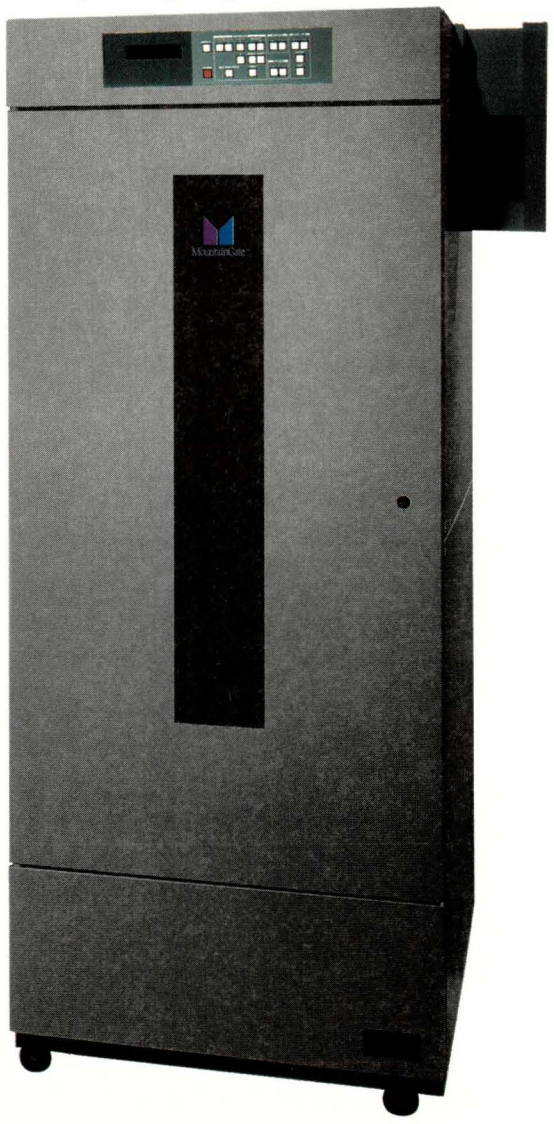
MountainGate also manufactures disk array and RAID disk subsystems to complement your robotics tape storage system, providing you with a single source for all your hardware needs. And it's all backed by an industry leader with more than 20 years storage experience.



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Warehouse, like Digital Library, uses DB2 "under the hood," you can publish warehouse data over the Web.

IBM has also announced new Java-enabled data mining technology and programs that will complement business intelligence tools such as IBM's Intelligent Miner product line (`http://www.software.ibm.com/data/intelli-mine`), which is available under AIX, OS/400 and OS/390, and other related customer and product discovery technologies available at `http://direct.boulder.ibm.com/bi/tech/mining/index.html`. The Web versions will allow businesses to link site visitors with database marketing, cross-selling and customer retention programs and to perform tasks such as market basket analysis.

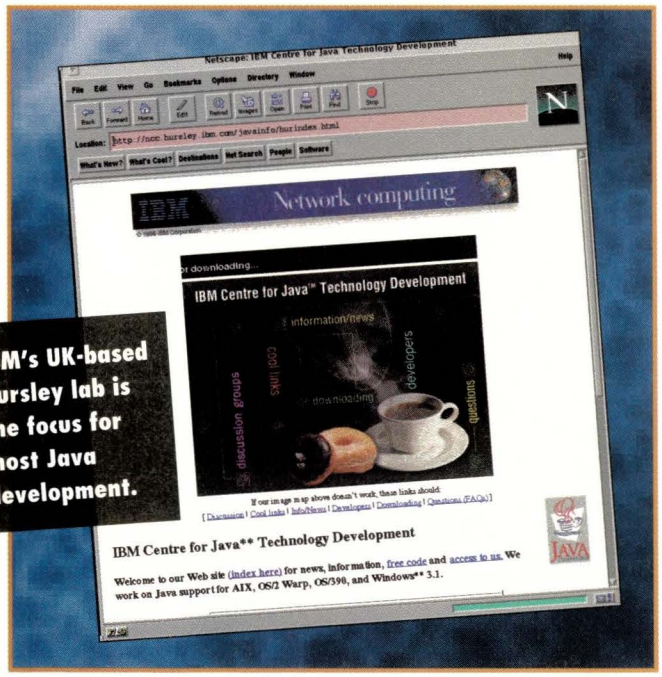
IBM has Web-enabled more than just its database and mining tools. For example, Rexx programmers can now use NetRexx 1.0 to generate Java code (`http://www.ibm.com/Technology/NetRexx`). MQSeries users might try the MQSeries Internet beta and MQSeries Client for Java products (`http://ncc.hursley.ibm.com/mqseries`), which will let users issue calls and queries from their browsers.

Want to control your Netscape Navigator with voice commands? IBM VoiceType Connection Netscape Edition brings voice recognition to the 32-bit Windows 95 version of Netscape Navigator 3.0. The beta version is available for free download from `http://www.software.ibm.com/is/voicetype/vtconn/vtconn.html`.

Hursley = Java++

If you're a Java developer, chances are you're already familiar with IBM's Hursley lab site (`http://ncc.hursley.ibm.com/javainfo/hurindex.html`), where you can find Java Developer's Kits (JDKs) for AIX, OS/2, OS/390 and AS/400. (To obtain the AlphaWorks Developer's Kit [ADK] for Windows 3.1, go to the AlphaWorks site.)

The Hursley site is also where you can find out more about



accessing CICS (Customer Information Control System) over the Internet using:

- CICS Gateway for Java, which lets Java applets launch CICS applications–working with the IBM CICS Client.
- CICS Internet Gateway, a CGI script that provides 3270 emulation for a user's browser.
- CICS Web Interface (ships with the CICS Transaction Server for OS/390), which provides direct TCP/IP connection into CICS.
- The forthcoming server-based Java support for CICS.

By making CICS APIs and services available as Java class libraries, CICS will basically become a CORBA-compliant Java object server using the Internet InterORB Protocol (IIOP).

MQSeries users can also participate in the MQSeries Internet Gateway beta (`http://ncc.hursley.ibm.com/mqseries`) or find out more about using MQX, IBM's new MQSeries service that lets MQSeries applications in the United States exchange data with other MQSeries applications over the IBM Global Network (`http://www.ibm.com/globalnetwork/cb9702.htm`).

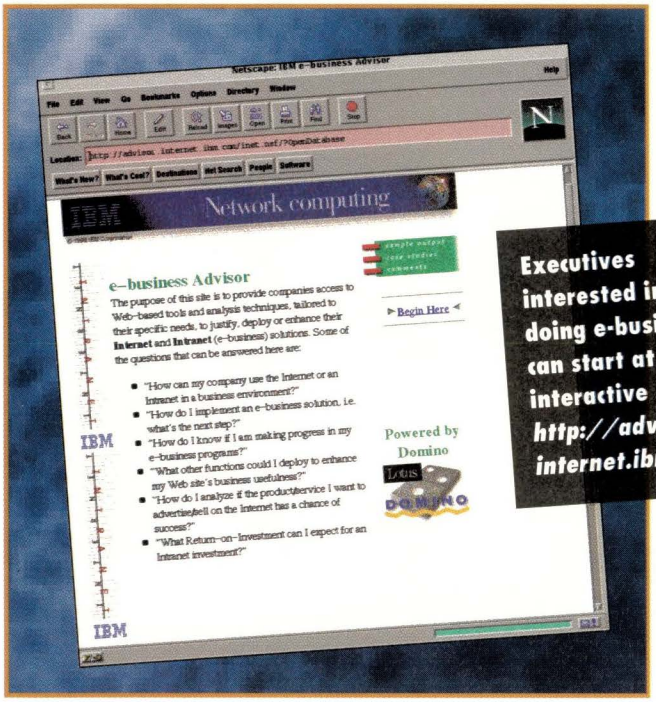
As you can see, IBM is making a tremendous amount of alpha and beta technology widely available. Some of the downloads such as J-Empower–an API for embedding Java code into applications–however, are password-protected and require you to be registered as a developer (`http://www.developer.ibm.com`). You can become a member of the Developer Connection for as little as $199, which entitles you to quarterly CD-ROMs that contain betas, examples, articles, white papers and so on.

Two of the services available to IBM's developer/partners are an Internet porting service and "100% Pure Java" certification. These services, now only available in the United States at the Waltham, MA, and San Mateo, CA, porting centers, are scheduled to be available at additional international labs in the near future.

To be fair, Hursley isn't the only site where Java development is progressing at warp speed, and IBM has created a Java site that not only showcases new tools (which, as of early February both happen to be Hursley products: AppletAuthor and CICS for Java), but also explains Java technology. AppletAuthor is a developer's tool that lets you create JavaBeans-compliant applets (JavaBeans is part of JavaSoft's Java class specification). IBM's VisualAge team is also working on a VisualAge for Java.

Lots of additional Java and Internet-related work is being conducted by IBM subsidiary Lotus. Betas are generally available at `http://beta.notes.net`, and that's where you can download Lotus Weblicator, for example, an application that selectively prefetches Web pages that you can store, sort and search while off-line.

The Lotus components team is also making Java applets available from `http://www.components.lotus.com`. Lotus is working on Java Database Connectivity (JDBC) support for Domino as well as a Java-based Domino.Document Manager that will provide check-in/check-out functionality. Lotus' main Internet site is `http://www.lotus.com/internet`.



E-Commerce

Java technology is great, but only to the extent that customers are asking for it and its benefits. IBM recognizes that many of its customers want to do business over the Internet and is involved in developing and deploying a number of products and services. IBM has developed an interactive e-business advisor at `http://advisor.internet.ibm.com` for businesses that don't know where to start. Here, business people can find out how they can use the Internet in their businesses, how to calculate return on investment and so on.

For companies interested in rolling out commercial Web sites, IBM offers its CommercePOINT family (`http://www.internet.ibm.com/commercepoint`), which consists of Net.Commerce, World Avenue online mall and World Commerce.

Net.Commerce is a solution for retailers who want to run their own systems and handle their own payments. The package will generate dynamic, interactive catalog pages for shopping, check-out and ordering, and keep track of customer purchases and statistics. Entry-level Net.Commerce packages start at $5,000.

World Avenue is an IBM-hosted online mall that provides businesses with a secure venue for conducting e-commerce and the ability to use IBM's data mining and business intelligence tools.

World Commerce is IBM's turnkey system that gives retailers their own private label, stand-alone sites for conducting Internet commerce in a safe fashion built on Secure Electronic Transaction (SET) standards. IBM will optionally handle billing for any of its CommercePOINT customers and offers additional connectivity in the form of World Distributor and World Purchasing.

World Distributor is a service-based commerce offering for wholesale distributors and other business-to-business suppliers who want a complete Internet solution from catalog creation to account reconciliation. World Purchasing is designed for large businesses and governments that do contractual buying and selling and can be deployed either by IBM or the customer.

Lotus is also developing a Notes-based product for hosting Internet commerce, Domino.Merchant, which will support CyberCash and other SET-compliant products.

Like Lotus' Domino.Merchant, IBM's electronic commerce infrastructure is based on SET-based payment and certification. SET was jointly developed by Visa and MasterCard but is already widely adopted for secure credit card transactions over the Internet, and IBM is working with the global banking industry to implement related standards and technologies, including SET-J for the Japanese debit-card-driven marketplace.

IBM has four different electronic payment systems:

- Net.Commerce Payment is IBM's complete SET package that handles all aspects of credit card transactions over the Internet.
- Net.Commerce Payment Consumer is a browser plug-in that functions like an electronic wallet and allows consumers

to add, edit or delete credit cards and manage electronic certificates.

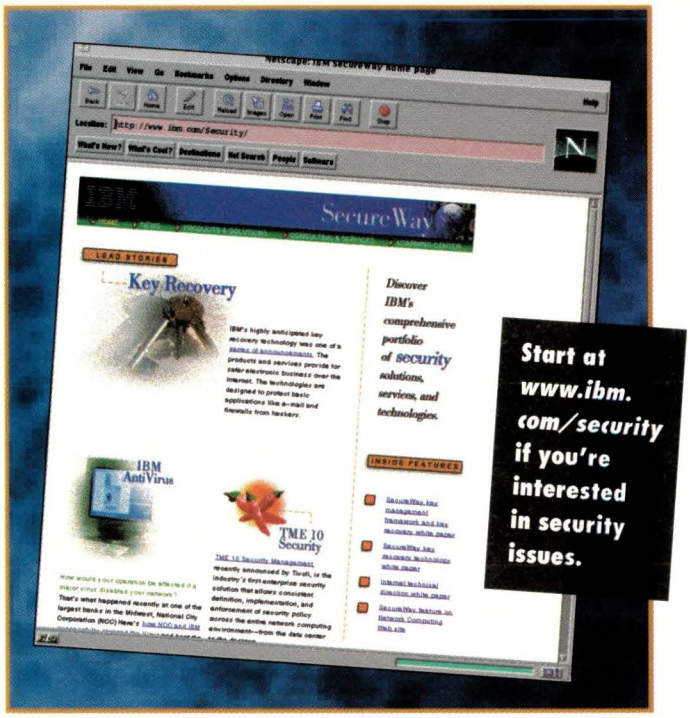
• Net.Commerce Payment Merchant is a SET-compliant payment processing application for merchants that handles transaction messages, encryption, certification and record keeping.

• Net.Commerce Payment Acquirer is a payment gateway that handles protocol conversion and transaction routing in a secure fashion.

IBM has export approval for its Net.Commerce family of products and is working with more than 40 members of the Global Key Recovery Alliance to promote the recovery of encrypted information in a fashion that is mutually agreeable among members and their governments.

IBM also offers digital certification services via the IBM Registry and World Registry, its digital certificate and public key infrastructure (PKI) products, respectively. PKI provides digital authentication, digital signatures and security functions. PKI lets cardholders verify that a merchant is a bona fide vendor. Merchants and banks can similarly confirm that customers have sufficient funds to cover a purchase.

IBM's Registry and World Registry products provide all the tools needed to authorize, record, track and handle digital certification online, but they're also suitable for internal communications over company intranets. Some organizations, for example, may want to validate communications between employees. IBM Registry is being piloted to select customers for their intranets, and a Web version should be available for general shipment by the end of 1997. IBM World Registry is slated to be available "to select companies" in the second quarter of 1997.



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CommercePOINT, IBM Registry and World Registry are all part of IBM's SecureWay brand of security-related hardware, software, services and consulting (`http://www.ibm.com/security`), which includes products and services as diverse as IBM AntiVirus software to IBM Emergency Response Service and the Global Security Analysis Lab (GSAL).

One of the fundamental components of IBM's secure commerce product line is its Cryptolope container technology (`http://www.cryptolope.ibm.com`), first announced in May 1996. Cryptolope containers provide a means for distributing digital content and enabling payment over the Internet. IBM's infoMarket, for example, delivers fee-based digital content contained inside the Cryptolope container, but the buyer can preview the contents shown on the Cryptolope's envelope.

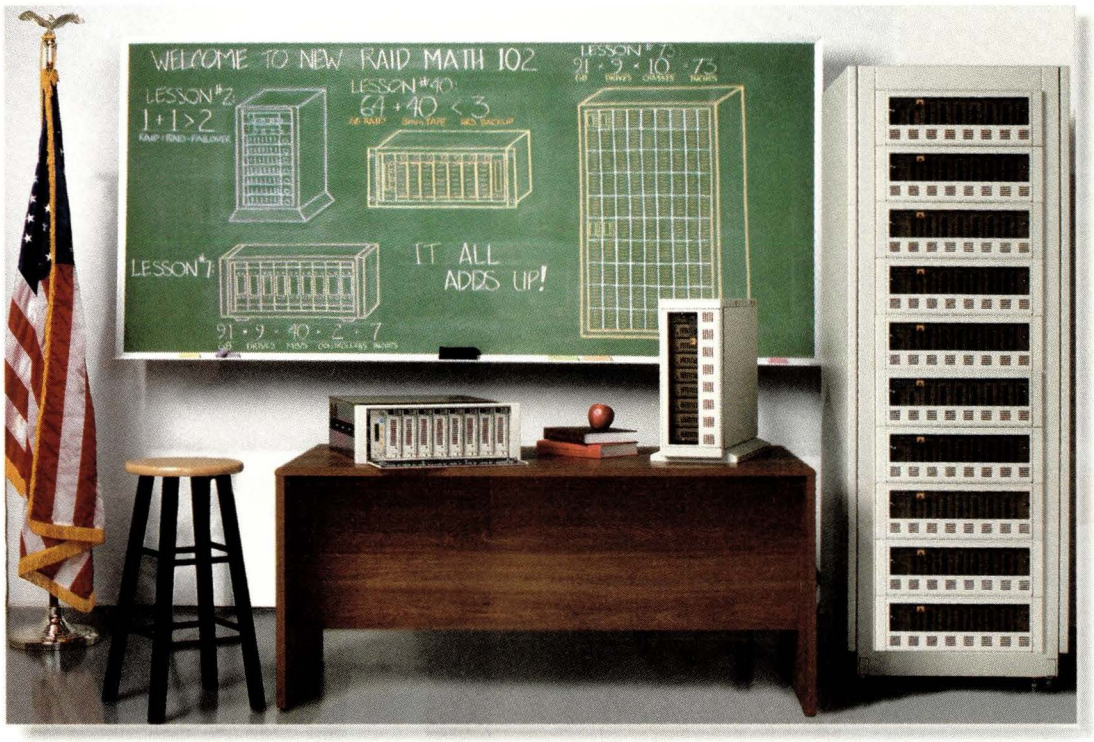
IBM's recently announced DataBolts are a component technology designed to let customers put the more compelling aspects of their Web site offerings into components that can be distributed securely over the Web or across intranets. DataBolts can be ActiveX, Java applets and/or JavaBeans components that can be used directly by developers in conjunction with Web site development tools.

IBM's own Cryptolope DataBolt can also be used over intranets to control access to corporate databases that contain legacy information to be searched, for example. IBM has said it will create some 60 different DataBolts by the end of the year based largely on the content of its infoMarket and now defunct infoSage services. In the pipeline: Query & Retrieval, Cryptolope Packer, Cryptolope Opener and Current Awareness DataBolts.

IBM's technology is coming "out of the closet" (the labs) so quickly that it's difficult to keep track. Use this article as a starting point for familiarizing yourself with some of the aspects of IBM's diverse Internet presence. And don't forget its forthcoming Network PC, expected sometime this summer. In the meantime, where do you want to go today? AlphaWorks.com? Beta.Notes.Net? The Hursley site? Have fun. ⊷

Karen Watterson is an independent San Diego, CA-based writer and consultant specializing in client/server and data warehousing issues. She writes a monthly column for *Data Management Review*, is a contributing editor to *Windows NT Magazine*, and is editor of Pinnacle Publishing's *Visual Basic Developer and SQL Server Professional* newsletters. Email: `1119390@mcimail.com`.

Artecon's New RAID Math



It All Adds Up!

New Math. An innovative approach for coming up with the right answer. A new and better way to look at an old problem. If coming up with the right RAID solution has been like trying to figure out a complicated trig problem, you'll want to study up on Artecon's **New RAID Math**. You won't struggle with these lessons when selecting RAID for your workgroup, department or enterprise.

Lesson #1 *Performance at the Top Of Its Class.*

Our top-of-the-class RAID controller outscores the performance of two comparable RAID systems on the market - added together!* Artecon's **LynxArray** scores high marks in throughput under heavy workloads whether data warehousing, imaging or transaction processing.

Lesson #2 *Be Pre-Paired!*

Get a lot more than the sum of two RAID sets when you configure your system for failover. **LynxArray** offers optional failover even at the entry-level. No need to take recess with hot-swap removable components including controllers, drives, N+1 fans and power supplies.

*Compared to Clariion® Series 100 Disk Array (1350 IOPS) and Digital StorageWorks RAID Array 310 (3000 IOPS) controllers at the desktop level.

Lesson #7 *Capacity That Passes All The Tests!*

In only 7" (4u EIA) you can pack in 82 GB of disk capacity and still have room for dual hot-swappable failover controllers. This densely packaged, extremely powerful RAID configuration is ideal for environments where space is at a premium.

Lesson #40 *High Scores in Backup.*

Pop Quiz: How are you going to backup your RAID? You'll score high with **LynxArray** because of its ability to support inline DLT or hot-swap tape devices, making RAID and backup in the same enclosure a viable choice.

Lesson #70 *Graduate To The Next Level!*

Graduating to the next level of RAID systems is almost impossible with other entry-level RAID solutions due to the number of confusing choices in controllers and enclosures. **LynxArray** gives you true scalability. From a few gigabytes to multi-terabyte RAID systems, each component can be used toward your system's move to the next grade.

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Circle No. 4

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Email: carolf@cpg.com

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NEW PRODUCTS

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

Distributed Management System Out

Sterling Software has announced the availability of Solve:Operations, which runs on NetView/AIX from Tivoli Systems Inc. and Hewlett-Packard Co.'s OpenView. The product is a management system designed to monitor mainframe and distributed resources, allowing a systems administrator to identify the most important enterprise resources and ensure that they are available for mission-critical applications, the company says.

Solve:Operations is positioned as an alternative to having multiple products managing applications on the mainframe and the distributed environment. Also, multiple components of a process can be linked in a logical fashion. If any component fails within a linked system, Solve:Operations will attempt to recover it and, if unsuccessful, a message will be submitted to the management platform. The failed component will be identified as well as any other service that depends on the failed component.

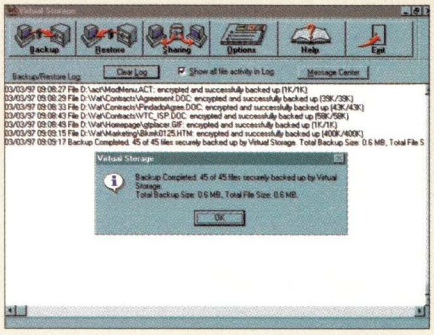
Pricing for Solve:Operations for NetView/AIX and OpenView ranges from $15,000 to $35,000, depending on customer implementation.

Sterling Software
1800 Alexander Bell Drive
Reston, VA 22091
Circle 101

Free Online Virtual Storage

Virtual Technology has announced the launch of its online data storage and retrieval service via the Internet. Virtual Storage provides automatic, online backup for business-critical and home-critical data from servers, workstations and stand-alone personal computers, including laptops, the company says.

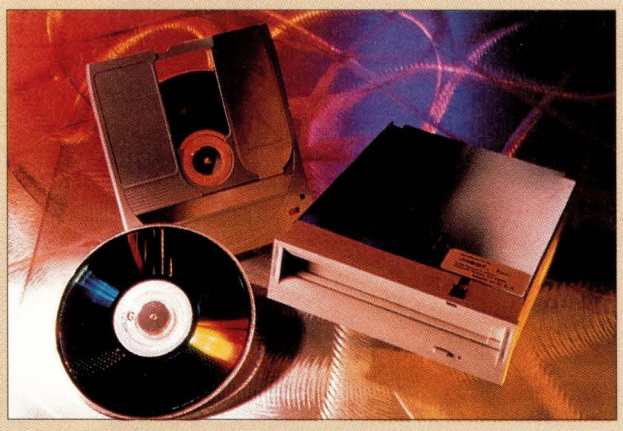
Overnight, new and changed files are encrypted and compressed before transmission to each of two secure data repositories, where they are available for instant retrieval on demand. The exclusive Delta Block technology reportedly allows Virtual Storage to send you only those parts of your files that have changed. Military-grade (56-bit) encryption prevents unauthorized viewing, the company says.



Any version of any backed up file can be retrieved online. Alternatively, files can be transferred by Virtual Storage to CD-ROM and sent to you the next day.

A Faster Magneto-Optical Drive

Mass Optical Storage Technologies (MOST) has begun shipping its Jupiter 2 direct overwrite magneto-optical drives. Nikon Inc.'s patented Light Intensity Modulation-Direct Overwrite (LIMDOW) technology permits the Jupiter 2 drives to carry out the overwrite process in a single pass at a full 3,600 rpm rather than the slower, two-pass process required by earlier drives, MOST says.



The new drives are said to provide an internal sustained read and write transfer rate of 4 MB/s and a burst transfer rate to the host of 10 MB/s. The Jupiter 2 drives have a mean time between failure rate of more than 100,000 hours, the company says.

With an average seek time of 24 msec and a storage capacity of 2.6 GB, MOST says, the Jupiter 2 drives are being targeted as solutions for 3D design, graphic and engineering design, animation and full-motion video capture and on-the-fly backup/recovery.

These drives are also a simple way to increase jukebox capacity, MOST says. With the 2.6-GB Jupiter 2, the capacity of a 20-platter jukebox reportedly increases from 26 to 52 GB without increasing the size of the jukebox.

The drives are available either with a single-ended or differential SCSI-2 interface, ensuring compatibility with Macintosh, Windows, NT and 95, OS/2 and UNIX-based systems and networks.

The list price for a Jupiter 2 drive with LIMDOW compatibility is $2,450.

Mass Optical Storage Technologies Inc.
11205 Knott Ave.
Cypress, CA 90630
Circle 100

New Products

The use of Delta Block technology along with compression is said to provide fast and efficient use of bandwidth.

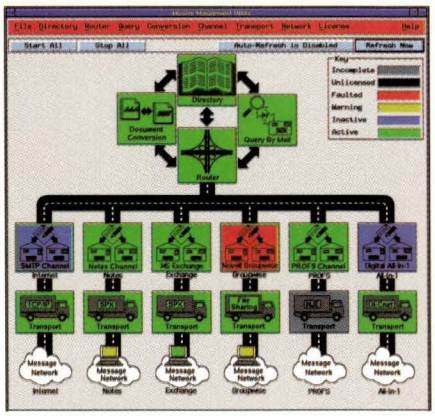
Virtual Storage is being sold primarily via the Internet and direct channels. This service will be offered on a free trial basis. The trial program includes 30 days service and 50 MB of Virtual Storage. Unlimited data storage capacity during the trial period is available for $.25/MB. After 30 days, users may register and continue the service for a monthly fee of $14.95. For larger volume users, customized pricing is available. Users have unlimited access to their data and virtually unlimited capacity at their disposal.

Customer support is handled via email or a live, toll-free customer support center which operates 7 a.m. to 8 p.m. EST, seven days a week. Free upgrades are supplied within 90 days of purchase.

Virtual Technology Corp.
3100 W. Lake St., Ste. 400
Minneapolis, MN 55416
Circle 102

Email Switch for Solaris

Wingra Technologies, creator of the Missive family of messaging integration products, has announced the release of a Solaris version of Missive. This Solaris release is said to extend the benefits of messaging and directory integration to Sun customers.



Wingra's software-only, Internet email switch has been available on IBM's AIX platform since January 1996 and is also available on Digital Equipment Corp.'s VMS platform. Missive brings the benefits of open email to proprietary email systems and offers the management of messaging

and directory integration across disparate email systems, Wingra says.

Netscape Communications Corp. Navigator and Microsoft Corp. Internet Explorer email users can also benefit from Missive's new directory schema, which, according to Wingra, enables them to click on their local address book and access their enterprise directory, which is actually Missive's X.500 directory, natively.

Missive Version 3.0 is also compatible with the latest versions of Navigator 4.0 and Explorer 3.0a because they now support the Lightweight Directory Access Protocol (LDAP). For Navigator and Explorer users in large enterprises, this means their address book will now contain the addresses of all of the mail users in their enterprise.

The Missive product line provides an X.500 central directory with automatic synchronization capability among the different email systems it supports. This directory synchronization (Dir Sync) feature reportedly supports both centralized and distributed data ownership models. Version 3.0 incorporates IBM's PROFS and Microsoft Mail Dir Sync capabilities to automate the process of keeping directory changes across disparate email directories in sync.

Missive is targeted as a solution to customers who previously saw their PROFS and other email systems become isolated from newer, more popular email systems.

Base price for Missive Version 3.0 is $25,000; pricing for standard channels and premium channels (e.g., PROFS) is $7,500 and $10,000, respectively.

Wingra Technologies Inc.
450 Science Drive, One West
Madison, WI 53711
Circle 103

Affinity Desktop Network Computer

Affinity Systems has introduced a Network Computer called Visara. Visara offers multihost connectivity, PC functionality and Inter/intranet capabilities.

According to Affinity, Visara runs midrange, mainframe, Windows 95 and NT, UNIX and DOS applications. Using a TCP/IP Ethernet connection, the base model can attach to IBM AS/400, S/390 and RS/6000, as well as Hewlett-Packard Co. and Digital Equipment Corp. machines. In addition, Visara can access PC applications and data residing on a multiuser server. Also included is a Web browser and Java Virtual Machine, which provides Visara with Internet capabilities.

Visara is available at a starting price of $698 and can be expanded to support multimedia and videoconferencing.

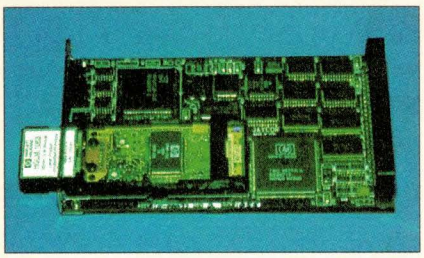
Affinity Systems
1000 N. Broad St.
Lansdale, PA 19446
Circle 104

SBus Fibre Channel Adapters Out

The SBus FibreStar plug-and-play Fibre Channel adapters are the first release in Jaycor Networks' long-term Fibre Channel Program, which includes

plans to introduce new technology and performance refinements on an ongoing basis.

The adapters offer a single-slot solution and can be easily upgraded in the field. Changing from a copper interface at 266 Mb/s to an optical interface at 1,063 Mb/s is accomplished by simply replacing the interface module, Jaycor says. No further software or hardware changes are required, and the user is returned to online status immediately.



These products are compatible with virtually all Sun Solaris operating environments and offer a high-performance Fibre Channel solution for storage, client/server and enterprise networks, intranets and clustered computing applications, the company says. The boards support switched and arbitrated loop configurations and all classes of service, including an intermix of Fibre Channel classes 1, 2 and 3. Communications software drivers are included for standard networking peripheral protocols, including TCP/IP and SCSI.

Three SBus FibreStar Models are available, all of which meet ISO 9000 standards. Model FC-266-OM is a 266-Mb/s adapter with a removable optical interface module, priced at $2,970. Model FC-1063-CM is a 1,063-Mb/s board with a removable copper interface module and costs $3,530. Model FC-1063-OM offers 1,063-Mb/s speed with a removable optical interface module and sells for $3,655. All prices shown are single-user list prices.

Jaycor says the SBus adapters have undergone extensive lab and field testing since 1994 in the United States and Japan by major system and network distributors and software developers.

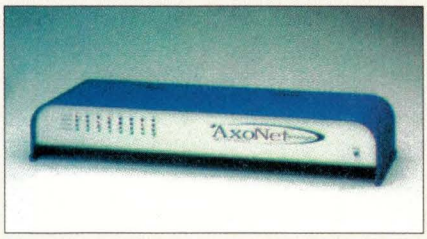
Jaycor Networks Inc.
9775 Towne Centre Drive
San Diego, CA 92121
Circle 105

Competitively Priced Ethernet Switch

AxoNet Technologies, a start-up focused on providing small to medium-size environments with affordable networking equipment, has introduced its debut product, the AxoNet NC-100 Ethernet switch.

The NC-100 offers eight switched ports, each providing 10 Mb/s of dedicated bandwidth to the desktop. This design is a significant improvement over conventional hubs, which share one collision domain among eight ports, the company says.

AxoNet says it has specifically addressed customer concerns about the complexity of installing networking devices and has designed this switch for easy installation and configuration. The



NC-100 installs in 15 minutes or less and requires no upgrade of cabling, network interface cards or software. Users simply unplug their hubs and replace them with the NC-100.

AxoNet is able to offer aggressive pricing by adopting existing technologies. The company has reportedly eliminated the expense of designing custom processors and has reduced manufacturing costs by orders of magnitude. By keeping pricing on par with that of a managed hub, AxoNet says it is addressing a large market segment that requires switches for bandwidth but could not previously afford to install them. AxoNet also preserves the existing infrastructure of network cards, cables and software.

The NC-100 Ethernet switch is available through Creative Computers and Micro Warehouse catalogue distributors. The manufacturer's suggested retail price is $500.

AxoNet Technologies Inc.
2672 Bayshore Pkwy., Ste. 1055
Mountain View, CA 94043
Circle 106

OLAP Data Mart Manager

Decision•ism has announced the availability of Aclue Decision Supportware, used to manage the transformation of data from operational systems

Upgrades, Enhancements, Additions...

■ SM-arch Version 4.0, a backup solution for large distributed networks, is now available with support for True Image Restore, Live Database Backup and File Archiving. Its manufacturer, Software Moguls, is also offering the SM-arch 4.0 jukebox, with up to 16 jukebox drives, providing drive sequencing, tape cleaning and slot mismatch prevention. SM-arch is available for Solaris, HP-UX, AIX, Windows NT and Macintosh. The SM-arch jukebox supports storage options such as 4mm, 8mm and DLT tape drives. Server pricing starts at $1,000, and client pricing at $125.

Software Moguls Inc.
12301 Whitewater Drive
Ste. 160
Minnetonka, MN 55343
Circle 107

■ Ganymede Software has released Version 2.0 of its Chariot network performance testing software. Chariot is used to perform remote multiprotocol tests between different devices and operating systems, which the company refers to as "end-point agents." New features of the package include support for NetWare endpoints; UDP; APPC support on Windows NT; data compression; datagrams; Internet scripting, grouping and sorting; new graphics and printing features; and an improved interface.

Ganymede Software
1100 Perimeter Park Drive
Ste. 104
Morrisville, NC 27560
Circle 108

■ Wolfram Research, maker of Mathematica, has added symbolic control algorithms to its Control System Professional, part of the Mathematica Applications Library. With it, users can integrate the arbitrary-precision, machine-precision, symbolic and graphical operations that are normally used in control and systems areas. Control System Professional requires Mathematica 2.2 or 3.0, which runs on Windows NT and 95, Macintosh (68000 and PowerPC) and several varieties of UNIX. Professional pricing for the module is $995; academic pricing is also available.

Wolfram Research Inc.
100 Trade Center Drive
Champaign, IL 61820
Circle 109

■ KL Group, maker of the graphical Motif widgets and utilities, has announced a significant upgrade to its XRT/graph product, with features such as Motif 2.0 support, built-in property pages, enhanced bar charts and axis label formatting. Also, XRT/graph 3.0 can now be purchased as part of the XRT Professional Developer Suite (XRT PDS), along with several other XRT modules, including XRT/3d, XRT/field, XRT/gear, XRT/table and Mode-View-Controller software. Pricing starts at $4,995.

KL Group Inc.
260 King St. East
Toronto, Ontario
Canada M5A 1K3
Circle 110

■ New versions of Fortner Research's Plot 1.3 and Transform 3.3 packages have been announced, to assist the scientific community in visualizing technical data. Both Plot and Transform feature improved documentation and built-in HDF 4.0 Release 2 libraries. Also, Transform's kriging operations–a method of determining the best estimate for each point in a target matrix–have been improved to include separate range settings for each dimension of data. Plot and Transform cost $99 each, for Solaris, HP-UX and SGI IRIX.

Fortner Research LLC
100 Carpenter Drive
Sterling, VA 20164
Circle 111

■ UIM/Orbix 2.1, the latest release of the distributed graphical application builder from Black & White Software, includes a new embedded C++ interpreter. UIM/Orbix is a CORBA development environment based on the company's UIM/X GUI builder; Orb/Enable, a productivity tool set also from Black & White; and Iona Technologies' Orbix object request broker. Other features of UIM/Orbix include an enhanced graphical editor for constructing IIOP-enabled clients and servers, support for both graphical and nongraphical objects, and automatic code integration for user interfaces and distributed objects. The product is available on Solaris and HP-UX 10.x platforms for $9,000 (single-threaded) or $10,350 (multithreaded).

Black & White Software Inc.
1901 S. Bascom Ave., Ste. 700
Campbell, CA 95008
Circle 112

and data warehouses into business information. Aclue is designed to distribute synchronized information to multiple online analytical processing (OLAP) data marts throughout the enterprise to help managers make informed business decisions.

Aclue Decision Supportware segments the traditional OLAP environment by providing metadata management, ad hoc query support, auditability and a publish and subscribe facility for end users. According to the company, Aclue Decision Supportware transforms, cleanses and synchronizes raw data from disparate source systems and delivers a single version of the data to business managers from various OLAP applications such as sales analysis, product and customer profitability, budgeting, forecasting and planning.

The product runs on Solaris servers, and data is fed through to an Arbor Essbase OLAP server from Arbor Software. The client side works with Windows 95 and NT.

The initial server package costs $30,000, and groupings of five simultaneous user ports are available for an additional $5,000.

Decision•ism Inc.
4775 Walnut St.
Boulder, CO 80301
Circle 113

Codeless Data Migration Tool Unveiled

A new data migration tool from Reliant Data Systems reportedly allows organizations to convert their data from any database and hardware platform to virtually any format using a GUI-based environment. Reliant Data designed the tool, Data Conversion Language Engine (DCLE, pronounced "diesel"), with projects such as legacy-to-client/server migration, data warehousing and cleansing, and Year 2000 issues in mind.

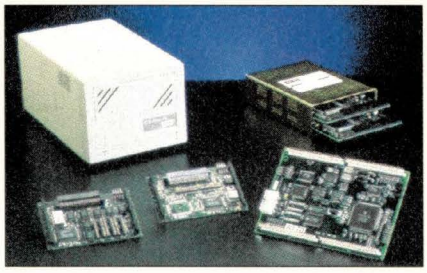
DCLE is said to be a multiuser, objected-oriented and database-independent tool. Through its GUI, users define data sources and targets. There, they also define the transformations necessary to convert the data with an SQL-like syntax. The DCLE engine performs the actual conversion.

The DCLE application runs on Solaris, HP-UX, AIX and Windows NT; other clients can access a character-based DCLE through a telnet connection. Pricing varies depending on the size and scope of the data conversion project. For example, a perpetual, 10-user, multiproject site license costs around $200,000.

Reliant Data Systems Inc.
13915 Burnet Road, Ste. 200
Austin, TX 78728
Circle 114

Expander Offers Wide SCSI Performance

ATTO Technology has announced SCSI Expander, which reportedly delivers Wide SCSI performance in an external desktop configuration. The product enables integrators to increase the number of devices that can be attached to a single bus without causing performance degradation to 105, ATTO says.



This expanded range of attachments could allow for simultaneous access to terabytes of online data from massive, high-end storage applications such as digital video, prepress, imaging, database servers, CD-ROM libraries and disk drive towers, the company says.

This product is able to overcome the SCSI seven-device limitation due to its ability to translate SCSI bus IDs into SCSI Logical Unit Numbers (LUNs). These LUNs are used as a means of subaddressing a group of devices under a single SCSI ID. This reportedly allows each SCSI bus ID to support seven standard devices.

The SCSI Expander offers easy installation, without having to open up the system, add SCSI controllers or reconfigure software, the company says. It provides 16-bit, Fast/Wide SCSI with transfer rates of up to 20 MB/s and can be integrated with any SCSI-based workstation or PC. Other features include compatibility with SCSI-1 and SCSI-2, flash ROM for field updates, staggered device spin-up, single-ended or differential SCSI and support for multiple block sizes and removable active termination.

SCSI Expander is available in various configurations starting at $495.

ATTO Technology Inc.
Audubon Technology Park
40 Hazelwood Drive, Ste. 106
Amherst, NY 14228
Circle 115

Advanced Speech Processing Platform

Thanks to Periphonics, you don't have to be in a motion picture to get an OSCAR. The Bohemia, NY-based company has announced the availability of its Open Signal Computing and Analysis Resource (OSCAR) platform.

According to the company, OSCAR provides an open, standard CPU-based, scalable hardware/software environment for processing multichannel large vocabulary speech recognition, text-to-speech synthesis, natural language understanding and similar algorithms for advanced speech processing.

Interactive Voice Response (IVR) applications can use OSCAR algorithms on a client/server and shared resource basis. Speech processing resources, such as a speech recognizer engine or a natural language understanding processor, need to be attached to a telephone port only for the duration of the speech utterance, according to the company.

OSCAR consists of an array of Sun SPARC processing modules operating with unmodified UNIX operating software. This serves as an open standard for many advanced speech processing algorithm developers, the company says.

Pricing for the OSCAR platform starts at $15,000, and individual ports cost $5,000 each. Quantity discounts are available.

Periphonics Corp.
4000 Veterans Memorial Hwy.
Bohemia, NY 11716
Circle 116

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Circle No. 349

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The merger of ***RS/Magazine*** into ***SunExpert Magazine*** is a logical move since most UNIX server/workstation networks are heterogeneous and subscriber base of both publications has increasingly overlapped.

Beginning with the **APRIL** issue, we will offer the largest UNIX IS circulation and the leading server/workstation publication.

Watch for ***RS/Magazine*** editorial in the **APRIL** issue of ***SunExpert Magazine.***

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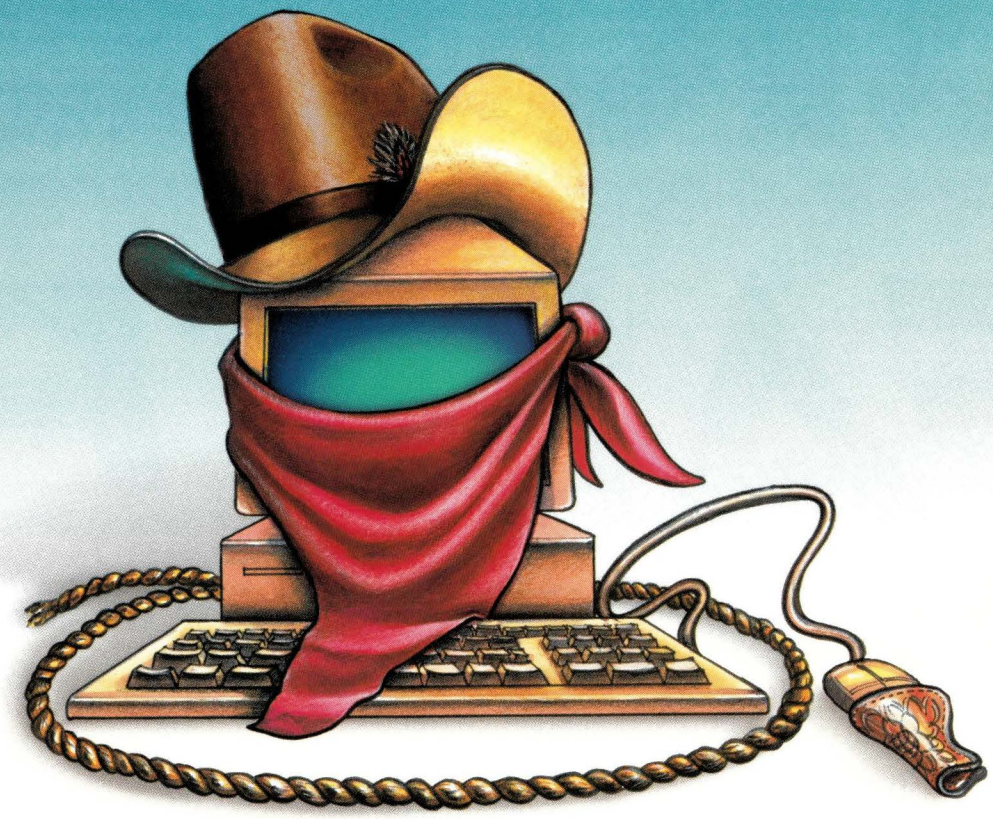

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HDS
HDS Network Systems, Inc.

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