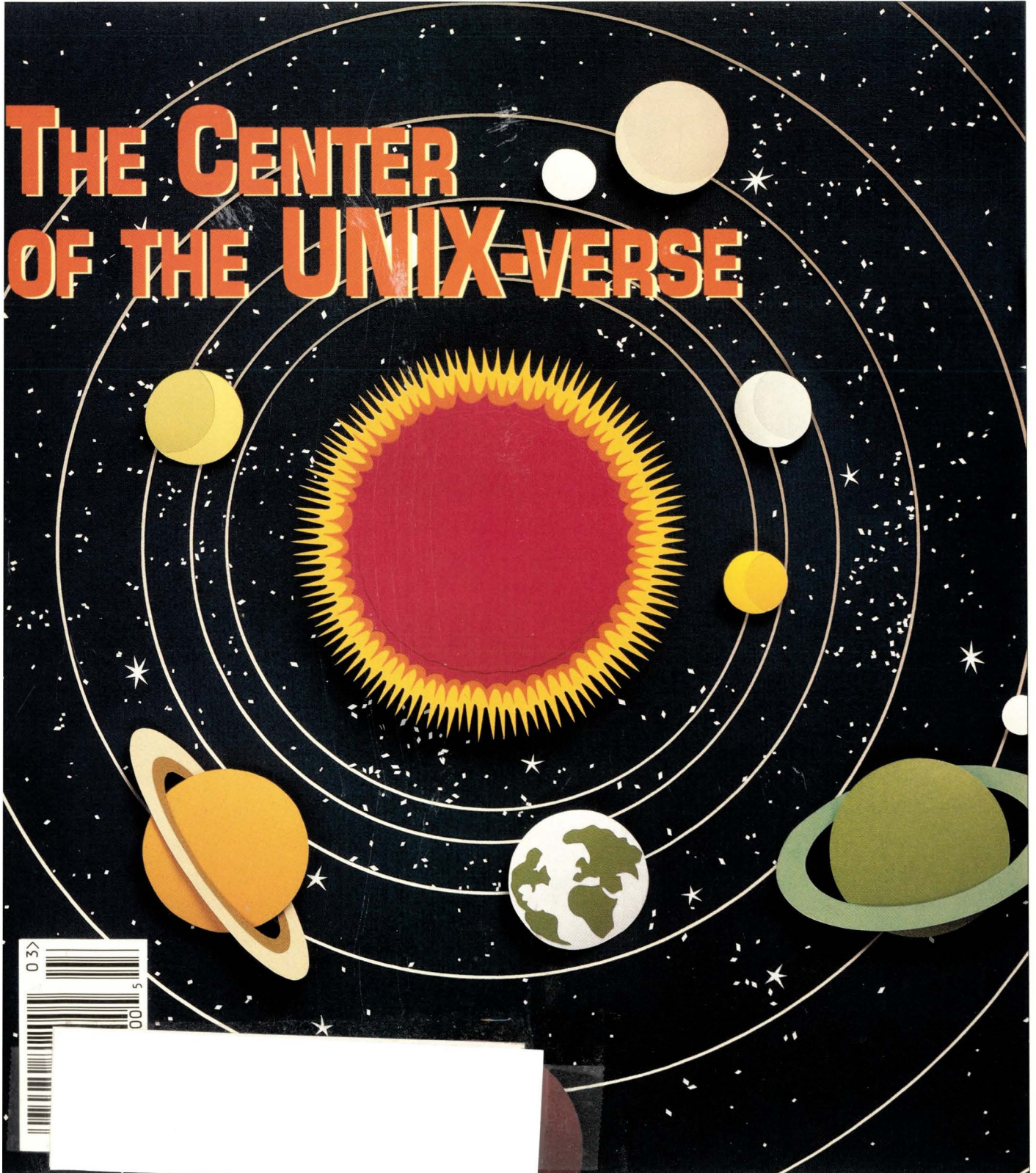


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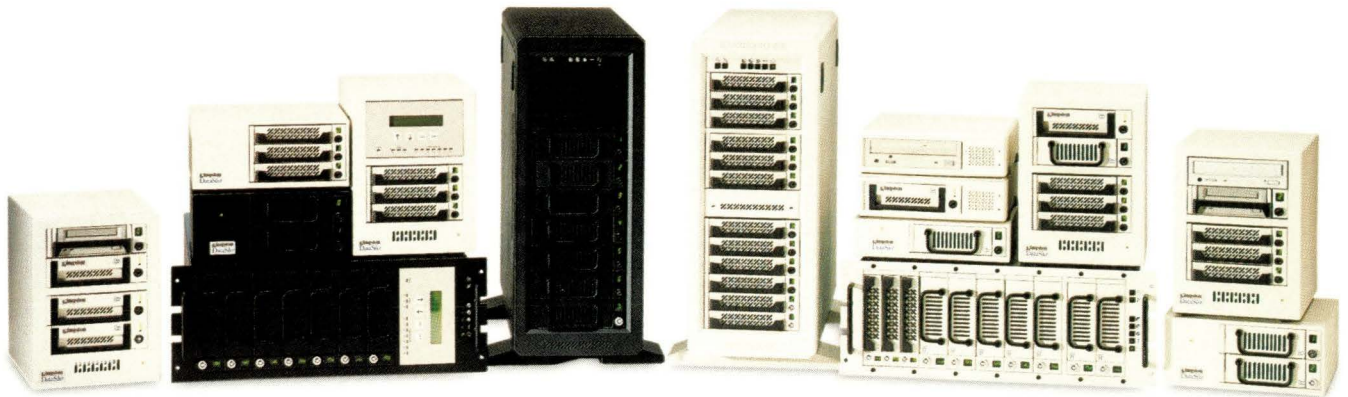
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Reviews: NT Wrap-Up

Survey: Firewalls



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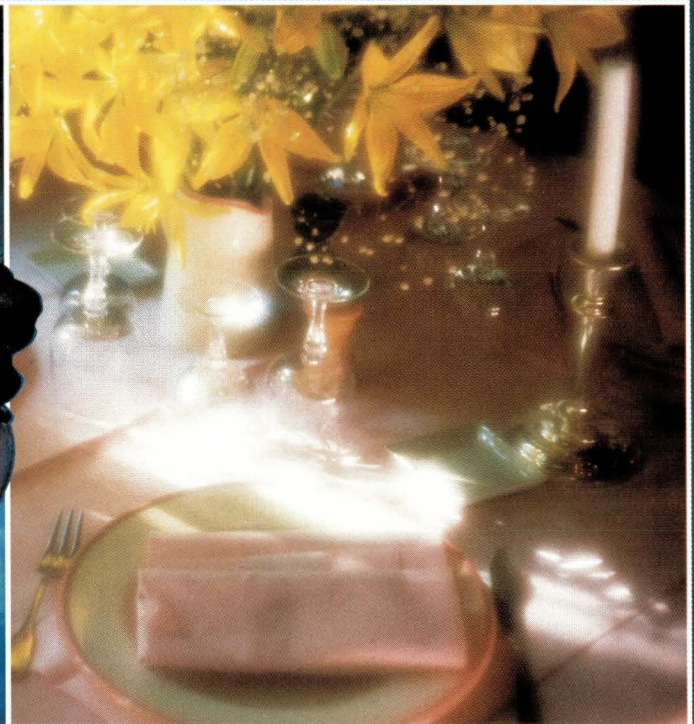


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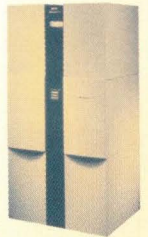
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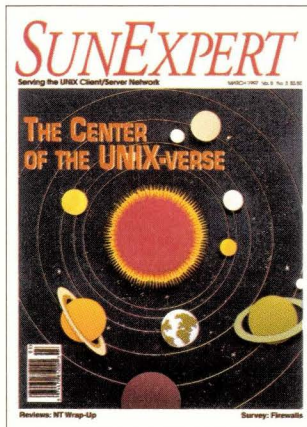
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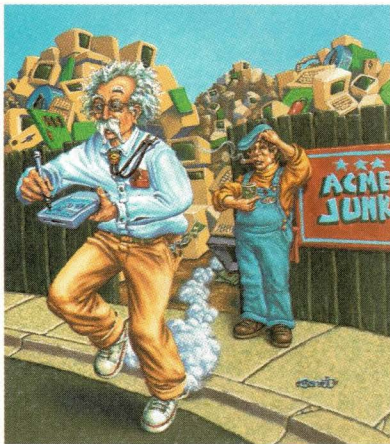


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Cover by Calvin Nichols



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SUNEXPERT

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

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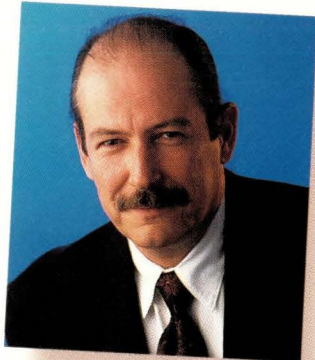
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Editorial

Where the Sun Shines Best

Next month, when you receive your copy of *SunExpert*, don't be too surprised. We have quite a few changes in store for the magazine. Not only will the new *SunExpert* include a supplement for the RS/6000 AIX community but it will also have an improved look and feel. So watch for it and let us know what you think of the shiny new changes.

This month, we take a look at Sun and the Internet. It seems to me that the Net will be Sun's bread and butter for the foreseeable future. All of us who scoffed five or six years ago at "The Network is the Computer" have



had to eat a little crow. Who could have foretold that this thing called the Internet that we used only to send email and FTP files around would become *the* network and what it would do to computing? Of course, all of these turns of phrases depend to some extent on equivocation.

Sun did not mean the Internet or intranet when it used the word network. And many of us used to say in those days as we pushed the QIC tape into the overnight envelope, "Never underestimate the bandwidth of Federal Express."

Imagine what the world would be like if

HTTP didn't exist or if all those PCs had never learned to speak TCP/IP? So maybe there's a little more than vision at work here—perhaps luck has a lot to do with it. Nonetheless, Sun is, as Paul Korzeniowski discovers in this month's cover story, "Still the Center of the UNIX-verse," and continues to get high marks from Internet and intranet implementors, whether for commerce applications, scalable servers or reliable hardware.

If you are one of those implementors and you have security on your mind, take a look at our sampling of firewall products on Page 58. The network, unfortunately, is the security hole.

Also in this issue, Technical Editor Ian Westmacott wraps up his exploration of distributed NT. These articles will give you a lot of aid and comfort if you've been charged with integrating multiuser NT into a UNIX-centric network.

Doug Pryor

SUNEXPERT

Serving the UNIX Client/Server Network

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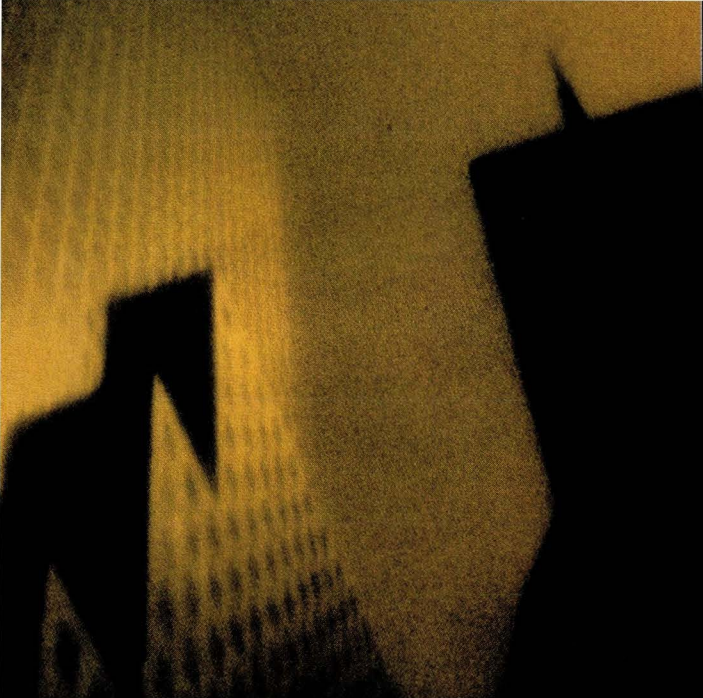
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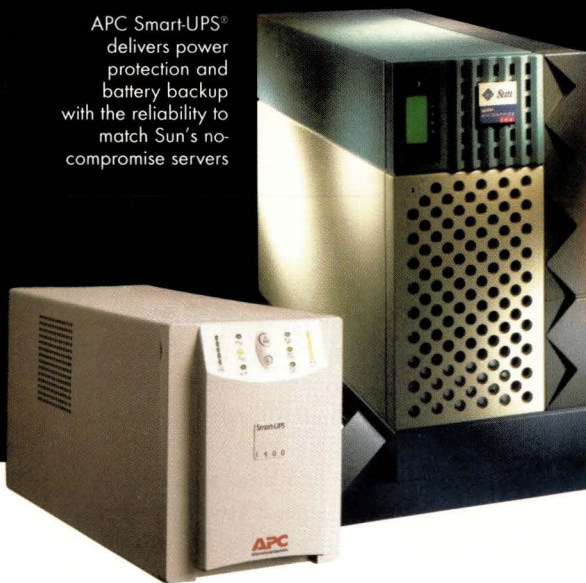
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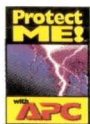
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NEWS

Sun Invades Mainframe Territory

Once upon a time, Sun Microsystems said the mainframe was dead. If it's still kicking, it appears the company wants to drive the final stake through its heart based on its January product and services introductions. This announcement brings to market servers and storage products that top off Sun's product line, and Sun itself calls it the most important product launch in its 15-year history.

Sun positions its new server, called the Ultra Enterprise 10000 and powered by up to 64 250-MHz UltraSPARC II processors, squarely against existing mainframes and hopes to gain a strong foothold in high-end data centers and other throughput-heavy environments. The new system features more than twice as many CPUs as any current Sun server, or any other UNIX server on the market, the company says. At the same time, as its name implies, it is an extension of Sun's Ultra Port Architecture specification, implemented throughout the Ultra product line.

Sun officials aren't the only ones who think they've entered the land of the mainframe giants with resounding footfalls. Analysts see the Ultra Enterprise 10000 as nothing short of "revolutionary."

"I would classify this as a revolutionary announcement for Sun, especially this soon after the introduction of the Ultra architecture last June," says Jerry Sheridan, director and principal analyst in client/server computing at Dataquest Inc., San Jose, CA. "Certainly, technologically they have a product that will compete with

IBM's SP2, HP's T series, and some of Fujitsu's mainframes."

The unit, which features technology from Sun's acquisition of Cray Research Inc.'s SPARC-based server unit (by way of Silicon Graphics Inc.), can be configured with up to 64 GB of memory and 64 I/O channels, supporting more than 20 TB of on-line storage. There is no slot trade-off between processors and memory—all 64 UltraSPARC II processors and 64 GB of memory can sit in the chassis at the same time.

The server, called Starfire, houses a new symmetric multiprocessing (SMP) architecture that features Gigaplane-XB interconnect, the high-performance crossbar switch interconnect developed by Cray. The Gigaplane-XB boasts a memory bandwidth of 12.8 GB/s, 6.4 GB/s of aggregate I/O bandwidth, and constant low-latency access to all system resources regardless of the number of processors, according to Sun. It includes error correction logic along all data paths within the system.

"There's no reason for anyone to buy another mainframe... The Starfire server forces the industry to re-examine what an SMP-based system is capable of doing," says John Shoemaker, vice president and general manager of

Sun Microsystems Computer Co.'s enterprise server and storage group.

Another carryover from Sun's Cray acquisition makes its debut in the Ultra Enterprise 10000. It's a partitioning technology on which there is a patent pending. Currently found in mainframes, the technology allows resources such as CPUs, operating systems, memory, I/O and interconnects to be partitioned into domains without rebooting the system—what Sun calls multiple separate environments. What's more, network administrators can isolate, resize and manage domains separately in order to dynamically modify and streamline application deployment, cut administrative costs and eliminate idle or underutilized resources.

While the server can produce impressive throughput, Sun's new storage systems would make banner headlines on their own. The company says it has more than 1.5 petabytes (1,500 terabytes) of high-end RAID installed, making it one of the largest providers of enterprise storage solutions, and the new product line is being introduced just as analysts predict the multiuser storage market to reach \$35 billion by the year 2000.

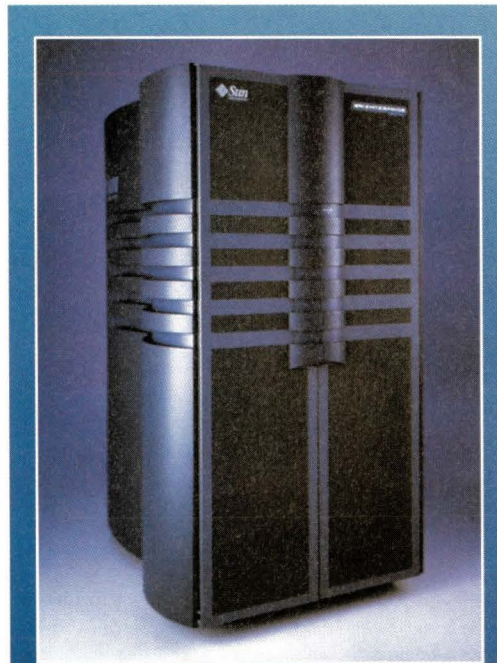
Sun's new storage offerings include

- The Sun RSM Array 2000, a RAID solution for heterogeneous servers that, according to Sun, features the industry's best price/performance.

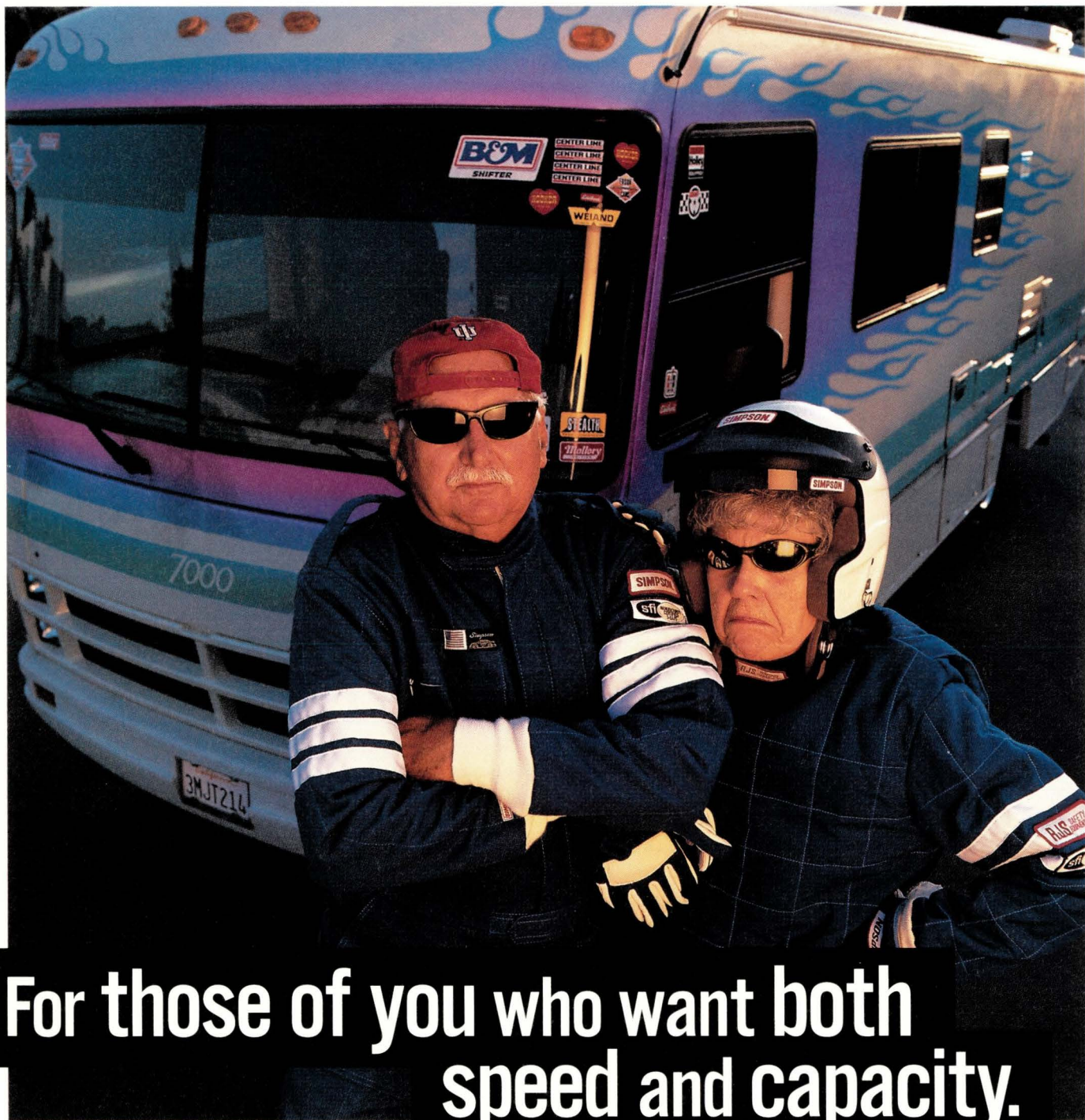
- The Sun Enterprise Tape Library (ETL) 4/1000, which will spawn a new family of multiterabyte libraries that provide the capacity, performance and reliability sought at data centers.

- Sun Enterprise Storage Manager Software, a line of integrated Java-based tools that provide scalable enterprise storage management in heterogeneous, geographically dispersed data centers through a single console, including RAID and logical disk management, backup/restore, archive, HSM, and media and library management.

The company is expected to announce support for HP-UX



Sun's Ultra Enterprise 10000 is powered by up to 64 250-MHz UltraSPARC IIs.



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and Windows NT hosts sometime this summer. Support for other UNIX variants, including IBM AIX, will be announced later in the year.

New Server Binary Compatible

The Ultra Enterprise 10000 runs Solaris 2.5 and maintains binary compatibility with more than 12,000 Solaris applications, including common data center applications such as Oracle, Informix, Sybase, SAP, as well as packages from Baan Co. and Computer Associates International Inc., according to Sun.

Sun officials tout the Solaris environment's longevity and stability, which becomes increasingly important as applications achieve mission-critical status. "Customers are buying systems and installing them in an environment where they simply cannot fail, and the larger the environment, the more stability they need," says Brian Croll, director of Solaris product marketing at Sun.

Noting that it takes a long time for some OSs to be able to handle even two or four processors, Croll says that Solaris' "baking time" has provided a body of knowledge established over its 14-year existence (when added to the lifetime of SunOS), which has included multiprocessor support since 1991. "We are baking our OS on a 64-processor machine right now, which shows we can handle that amount of throughput, and it's the same software that's running on our low-end machines, which is a unique capability. No one else offers scalability from a \$7,000 server to a \$1,000,000 server," Croll says.

Dataquest's Sheridan, referring to the range of Solaris scalability, warns that Sun still has to prove the OS is stable at the high end. "I'm impressed that it's binary compatible across the Ultra architecture, but we still need some trial runs with real customers. This is a new realm for Sun, and they are in a learning curve right now," he says.

Along with the new server and storage line, Sun introduced new reliability, availability and serviceability (RAS) features under the moniker SunTrust. The features include com-

plete hardware redundancy, fault-tolerant power sourcing and distribution, and hot-swappable system boards to provide up to 99.99% availability, according to the company.

Storage Systems Span RAID, Tape Backup, Management

Sun's new storage systems run the gamut from disk arrays to tape backup, and the company announced expanded relationships with storage-management software vendors.

The RSM Array 2000, which boasts twice the performance of existing SPARCstorage Array systems, will support up to 20 TB on the new server and offers dual hot-swappable RAID controllers supporting RAID levels 0, 0+1, 1, 3 and 5. It incorporates dual Ultra SCSI differential (40 MB/s) channels to the host that permit automatic failover to the second active controller if either should fail. Of special note is the fact that the system is fully redundant all the way through the I/O path with dual hot-plug controllers, power and cooling.

The ETL 4/1000, which Sun OEMs from ATL Products Inc., Anaheim, CA, is intended for use with 200-GB or larger databases; archiving financial, legal or historical data; and Hierarchical Storage Management (HSM). It offers up to 2 TB of capacity (with 2:1 compression), accessible via four parallel DLT 4000 tape drives.

ATL officials are ebullient about their blossoming relationship with Sun. "We are one of just a handful of suppliers to Sun," says Chet Baffa, vice president of marketing and sales at ATL. "We were able to instill faith in them because our product is reliable, and we helped them understand where our products fit into their market."

Sun's Enterprise Storage Manager software is the outgrowth of several partnerships between Sun and backup software vendors. The overarching software is an integrated version of the Veritas Volume Manager, from Veritas Software, Mountain View, CA. In addition, Sun has signed an agreement with OpenVision Technologies Inc., Pleasanton, CA, and continues its relationship with Legato Systems

Inc., Palo Alto, CA, with whom Sun had already done business by including Legato's NetWorker technology in its Solstice Backup software.

The Enterprise Storage Manager comprises Sun Enterprise NetBackup and Sun Enterprise HSM, which are Web-based versions of OpenVision's AXXiON software. OpenVision will incorporate Java Management APIs into its NetBackup and HSM software to enable bidirectional backup over the Inter/intranet.

As for expanding its relationship with Legato Systems, Sun says it has integrated NetWorker technology into the Enterprise Storage Manager. Sun also announced Solstice Backup Release 4.2.6 and Solstice Backup Database Module for SAP R/3.

Big Server, Big Service Plan

Rounding out the big rollout, Sun introduced a three-pronged service plan for the new data center systems. Administered by its SunService division, the plan includes a suite of consulting services to assess network effectiveness and security, a new education curriculum tailored to the demands of high-performance systems, and a support offering designed to ensure network uptime.

"Several years ago, when we moved from the technical space into the commercial space, essentially the mainframe displacement space, we realized we had to expand our service plans by incorporating a professional services group, and supporting our high-end offerings," says Tom Berghoff, director of worldwide support services for Sun's SunService division.

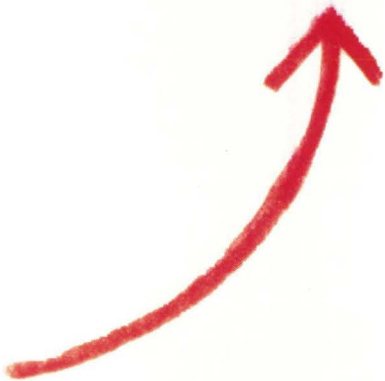
Included in the new support offerings is the SunSpectrum Gold support warranty, which is bundled with the Ultra Enterprise 10000 systems, and the SunSpectrum Platinum support for mission-critical applications. The SunSpectrum Gold program provides proactive support to data center system customers, 24 hours per day, Monday through Friday.

In addition, the SunVIP (Vendor Integration Program) can lead to faster problem resolution by providing customer assistance in conjunction with major software vendors, Sun says.



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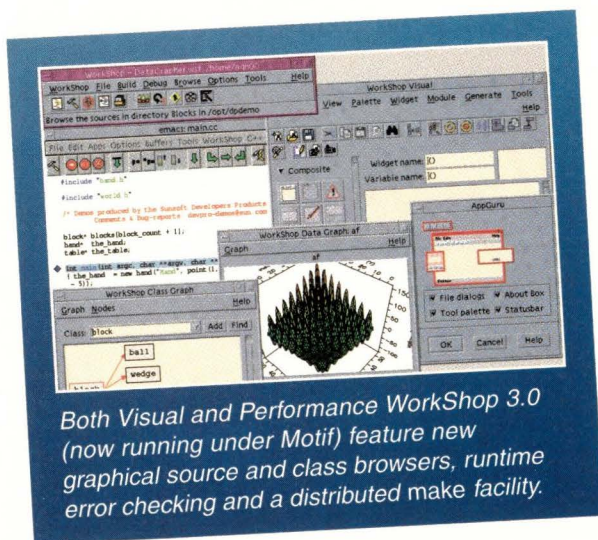
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"Instead of a backline to frontline relationship with the customer, this provides a frontline-to-frontline relationship. This means that if you're running Oracle, for example, and you run into a problem, you'll normally call Oracle, and they might say it's an OS problem. The customer is caught in the middle. Because we're involved with Oracle, we can step in and work out the problem," Berghoff says.

An entry-level Ultra Enterprise 10000 system, with 16 processors (scalable to 64 processors) and 2 GB of memory, is priced at \$870,000. Volume shipments are scheduled to begin this month. The Sun RSM Array costs less than \$0.50 per MB for a fully configured system and began shipping in February for Solaris servers. Support for non-Solaris hosts will be announced later this year. Pricing for the Sun ETL 4/1000 (available now) starts at \$85,000, which includes management and monitoring software. Pricing and availability for the Sun Enterprise Storage Manager will be announced at a later date.—*jsw*

Sun Unveils Next-Generation C, FORTRAN Tools

Contrary to what you might have been led to believe, Sun has not abandoned all non-Java-related tasks. Case in point, SunSoft recently announced major new releases of its Workshop development environments, Visual Workshop 3.0 for C/C++ and Performance Workshop 3.0 for FORTRAN; as well as Sun Workshop TeamWare 2.0, a version control tool.



Both Visual and Performance Workshop 3.0 (now running under Motif) feature new graphical source and class browsers, runtime error checking and a distributed make facility.

On the contrary, says Jon Williams, group marketing manager for SunSoft, Mountain View, CA, Sun is still quite heavily invested in C++ and FORTRAN, and "we want to assure our customers of that fact. C++ is alive and well, thank you," Williams says.

True to Sun marketing form, however, this latest Workshop release can be placed in a Java context. FORTRAN and C/C++, Williams explains, are the programming languages of choice for server-side development. And in this era of the thin client, there's a renewed emphasis being placed on the servers. Hence, there's a strong need for efficient, powerful server-side toolsets, he says.

Both Visual and Performance Workshop 3.0 differ from their predecessors in their user interface. Workshop now runs under the Motif, vs. Open Look, windowing system; and the GUI has been totally redesigned "to make power features more accessible," according to Williams.

In a move that should warm most programmers' hearts, Sun's Workshop capitulates to the hegemony of Emacs and vi as programmers' preferred text editors. Both editors, as well as Xemacs, are fully integrated into the environment.

"When we polled our customers, we found that 80% of programmers out there use either Emacs or vi, and that the question of which editor is best is practically a religious issue," Williams says. "We thought we'd be better off if we just stayed out of it, and let people use what they want."

Other features of the latest Workshop releases include, on the C/C++ side, an integrated GUI builder called AppGuru, which is licensed from Imperial Software Technology, Palo Alto, CA; and on the FORTRAN side, a data visualization facility. Both Visual Workshop and Performance Workshop feature new graphical source and class browsers; runtime

error checking; and a distributed make facility (dmake), which is said to cut build time by using available processors on your network.

SunSoft has also improved some of the preexisting Workshop features. These include multithreading and parallel processing support, the debugger, and the compiler, which is said to deliver impressive performance increases. "Recompiling alone can give you impressive performance boosts," says Williams. The compiler, too, runs faster, delivering 37% more SPECint95 performance, and 7% more SPECfp95 performance.

Pricing for Workshop 3.0 is \$3,495 (price is the same for both versions), and Workshop TeamWare 2.0 is \$1,295. Upgrades start at \$1,050 for Workshop 3.0, and at \$340 for TeamWare.

Workshop beta testers, of course, have their own list of favorite features. For example, Han Tunca, a programmer at TradeLink L.L.C., Chicago, IL, likes the new debugger a lot.

"I really hated the last debugger, but this one is really good," Tunca says. In particular, he likes features such as hypertext links back to source, and being able to debug two programs at once, which he says is useful if you are developing any kind of client/server system. More exotic features, such as the distributed make, and the new compiler, don't seem to figure into Hunca's environment, "because we can't use beta software to develop production code," he says.—*as*

Sun Leads in Flat Market

Sun Microsystems Inc. continued to dominate the traditional workstation market in 1996 by shipping more units than Hewlett-Packard Co., Silicon Graphics Inc. and IBM combined, according to a preliminary report on the 1996 worldwide workstation market released by International Data Corp. (IDC), Framingham, MA. While Sun remained the definitive market leader, the traditional workstation market remained flat in terms of growth, and the personal workstation market demonstrated strength as a viable alternative by shipping 38.3% more units in 1996 than in 1995.

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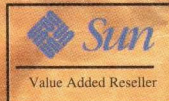
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According to IDC, a personal workstation is a single-user system with high-performance graphics. The machine must perform tasks typically associated with workstations, including mechanical and electrical engineering applications, scientific research, animation and high-end publishing. IDC characterizes the traditional market as UNIX workstations, while the personal market is considered to be high-end PCs—Microsoft Corp. Windows NT and Intel Corp. microprocessor-based systems—on which people perform UNIX-type applications.

According to IDC's report, the flat traditional workstation market resulted from pressure by Windows NT and "poor execution by several major workstation vendors." The traditional market shipped 712,256 units in 1996, up from 711,390 units the previous year. Of the total number of units shipped, Sun accounted for 41% of the traditional workstation market, followed by HP with 19%. SGI and IBM each had around 10% of the market, and Digital Equipment Corp. was left with 7.1%. The remaining 12.6% was classed "other." This grouping primarily indicates the numbers for several Asia/Pacific vendors, mainly Japanese companies working within the Asia/Pacific region.

In terms of revenue for 1996, Sun saw a modest 1.5% decline on the workstation side of the ledger. "Sun has always been fairly aggressive in their pricing," says Tom Copeland, director of workstation research for IDC and author of the report. "The fact they are down a little in their revenue is not surprising. Throughout the year, they were very aggressive in driving prices down. But, I think [Sun] made very good margins on those systems, just the total revenue was down."

Genelle Trader, director of marketing for SPARC and Solaris desktop products at Sun, attributes the slight drop in revenue to the maturing of workstation marketing, resulting in a lower than average selling price. "What you saw is lower ASPs [average selling prices] driving lower revenue. The market is starting to mature, and what typically happens is ASPs do decrease over time. I think that's a

Preliminary Worldwide Traditional Workstation Client Market Shares (%)

	Unit Share		Revenue Share	
	1996	1995	1996	1995
Sun Microsystems	41.0	38.1	32.0	30.7
Hewlett-Packard	19.0	21.7	21.4	22.5
Sillicon Graphics	10.5	9.9	14.5	12.9
IBM	9.8	8.2	9.8	10.5
Digital Equipment	7.1	8.6	6.8	8.7
Other	12.6	13.5	15.4	14.7
Total	100.0	100.0	100.0	100.0

Source: IDC

characteristic of this high-tech industry in general."

While the IDC report shows a drop in Sun's workstation revenue, recently released second fiscal quarter numbers ending December 29, 1996, show revenues of \$2.082 billion for the company. That is a 19% increase over the number in the second quarter of fiscal year 1995. "The server market is extremely strong for them," Copeland says.

HP's numbers, as reflected in the IDC report, show close to a 13% drop in units shipped as well as a slight decrease in market share. In addition to the product transition problems, Copeland says the company's sales force did not have a focus on pushing workstations. In January, HP announced a new pricing structure that may indicate the company has reoriented itself toward the workstation market.

"The server market was going very well for them, and they tended to focus more on that. But their announcement clearly indicated that they are going to go back and fight for that technical market. They know they had a bad year," Copeland says.

Holding the third spot in market share is SGI. The company managed a nearly 7% growth in units shipped, as well as close to a 6% growth in revenue. In addition, the company also saw a very small gain in market share. SGI and Sun are the only major manufacturers offering just a UNIX flavor. The other vendors sell both UNIX and personal workstations.

"With SGI they have seen very strong growth [in the UNIX market]," Copeland says. "I think they

believe the UNIX environment is the most productive for the company and they'll stay there."

The only other major manufacturer to see positive numbers in growth for units shipped was IBM. Big Blue was able to push nearly 20% more units out the door but also saw a drop of 12% in revenue. The reason for this may have to do with the introduction of a new version of the 43P. "That system has an average price of around \$8,000 and replaced a system that was priced at around \$15,000," Copeland says. "With the new products that they introduced, their entry-level system came down in price, being more in line with other manufacturers."

Tom Arthur, IBM's manager of RS/6000 workstations and workgroup server marketing, questions some of the accounting methodology in the report but doesn't dispute the idea that the new product offerings and pricing account for the higher volume and lower revenue. "In general, we introduced some products in October and began shipping those in November. We had tremendous orders for those boxes, and we have a good strong backlog," Arthur says.

"When we introduced the new products, we of course priced them off the competition and so some of the entry points came down a little bit and shifted some of the net volume."

DEC struggled in the traditional workstation market in 1996 with a drop in units and revenue. Copeland attributes this to the company's shift toward personal workstations. "We think they have some of the best products in the industry. Unfortunately, the

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uncertainty of the company's finances had significant impact. People are reluctant to buy from them in quantity," Copeland says.

A DEC spokeswoman disagrees with that comment on public perception but acknowledges the new emphasis on the personal market. According to Paula Hunter, personal workstation marketing manager for DEC, the report doesn't reflect the company's performance in the personal workstation market. "It looks like we're down 18%, and it doesn't take into consideration that since we announced personal workstations we've shipped over 50,000 units in that space alone," she says.

While the report does not break out the number of units shipped specifically in the personal workstation market, it does indicate that companies like DEC, Compaq Computer Corp., HP and Intergraph Corp. as well as NeTpower Inc. and NEC Technologies Inc. showed a strong presence in the market.

Stuart Gibbs, program manager for pricing and configuration monitor with D.H. Brown Associates Inc., Port Chester, NY, agrees that DEC is moving toward NT. "It looks to me like they're going to be putting their eggs in the NT basket as we get further in '97," Gibbs says. "Everybody in the UNIX workstation area is losing market share, and Digital is losing the biggest market share."

The primary growth in the personal workstation market came in the area of Windows NT. This subset of the workstation market saw a 16% growth in revenue and more than 38% growth in units. IDC attributes the growth of this market to a combination of two things. First is the migration of people from DOS- and Windows 3.1-type systems into higher systems that have higher performance and graphics capabilities, especially machines like the Pentium Pro systems. The other is the miscues from some of the major manufacturers.

"The big thing is that Windows NT is now viewed as a very viable alternative to the traditional workstation market," Copeland says. "IDC thinks the personal workstation market will continue its strong growth. We also think companies like SGI, HP and Sun are going to re-engage in that UNIX market and the

battle is going to be pretty fierce."

DEC has already indicated that it will aggressively fight for the emerging personal workstation market, and announcements from other manufacturers are expected later this year.

On the other hand, Sun has clearly shown it will stay on the UNIX-only side. "We are very serious about this market. We have a great product lineup. We are focused on the technical markets, and we will still push the performance envelope," Sun's Trader says.

IDC plans to release final numbers in April but does not anticipate any significant changes.—*pc*

Sun, HP, DEC Prices Down

Lower prices is the theme this year from three workstation manufacturers. Sun Microsystems Computer Co., Hewlett-Packard Co. and Digital Equipment Corp. are all offering a major price reduction of some kind, either in the form of a reduced price on a new product or a revamped pricing structure.

Sun has introduced the latest SPARCstation 5 Model 170 at 30% below the price of the existing Model 110, and DEC is offering its AlphaStation line at a lower price. Not to be left out of the pricing game, HP has adopted a workstation pricing model offering cuts ranging from 27% to 41%.

The Sun pricing news follows an announcement the company made in November 1996, when the price on the Ultra workstation line was lowered. The Ultra 1 Model 140 was made available for \$7,995, placing it at the same entry-level price as the SPARCstation 5.

"What that meant was, for effectively the same price as the SPARCstation 5, you got a machine that was significantly faster and possibly better configured," says Peter ffoulkes, director of advanced desktop and workstation computing for Dataquest Inc., a market research firm in San Jose, CA. "However by reducing the [SPARCstation 5] price by 30%, they put it back nicely on the price/performance curve."

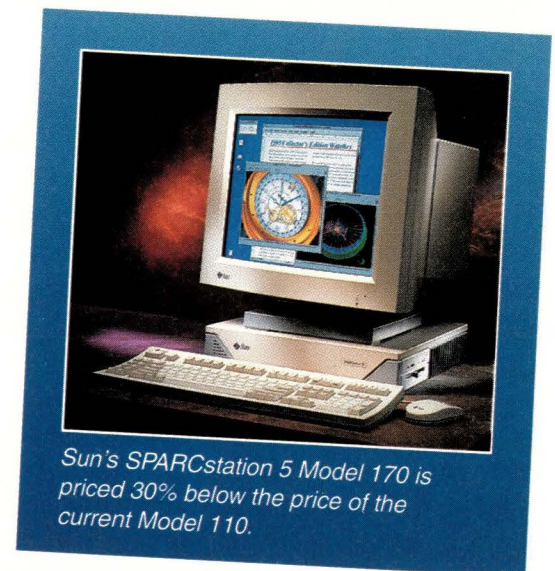
Available at an entry price of \$4,695, the new SPARCstation 5 Model 170 uses Fujitsu Microelectronics Inc.'s 170-MHz TurboSPARC processor, has 32 MB of memory and a 2-GB disk drive. According to Sun, this latest SPARCstation 5 offers users twice the performance of its predecessor.

"You can run everything the Model 110 ran, but it is about double the spec in both integer and floating-point versus the old one," says Bob Mitton, Sun's product line manager for volume desktops.

However, Tom Copeland, director of workstation research at International Data Corp., in Framingham, MA, says the new SPARCstation 5 does not offer much in terms of price to performance. "That system, for that price, does not have particularly good performance compared with the Pentium Pro systems. It's a good system for those people who are already buying higher end Suns and want some lower end systems, but as a pure competitor against the Pentium Pro system, it doesn't have the performance."

Stuart Gibbs, program manager for the pricing and configuration monitor for D.H. Brown Associates Inc., Port Chester, NY, agrees, "The SPARCstation 5 is not a very powerful workstation in today's market," he says. "Even though it's twice as powerful as the previous SPARCstation 5, price/performance-wise it is not very impressive."

Sun's Mitton concedes that from the standpoint of comparing industry spec



Sun's SPARCstation 5 Model 170 is priced 30% below the price of the current Model 110.

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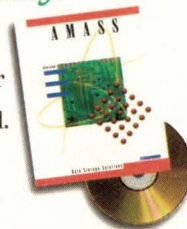
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marks, the new machine will appear lower. "But if you look at actual performance of applications, in a lot of cases, the applications will work at parity if not better. For the people we're selling the product to, it is more important to have it on a very stable UNIX machine. We're selling to professionals who need a machine to run 24 hours a day, seven days a week."

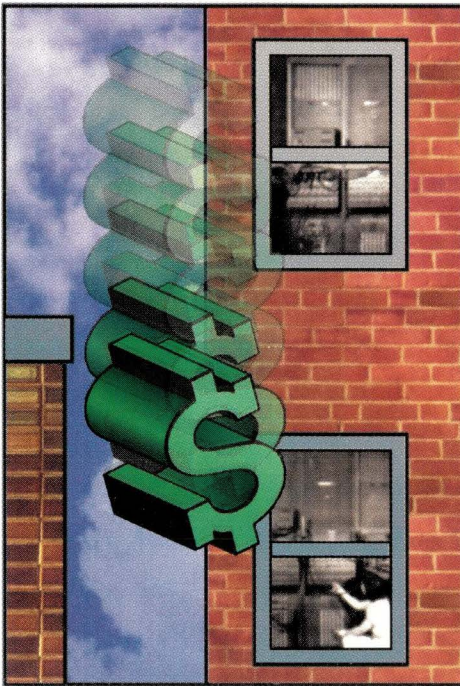
In addition to the lower price, Sun is offering a SunPC card with the SPARCstation 5 Model 170 to enable UNIX users to run Microsoft Corp. Windows 3.1, Windows 95 and DOS applications on their desktops. The Model 170 also features the Solaris Internet Access PlusPack, which includes Netscape Navigator Gold for Web page creation and access to the Inter/intranet.

HP's contribution to the price-slashing party is its repriced B-class, J-class and C-class machines.

"With the AlphaStation line, the price cuts were pretty much in response to Sun's price cuts of last year," D.H. Brown's Gibbs says. "HP's price cuts put them in what we believe is currently a leading price/performance position across the board from low end to high end. That is a pretty aggressive price cut."

HP's new pricing structure looks like this: The Model B132L, with the 17-inch color monitor and HP Visualize-EG, HP's entry-level 2D graphics adapter, is now available for \$6,795. This is a reduction of 41%. Model B132L with a 20-inch monitor and HP Visualize-24 goes down from \$17,700 to \$12,995, a 27% cut. Carrying an original list price of \$33,000, the Model C180 with HP Visualize-EG is now \$20,995. The Model C180 with Visualize-24 drops from \$38,000 to \$25,995. The price of the Model C180 with HP Visualize-48XP has been reduced by 32% from \$51,500 to \$34,995, and Model J210XC with the HP Visualize-EG (two-way) now has a list price of \$19,995, 37% below the previous list price of \$32,000.

In addition to the new pricing, HP has been working to restructure its operations to reduce costs within the



company. One example of this is the consolidation of the workstation systems division in Fort Collins, CO. "They also indicated that they will outsource some workstation production as well as try to maintain profitability at these lower prices," Gibbs says.

IDC's Copeland says the latest HP announcements are a reaction to the November announcement from Sun and, at the same time, signal that the company will compete for the workstation market in a new fashion.

"HP has always maintained sort of a premium pricing model. I think this is an indication that they are going to fight on price in a way that they haven't in the past," Copeland says. "They are clearly going to fight for that technical market."

The new pricing for DEC's AlphaStations includes a 42% reduction in price of the AlphaStation 600/333, now available for \$24,995. The AlphaStations 500/500 and 500/333 both dropped in price by 20% to \$39,995 and \$21,995, respectively. The AlphaStation 255/300 is now priced at \$9,995, a reduction of 28%.

"It made [DEC] very competitive in terms of price/performance," D.H. Brown's Gibbs says.

According to Dataquest's ffoulkes, this increased competition over price stems from falling memory prices, Sun's aggressive repricing last November, and

the growth of Windows NT-based workstations running on Pentium Pro-based systems (see "Sun Leads in Flat Market").

"Those systems offer the promise of quite substantial performance at a considerably lower price than some comparable UNIX workstations," ffoulkes says. "So the motivation there is to preserve the installed base of UNIX and reduce the rate of migration to the new WinTel workstation platforms."

While DEC has declared that its emphasis will remain on the Windows NT market, Paula Hunter, personal workstation market manager with DEC, says the UNIX market is very important to her company. "We're getting very aggressive on our pricing for the AlphaStation line and will continue to refresh and invest in R&D for our line," Hunter says.

From Sun's standpoint, this is just business as usual. "At Sun we're driving the performance again down to the lowest cost, highest volume," Mitton says. "I think a lot of people like HP, SGI and DEC follow us. They have to, or they lose."—pc

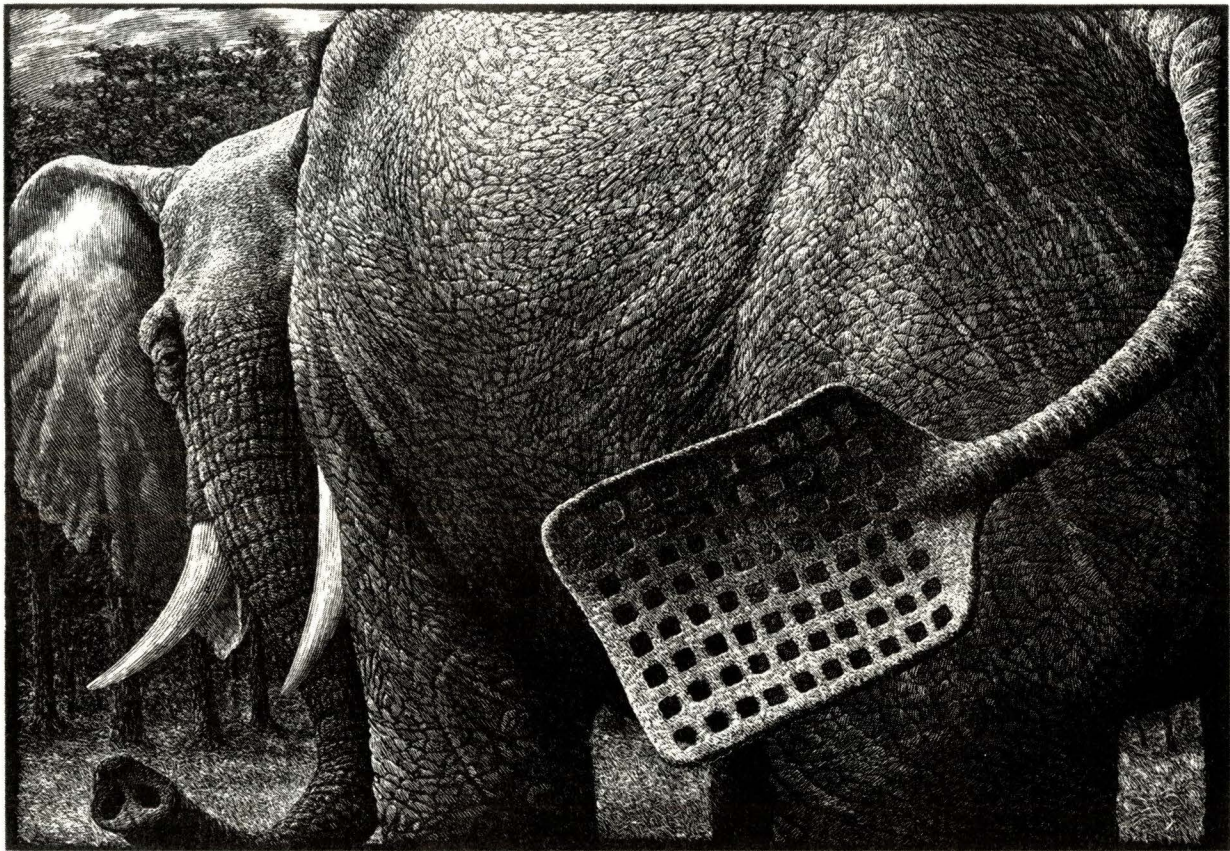
JavaSoft Gives Developers Compatibility Tests

Even as Java, with its cross-platform, Internet-based development capabilities, has taken the Internet market by storm, its developers at JavaSoft have been yearning to bring more functionality—and to bring it quickly—to the application development platform.

As of December's Internet World, application developers have a framework in place to help them assure customers that their Java-based programs will run without a hitch on any Java Virtual Machine (JVM) and will be compatible with all other Java-based software. They'll also get some marketing help from JavaSoft to spread the word about their products.

Called the 100% Pure Java initiative, the program has been endorsed by more than 100 companies. It is described by JavaSoft as an effort to help software developers build, market and sell Java applications that, true to Java's central tenet, can be written once and run anywhere,

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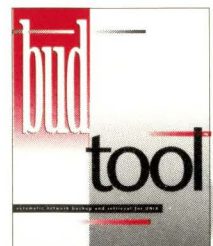
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regardless of the underlying platform and operating system.

JavaSoft says the initiative was envisioned when Java was introduced in August 1995—called at that time the Complementary Component Program—and it has been in the planning stages since then in order to guarantee a unified Java in which all implementations of the JVM are compatible at the application layer.

Over the course of the year leading up to the 100% Pure Java announcement, JavaSoft had been groping for ways to speed the evolution of the Java platform and increase its acceptance among application developers, says George Paolini, director of corporate communications at JavaSoft, Cupertino, CA.

“For the last year, we’ve struggled with how to evolve the Java platform. It’s been lauded for its inclusiveness, with 30 platform vendors supporting it, but there’s still some software functionality that hasn’t been there fast enough,” Paolini says.

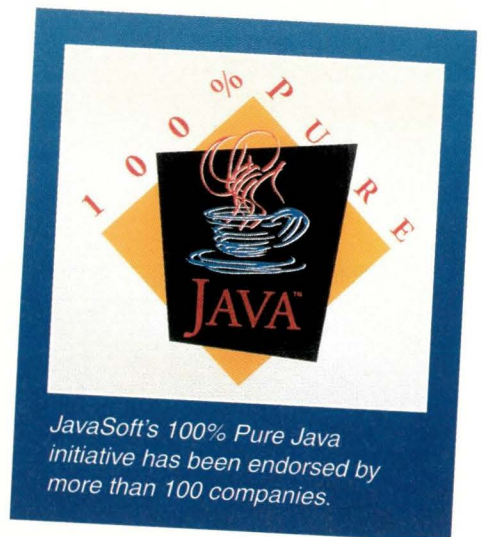
With backing from IBM Corp.,

Apple Computer Inc., Oracle Corp. and Netscape Communications Corp., among others, the effort will establish a common set of application programming interfaces for developers that will guarantee that Java programs will run on any Java-compatible virtual machine.

“A big part of the initiative started when we licensed Java to IBM, Netscape, Microsoft and others. We had about 30 companies working on developing the APIs, so it was truly an industrywide event. One mechanism that we had in place to ensure the platform remains unified was a series of test suites. We had 200 tests in July, and now we have 5,000,” Paolini says.

According to IBM, the test suites will ensure compatibility for both Java software developers and customers and eliminate the fragmentation the industry saw years ago when UNIX split into different flavors.

“The key is you want to make sure there is an industry standard for developers, which this provides. You don’t



want to see the same thing that happened with UNIX and its proprietary versions. [100% Pure Java] is a way to validate Java as a cross-industry, platform-independent technology, and it's a way to prove that to purchasers of applications. And it brings them some level of comfort that the applications will be compatible across platforms,” says Alan Hess, business development executive of IBM's Internet division, Somerset, NY.



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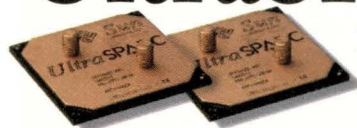
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Hess says the initiative will help developers work out bugs in their software at an early stage, and it will increase market acceptance of Java.

Available this month, the battery of tests will help entities that have licensed the Java Developer's Kit (Release 1.1 was also announced in December) and embedded the JVM to ensure cross-platform compatibility. The 100% Pure Java initiative will also help developers sell their Java-based software with a synergistic marketing program that will spread the Java gospel as well as increase the number of Java-compatible products on the market, according to JavaSoft.

Paolini says that software developers look at their potential customer base today and see two major platform categories: desktop machines and servers. The desktop market consists of about 80% Windows machines, and the server market is split into about 50% UNIX systems, 30% to 40% Windows machines, and some Apple machines. A third growing category includes Personal Desktop Assistants (PDAs),

cellular devices and SmartCards.

With that in mind, software developers have to think about development time, porting costs and marketing for each platform. With the 100% Pure Java initiative, they don't have to worry about the target platform, because the JVM will run on the whole range, from PDAs to fault-tolerant servers, Paolini says.

Because the JVM separates applications from the underlying OS, developers do not have to worry about supporting new OS features. That will be the job of JavaSoft and the JVM.

"One piece that's been confusing developers is they are trying to understand the level of functionality in Java. Should they enter the Java market now or wait? We're trying to lay out all the advantages to using it, and assure them that they won't miss features in Win32, for example, because the initiative is designed to keep them informed about it," Paolini says.

Overall, the series of programs will include education; developer assistance; testing and certification; a 100%

Pure Java logo for product branding, advertising and marketing collateral; Web site exposure through a "100% Pure Java Hall of Fame" network; and technical and marketing updates, hot lines and related affinity services.

"We'll issue white papers, 'cook-books' and produce the test suite on a CD-ROM. Testing will be done by a third party, or people can send their URL and we'll test the application on a player, like HotJava, Netscape or IBM's implementation of Java," Paolini says.

The affinity programs will assist Java-based software developers in establishing sales channels and give them early access to new Java functionality. Paolini says that a select group of applications representing a cross-section of the industry will be comarketed with Java. The members of this select group will be announced at the Java Developers Conference in April.

In addition, the initiative is designed to help expedite the evolution of the Java platform by encouraging the development of new, third-party 100% Pure

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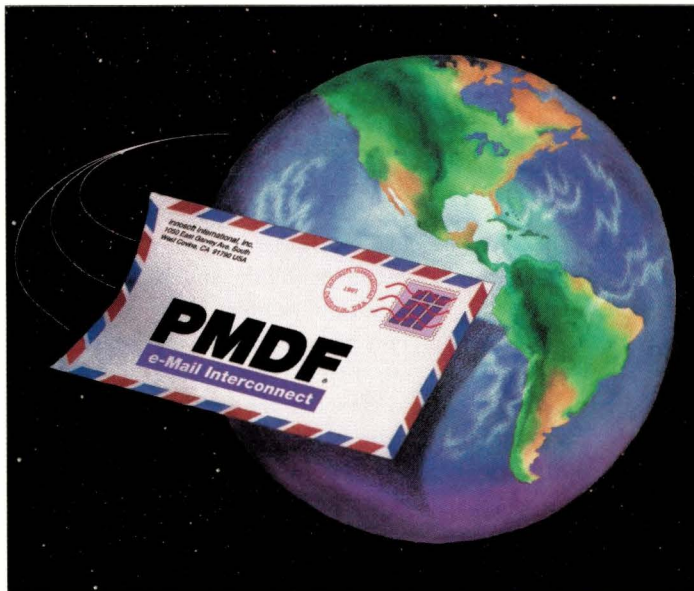
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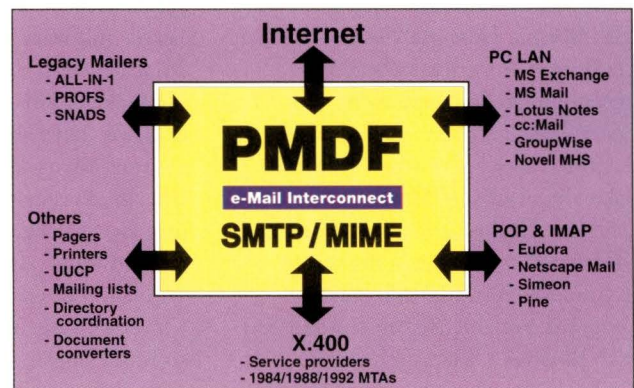
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Java APIs and libraries. Developers will have a wider range of functionality that can be accessed either through the Java platform, as established by JavaSoft, or by embedding third-party extensions in their applications, the company says.

In a related announcement, Sun and Netscape said the Netscape Windowing Internet Foundation Classes (IFCs) are designated as a GUI environment that can be used in building 100% Pure Java applications. The Netscape Windowing IFCs offer additional graphical user interface functionality to developers writing Java applications.

A component of Netscape ONE, the Open Network Environment, the IFCs are available for download from the Netscape Web site (<http://www.netscape.com>).

The application framework includes window hierarchies, integrated drag-and-drop, and all-Java user interface controls to give developers a way to create scalable, network-centric enterprise applications, which are 100% Pure Java certified, according to Netscape.—*jsw*

Informix Universal Server Opens Doors

When Informix Software Corp., Menlo Park, CA, purchased Illustra Information Technologies Inc. in December 1995, few analysts understood the extent to which this purchase would affect the relational database world. Sixteen months later, however, the Informix Universal Server—child of the Illustra-Informix technological union—has analysts redrawing the RDBMS landscape to include a new database model, the object-relational database, or ORDBMS.

On a technical level, the Informix Universal Server merges the server technology found in Informix's Dynamic Scalable Architecture (DSA) with Illustra's Object-Relational model. Thus, the Informix Universal Server is a relational database in the sense that you can access its data through a simple query language, in this case, a dialect of the SQL-3 standard; but it also acts as an object database, with support for features such as inheritance and polymorphism. The

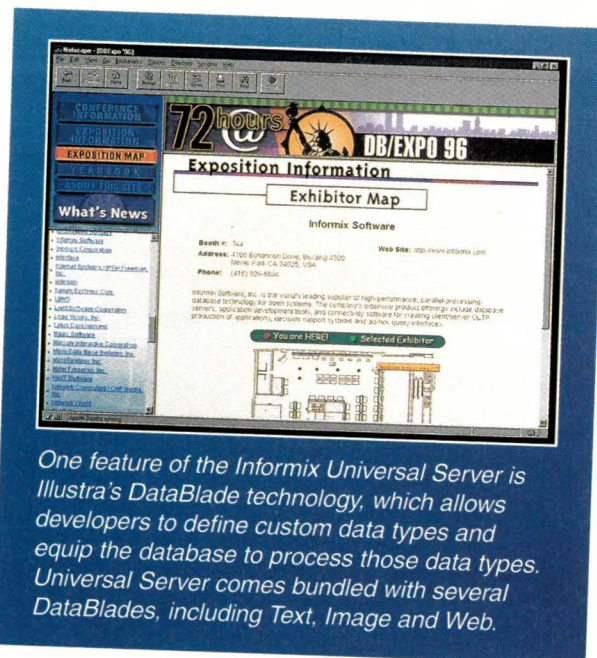
upshot is a database that provides simple querying of complex data types, which, independently of one another, neither the object nor relational model is very good at.

Another feature of the Informix Universal Server is Illustra's DataBlade technology. It allows developers to define custom data types and equip the database to process those data types. The Informix Universal Server comes bundled with several DataBlades, including, Text

DataBlade, Image DataBlade, 2D and 3D DataBlade, and Web DataBlade, each optimized for processing the separate data types. Dan Kusnetzky, director of UNIX and client/server programs for market research firm International Data Corp., Framingham, MA, says there are several advantages to the Universal Server approach. First, it gives organizations the ability to store rich data types—which, with the advent of the Web, everyone wants to do—within a relational database format. "This way, organizations aren't forced to restructure or retrain everyone in order to store and get support for rich data types, because the Informix Universal Server still rests upon database administrators' beloved SQL," he says.

Object databases, Kusnetzky explains, have always had the ability to store binary large objects, or BLOBs, as they are known in the industry. However, developers have resisted object databases on the grounds that database objects require a layer of built-in logic—written in a complex object-oriented language such as C++ or Smalltalk.

Kusnetzky says the other advantages are the performance gains achieved through DataBlades. Traditionally, databases know only how to store and retrieve data. If you want to do anything with your data—for example, sort it or search for a text string—it gets



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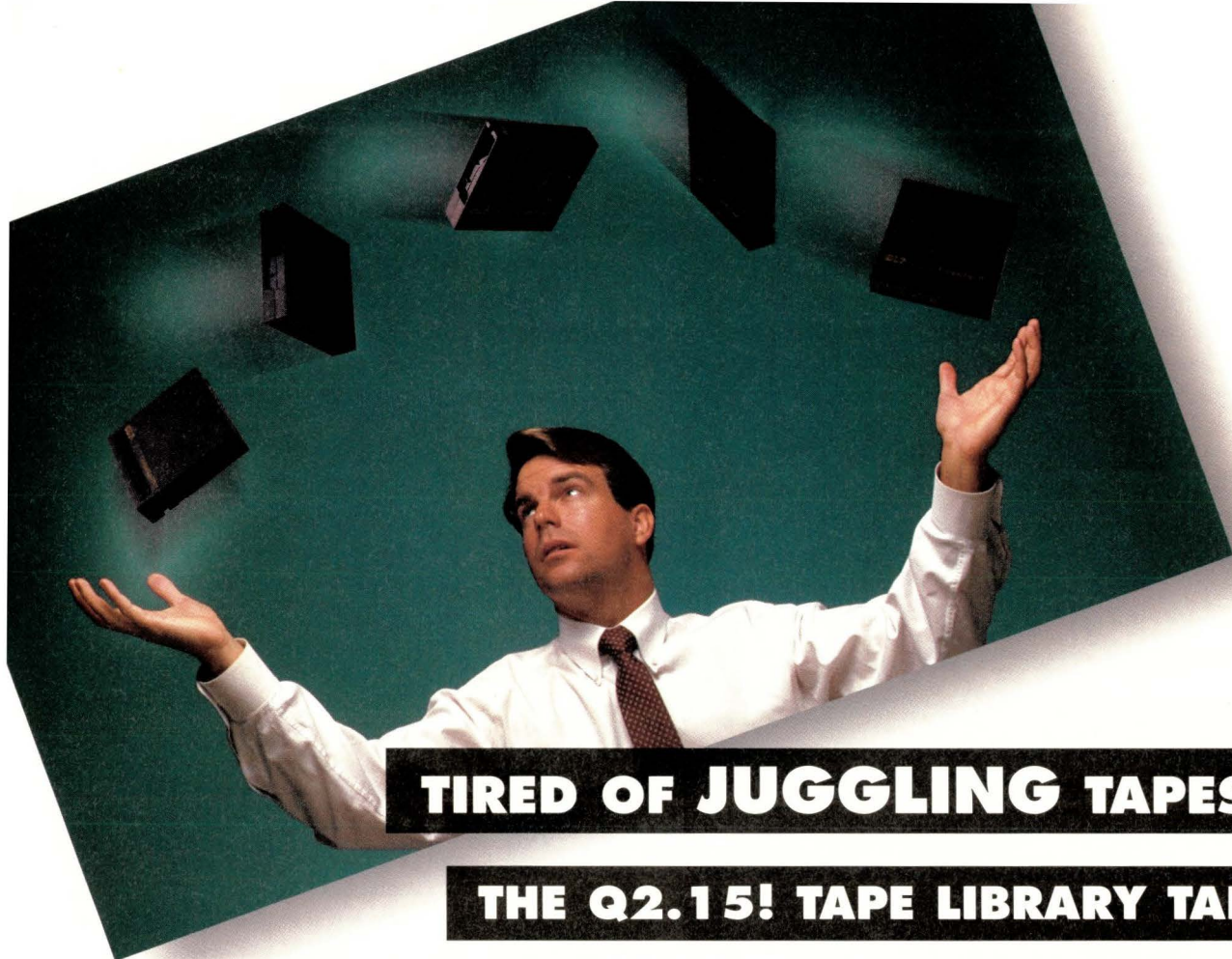
passed to an outside application. This can be a costly process, both in terms of speed and bandwidth.

"Now, imagine that instead of shuttling the data between the database and the application, the database instead has all the application logic built into it directly," Kusnetzky says. This is precisely the functionality that DataBlades offer.

To be fair, the notion of ORDBMS does not originate with the Informix Universal Server, or even with the Illustra database. The idea that you could add custom data types to a relational database started with IBM and its Database Extenders for DB/2. Version 7.2 of Oracle, from Oracle Corp., Redwood Shores, CA, added support for multimedia data types, and today, Oracle markets its own Oracle Universal Server.

The difference lies principally with who is allowed to develop data types. Neither IBM nor Oracle opened up data type development to third parties. Customers were limited to data types supported by their systems.

Informix, on the other hand, has taken a more open approach, with the Informix DataBlade Partners initiative. For example, the DataBlade Developer's Program provides third parties with training and consulting, a DataBlade Developer's Kit and quality assurance testing, for a single entry fee starting at \$700. At the time Informix announced



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the Universal Server, there were 29 DataBlade modules available from either Informix or DataBlade Partners, and another 50 in the works.

"Remember," says Malcolm Colton, director of database marketing for Informix, "a lot of companies have found themselves forced into the database management business, which has not been where they've wanted to be. Developing a DataBlade lets them hand off that task. It's really a win-win situa-

tion, which allows everyone to focus in on what they're good at."

"Plus," says Colton, "by developing custom DataBlades, these companies are walking into sales situations that previously would not have been possible."

DataBlade developers too seem enthusiastic about Informix's approach. Mark Demers, director of marketing and communications for Excalibur Corp., Vienna, VA, says Informix's approach to its partners is "perfect." He

adds, "Their toolkit is easy to use, and they've generally been very helpful."

Excalibur is the developer of both the Text and Image DataBlades that come bundled with the Informix Universal Server, as well as the Face-Recognition, SceneChange and Real-Time Profiling DataBlade modules. And so while Excalibur's success is not dependent on Informix's, Demers says, "we expect that we will do quite well in this area."

Currently, the officially announced 29 DataBlade modules fall into the following categories: data warehousing; financial services; digital media; mapping and spatial applications; text and document management; and Web and electronic commerce. In addition, Colton estimates that in the coming year, approximately 150 to 200 new DataBlades will be announced. "That's about one DataBlade for every business day," he says.

In watching the Informix story unfold, Kusnetzky remarks how "Informix has transformed itself from a bland technical vendor, selling a bland technical product, to a cosmic visionary. It's as if Informix has developed the framework around which an entire ecosystem could grow," says Kusnetzky. "And we're even seeing competition in that ecosystem," referring to the fact that Informix has recruited several companies to develop DataBlade modules of the same type.

Indeed, the Informix approach has panned out in terms of market share. Today, Informix stands behind Oracle but, more importantly, ahead of Sybase Corp., Emeryville, CA, which it has bumped to third place. According to an IDC report, in 1996, Informix held 15.6% of the market, up 3% from 1995, behind Oracle with 36.8% of the market, down 1%, but ahead of Sybase with its 10.3% share, down 3%.

However, Informix's Colton says IDC's numbers do not fairly represent Informix's position in the market. "In terms of pure database sales, we're neck to neck with Oracle," he says. "And if you think of Informix together with its DataBlade Partners, it quickly becomes the largest software corporation of them all, a 'virtual software corporation,' if you will."—*as*

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"Do you want to erase all data?"



– Whoever

"If the original MessagePad had worked like this, everyone would own one by now." – Reviewer of the Newton MessagePad 130

"Do we still have aliens?" – Diehard user hunting Easter eggs

Mr. Protocol and the Peripatetic School

Q: *I don't want to worry you or anything, but Mr. Protocol seems to be sitting on the couch. I don't think I've ever seen him do that before. Is he liable to get violent or anything?*

A: I'll admit that it gave me the leaping weem-weems when I got home and saw him doing that, but it turns out there's a reason he's not sitting in front of a terminal or lying down with a fiber cable sticking out the back of his head or something, the way he usually is. He's finally found something that a) connects him to the Net, b) isn't a terminal, and c) is fast enough so he doesn't get sick. I have to admit I'm impressed. It's one of the most famous failures of all time, and it seems to work just fine.

What Mr. P. has hold of is a preproduction model of the new MessagePad 2000, from Apple. I have no idea where he got it and, as usual, he refuses to say. I get the impression he doesn't understand the question. Because he never sleeps, as far as I know, he never lets go of the damn thing, and I had to arrange some pretty powerful distractions in order to get my own mitts on it to see why he liked it so much.

It was no good just asking him, of course. Out came the usual yatter about protocol stacks and clock rates

and low-level negotiations. Feh. As best I can figure, he likes it because he gets to write on it instead of typing, and it takes him back to his childhood. I always thought he learned to type before he could write, actually.

As best I can figure out, he prefers this to any other hand-held computing device he's seen, mostly because



it's far more powerful. Of course, "far more powerful" than the stench of a Komodo dragon isn't exactly a sterling recommendation, and that's about the level at which most people viewed Apple's first entry into the handheld computing market, the original MessagePad.

The Story of MessagePad

Apple had an idea that was original enough to make it dangerous to market: a handheld "personal digital assistant," so-called to make it distinct from a handheld computer. Of course it is a computer, but to call it that would be to make people immediately think of a Windows or Macintosh computer that was shrunk to the size of a paperback book. Apple didn't want to give that impression because it knew that everyone who was confronted with the notion of a paperback-size version of Windows or the MacOS would snort and walk rapidly in the other direction. How useful could that be?

Later, of course, Microsoft would unveil Windows CE, a version of Windows designed to be run on machines the size of a paperback book, and everyone nodded and said, "How wise of Microsoft to think of this! Lo, it never occurred to us that if we shrank that abominable pile of digital fewmets called Windows, it might make it less painful to use! Smaller is indeed better!" And behold, many wise columns praising Microsoft on its perception and foresight were written throughout the land.

Meanwhile, several years earlier, The Other Computer Company said, "Closed architectures and artificially

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high prices are going to allow us to clean up. Watch our dust!" And behold, it very nearly did crumble into dust, thereby proving that nobody has a lock on being stupefyingly wrong.

But at the same time, some smaller voices in the chorus at that company were saying, "You know, if you carry a computer around with you all the time, and refer to it frequently in short little sessions instead of in big long sessions, and use it for completely different things than you use your desktop machine for, or even your laptop, then maybe, just maybe, it should be built a different way."

Therefore, after a very intense development project, Apple introduced the Newton MessagePad. This product didn't prove anything, because it had been proven long before that if you design a radically new product, it's extremely likely that you'll get enough things wrong that people will laugh you out of the marketplace. This is pretty nearly what happened with the original MessagePad. In particular, the model of the Newton MessagePad was that of a notebook, on which you scribble dates, phone numbers, field notes and other short but important things. The problem was, the algorithm to perform handwriting recognition did not work very well. Even Garry Trudeau got in on the act with the comic strip *Doonesbury*, in which Mike Doonesbury is seen staring at the MessagePad after writing something and thinking to himself, "Egg freckles?"

And egg freckles it was, for the first several generations of the MessagePad. Certainly, there were many admirable features of the Newton. Applications were small because they were written in an object-oriented language and interpreted by a byte-code interpreter that had all the base classes available to it in ROM. Batteries lasted a long time because the Newton used a newly developed low-power RISC chip called the ARM. All this counted for nothing, or nearly nothing, because any device that took "head lettuce" and turned it into "egg freckles" was found wanting in most businesses. The more Dadaist of the improvisational theater groups were perhaps an exception to this, but this is admittedly a small

market. ("Not small enough!" you cry. Bourgeois traditionalist.)

We are fortunate, in Mr. Protocol's opinion, that Apple didn't do what any sane company would have done after the career of the original MessagePad, the MessagePad 100 and the MessagePad 110, namely, fired or shot the Newton design team and dumped the entire inventory off the continental shelf one midnight. Instead, Apple redesigned the Newton operating system, and the Newton hardware, and came out with the MessagePad 120

After a very intense development project, Apple introduced the Newton MessagePad. This product didn't prove anything, because it had been proven long before that if you design a radically new product, it's extremely likely that you'll get enough things wrong that people will laugh you out of the marketplace.

and, shortly thereafter, the MessagePad 130. Suddenly, things started to work the way Apple had claimed they would. There was enough memory to run real applications. The handwriting recognizer, *mirabile dictu*, suddenly started to recognize handwriting.

Mr. Protocol actually tried a MessagePad of an earlier vintage in the store, and spent some time with the device. Well, actually, he didn't, but he made me go out and do it. After some time struggling with the handwriting recognizer, I, like most people, pulled

out the big mental rubber stamp that reads "DOES NOT WORK" and stamped it all over my mental image of the device.

It was with considerable surprise, therefore, that I tried the MessagePad 130 and found that it recognized my handwriting without error on the test sentence that I wrote. This, of course, turned out to be luck, but not a great deal of luck. The new algorithm on the 130 recognizes about 95% of plain text that I write. For cases where I'm writing lots of acronyms, there is a print recognizer that recognizes 98% to 100% of what I write, though for me, printing is much slower than writing.

Mr. Protocol had a chance to find out the story (or, at least, a story) behind the checkered career of the Newton MessagePad handwriting recognition system. He was surprised when, at the Nomadics 96 conference, he ran into the authors of that system. They were Russian.

Mr. P. spent some time talking to them. It seems that the Soviet Academy of Sciences saw the economic handwriting on the wall. Not being entirely dim, they saw that state support for the sciences was only going to get grimmer in a country that was attempting to rewrite its entire economic system while staving off mass starvation. Therefore, the computer scientists in the Academy formed a corporation, ParaGraph International, and went out looking for work. Apple hired them to write the handwriting recognizer, because the mathematicians at ParaGraph have some startlingly clever and innovative algorithms for processing and compressing complex curves, such as handwriting.

However, dealing with the Russians for the first time, a cautious Apple Computer kept the ParaGraph workers completely in the dark as to exactly what they were writing a recognizer for. ParaGraph never saw a Newton MessagePad until the first units hit the market, which was far too late to fine-tune the recognizer.

When Apple started work on the Newton OS 2.0 redesign, ParaGraph jumped at the chance to improve its technology, and did so, very consider-

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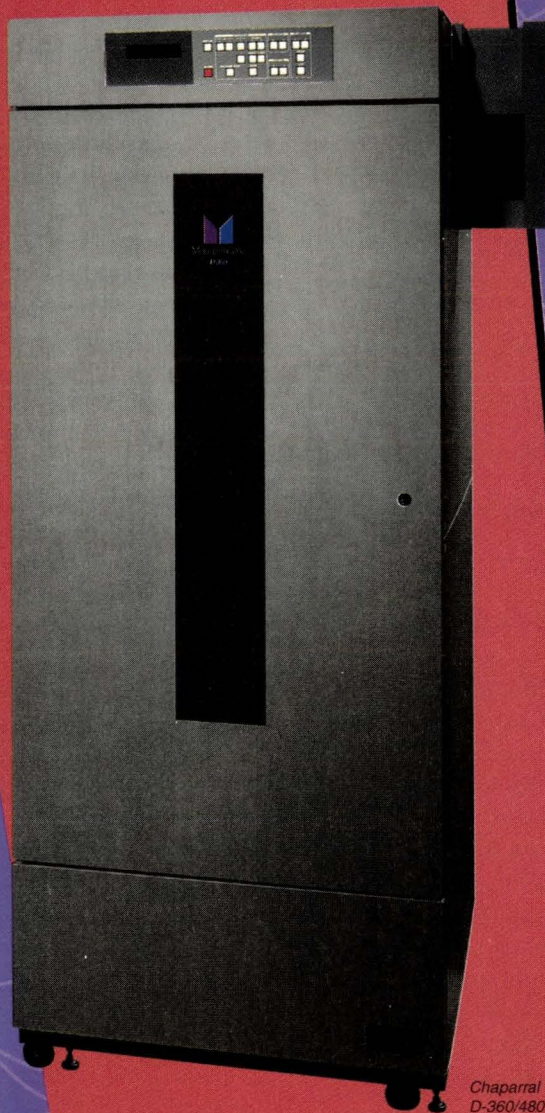
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ably. The fact that most people cannot write in a script readable to their spouses, let alone a computer, should not be taken as a handicap of the Newton. If you can write a note that the gas man can read, then the Newton MessagePad can probably be trained to read it too. But if all your Ls are so flattened that they look like Es, then you shouldn't be surprised if that's what the MessagePad thinks they are.

But why in the world should anyone buy a hand-held computerized notetaker? Why not buy a U.S. Robotics Pilot, which is a complete computerized daybook that fits in your pocket, and be done with it?

Mr. Protocol is glad you asked.

StrongARM Tactics

The reason is that the Newton MessagePad is a completely general machine, despite its unusual model of computation. And the newest MessagePad to be announced, the MessagePad 2000, will knock the socks off just about everybody (set for release by the time this appears in print).

The Newton MessagePad 2000 is the first MessagePad to use a different chip from the original ARM RISC processor. The new chip, dubbed the StrongARM, has the ARM instruction set but runs at 167 MHz. It is estimated that the MessagePad 2000, as a whole, is roughly equivalent to a Pentium 133 in raw computational speed.

Add to this a half-VGA screen with 16 levels of gray scale, two PC Card slots, an external I/O connector that can support two serial slots and/or a keyboard, a speaker and a microphone, and you have a device that will really tend to get under the skin of a whole lot of people.

Mr. Protocol likes this device mostly because it is blazingly fast. Everything happens at once. The handwriting recognizer, in fact, is so fast that the user will usually want to increase the delay before recognition begins, to avoid the feeling as they're writing that the machine is stepping on their heels.

Previous instances of the Newton MessagePad, whether they belonged to the "WORKS" or "DOES NOT WORK," had marginal responsiveness at best. The StrongARM chip is suffi-

ciently fast that the machine no longer feels as if you are dragging it along with you. Instead, it has a feel that says, "You want that? You got that! ZIP!" This is nice enough when you are working on a keyboard. When you are writing or tapping with a pen, the responsive feel is much more visceral.

However, the machine really shines in an area so fraught with peril that previous MessagePads have never even tried to address the problem: wireless Internet access. With two PC Card slots and 167 MHz of speed, the

With two PC Card slots and 167 MHz of speed, the MessagePad 2000 is finally fast enough to act as an Internet client machine without choking, or driving the user crazy.

MessagePad 2000 is finally fast enough to act as an Internet client machine without choking, or driving the user crazy. This opens up a broad range of possibilities.

Naively, one can imagine browsing the Web while riding the bus. One unanswerable argument against this view of the universality of network access consists of the question: "Who wants to browse the Web on a bus?!!?" Mr. Protocol and his amanuensis both regard this as a valid, cogent and correct argument.

If one travels frequently, maybe you *do* want to browse the Web in a hotel room, or more likely, read your mail. This works. There is a version of Eudora available for the Newton from Qualcomm Inc., the same folks who wrote "regular" Eudora.

However, aside from the much greater lightness and convenience of the MessagePad, you might feel more comfortable with a laptop. Certainly, if

you have any large messages to compose, a keyboard is easier. Although quite a nice keyboard is available for the Newton as an accessory item, a laptop is more familiar ground.

Where the Newton comes into its own, Mr. Protocol feels, is on the intranet, the private network run by the corporation for which you happen to work. Imagine that you had set up a private Web server where all of your information was organized behind a security screen such that only you could get at it. This could be data private to you, private to your project, or data generally available inside your corporation. It might even be the original data, made available through CGI scripts.

No one can bring all of this data to a meeting in a single bundle, though we all know people who try. These poor beasts of burden are usually regarded with some humor by their colleagues.

With the Newton MessagePad 2000 being used in "network appliance" mode, however, the picture differs considerably. Connect this thing up to the Web via a wireless Ethernet interface, and you have a Web browser with a speed on the order of magnitude of the box on your desk. It has the potential to reduce the occasions on which you say, "I'll have to get back to you on that" to exactly the set of occasions where you want to say that. You'll never have to say it again.

Certain steps have to be taken to make this a reality. First, the Newton Internet stack currently supports only PPP and SLIP connections to the Internet. Work is under way to make the stack "pluggable" so that arbitrary transport media can be used, but it's not complete yet.

Second, Web authoring tools are currently oriented primarily at those who wish to do marketing, not those who wish to turn the Web into a transport medium for internal corporate communications. Considerable work remains to be done to develop the back-end tools necessary to organize a truly huge library of corporate data mishmash into an equivalently huge pile of HTML. This task is already getting attention, but is primarily based on the views of people trying

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to organize the data from the point of view of the entire corporation, not those trying to organize a single person's view of that data.

If this problem can be solved, or at least reasonably addressed, then a MessagePad 2000 connected to the corporate intranet would be the most powerful tool imaginable at any meeting. Everything on your desktop would be available, and unobtrusively.

There are still some problems with the MessagePad 2000, but they're relatively minor. The lack of direct network connectivity is in some sense the most disabling. The SLIP and PPP protocols are generally found only on slow connections. Faster protocols, such as Ethernet, should already be available, but they're not.

Connectivity between the Newton MessagePad and desktop platforms is lagging far behind development of the MessagePad software itself. A set of Connection Utilities exists as a public beta-test distribution, but far more powerful tools are needed. Also, if the corporate intranet application is to take off as Apple doubtless hopes it will, more desktop platforms will have to be added to the repertoire. In particular, except for Internet connectivity, no synchronization or communication is supported with any UNIX platform. The Newton needs to be able to talk to a Sun, and synchronize with the Common Desktop Environment, as well as with Windows and Macintosh, if it is to succeed in technical arenas.

One nonproblem that still must be taken into account is that the Newton is fundamentally a low-power device. To test the Newton MessagePad Internet software stack, Mr. Protocol plugged in a Hayes Microcomputer Products Inc. Optima 28.8 PC Card modem. Although the batteries registered above the halfway point on the battery guidelines, the modem card took all of about seven seconds of operation to drain four AA batteries to the point that the Newton shut down. Either low-power modems, or an external power adapter, would be needed to make this connectivity work. Obviously, the Hayes PC Card modem expects to be fed by lithium

batteries the size of Cleveland, as sported by most laptops, rather than by four AA cells on a really small machine!

When the MessagePad was connected to AC power, it and the modem behaved perfectly well together, and Mr. Protocol was able to establish a PPP connection to his Internet service provider and surf away. Power requirements on wireless network interfaces may be even more stringent, and a thorough search for a low-power one may be necessary.

The Issue of Memory

Perhaps most critical is the issue of memory. The preproduction Newton that fell into Mr. Protocol's hands had a sticker on the back, obviously applying only to the hand-built prototype units, which had various amounts of various types of memory listed that the unit might have. Circles had been drawn around the items that reflected what the unit actually had. The first really useful Newton was the MessagePad 130, because this was the first Newton that not only had a decent OS and decent handwriting recognition, it was also the first Newton that had a sufficient amount of scratch memory to allow applications to run successfully...and even there, "enough" is a relative term.

Rumor has it that the MessagePad 2000 will arrive with the same amount of memory as the 130. This would be a grave mistake. One of the options listed on the little sticker is for 4 MB of scratch memory as opposed to 1 MB. Even if it were to cut battery life in half, which DRAM might well do, this should be made available as an option. Shortened battery life is a serious consideration, but there is a huge difference between a spare pair of batteries, and a machine that otherwise simply can't take on large tasks.

Other little extras make life worthwhile. The MessagePad 2000 comes with a new application, NewtWorks, which is more or less equivalent to MacWrite. It's no great shakes as a final word processing system, but it makes the Newton as good as a notebook at capturing typed text on the fly,

and probably lighter weight to boot. The Newton keyboard is excellent overall, very lightweight and with a good feel.

Best of all, the first in what Mr. Protocol expects to be a long line of Web clients is included as well: NetHopper, from AllPen Software Inc. This is a text-only Web browser, designed to make the most of a slow connection on a machine whose rendering speed is not great. The MessagePad 2000 is fast enough to make image rendering a viable possibility, but this capability hasn't yet appeared in a commercial browser. A fellow in Germany has created a shareware browser that can display GIF files, so there's hope yet.

Whether a Newton is a worthwhile purchase is a question of individual taste and accomplishments. Illegible scribblers who are goal-minded and want an organizer and nothing more than an organizer would do well to pick up something like a Pilot, where the Graffiti application forces one to write in machine-legible script. If one's handwriting is reasonably legible and one is an aficionado of general-purpose machines, it would be difficult to resist buying one of the new Newtons, even without Internet connectivity. Give this thing high-speed local Net connectivity and enough memory, and life around the corporation will get a little easier all round. ➡

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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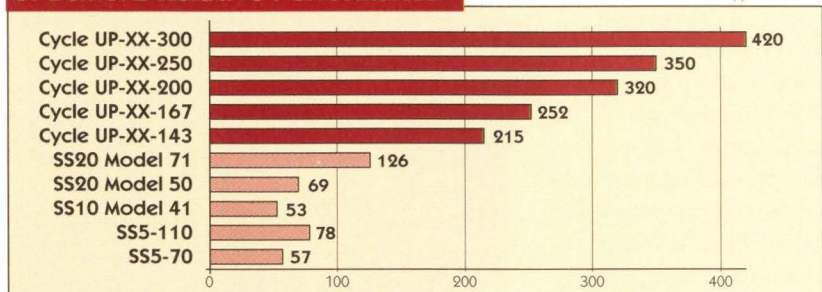
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Sorting

Every so often, I try to write articles that contain practical help. Actually, it seems these are the articles that generate the most email. I should reiterate that mail from readers is very welcome; it often sparks new articles or follow-ups. I try hard to place correct information in these columns, but obviously sometimes I do miss the mark. So, if you write correcting something that I expressed badly or have simply got wrong, I will suggest to the editor that your mail is printed in Letters to the Editor. It is worth sending mail that fixes bugs in the articles; it means other readers get corrected data and also educates me.

If I ask for your mail to be published, I will always give you a chance to fix the prose in your often hastily written note, so it's quite possible to dash off some corrective email without feeling that I will instantly pass it on to be printed. I cannot promise that the editor will have space to print your letter, but I don't think that there have been many cases where a letter that I suggested for inclusion has been "spiked," as the newspaper people say.

The notion to write this column came when I was processing data from one of the logs created by my Web server. The referrer log tells me the last port of call made by a visiting surfer; it records the page that a visitor was reading when they clicked a hyperlink to access one of my pages or images. I can find out who has links to my pages, and how often those links are exercised. The log has one line per record and three fields per line: the source URL, an arrow (in the form of `->`) and the destination page

or image. Each field is separated by white space and so can easily be processed with standard UNIX tools.

There are several questions that I like to ask about this data. What pages are most frequently used to link to my pages? Which pages are most frequently accessed from outside? Are there any surprise entry points that people have linked to? Is anyone linking directly to an image? I do think that it's bad manners to incorporate other people's images in your pages, unless you inform and ask the originator. On the whole, I don't mind people using my images as long as proper credit is given and others are not passing off my work as their own.

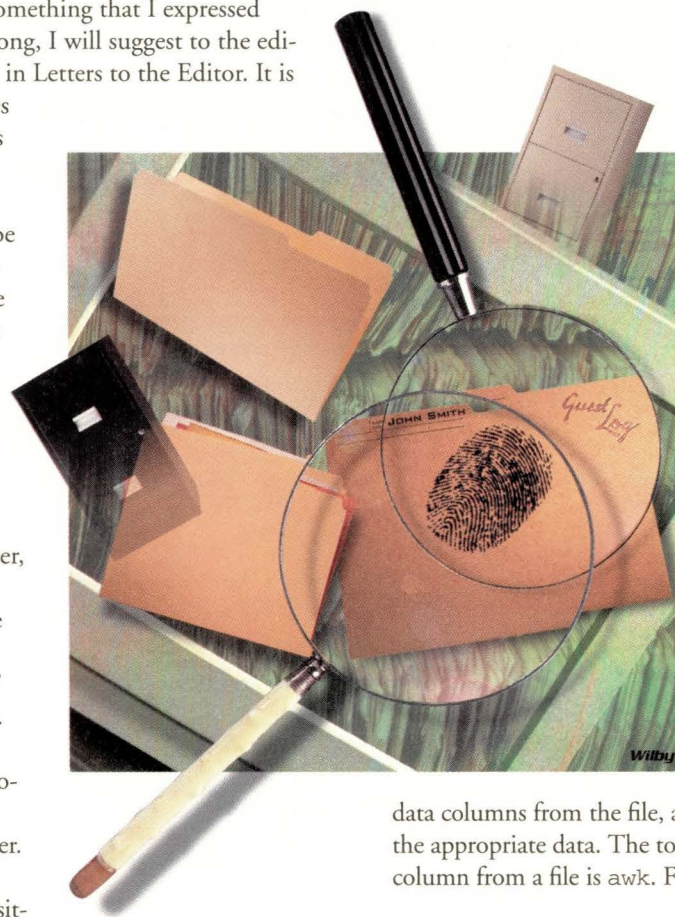
Using awk

I haven't created any specific shell scripts to process the referrer log data. I usually type the lines that I need into the shell to obtain the result I am looking for. The questions above mean that I will be processing one or other of the space-separated

data columns from the file, and I need some way of selecting the appropriate data. The tool that I always use to select one column from a file is `awk`. For example, the command

```
$ awk '{print $3}' log
```

will print column three of the source data file `log` on the standard output of the command. This column holds the target page addresses in the referrer log. The `awk` program in braces is quoted with single quotes so that the dollar character is not



expanded by the shell. Using quotes is a good habit to get into for `awk` or `sed` programs typed on the command line.

I find that I use the column selection facilities of `awk` more frequently than any of its other commands. The column selection format is easy to remember and is useful in many circumstances. For example,

```
$ awk '{print $3,$1}' log
```

can be used to filter the arrow out of the referrer log and also swaps columns.

The general form of an `awk` command is

```
selector { commands }
```

The selector is applied to all the lines that are read from the input data file, and if the selection succeeds, then the commands within the braces are executed. In the above examples, the selector is empty so the single command is applied to all the lines from the source file `log`.

Actually, because the `awk` command is processing a log file, it's a good idea to be suspicious of the data. Sometimes log files are not written properly, or the data that is written onto them is not what you expect. In this case, being suspicious paid off. It turns out that some of the URLs written in column one of the log contain embedded spaces, meaning that rather than having three columns on the file, there are sometimes more. I used a small one-liner to determine this:

```
$ awk 'NF != 3 {print $0}' log
```

The command makes use of the selector field. The selector here is a Boolean expression testing the inbuilt `awk` variable `NF` that holds the number of fields that `awk` has found in the input line. If the number of fields is not equal to three, then I print the whole line (`$0`). I then look at the output to see what the exceptions are and quickly see the embedded spaces in the five or so lines that are output.

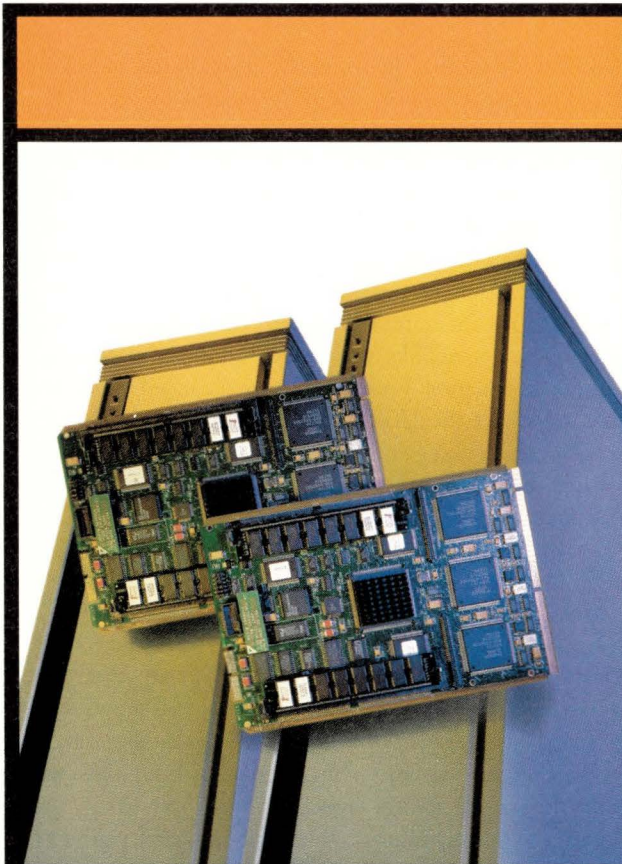
However, because the extra spaces are only in column one of the log, I can use an alternative procedure to obtain the last column. The easiest way to pick off the last column in a file is to use

```
$ awk '{print $NF}' log
```

Because the `NF` variable is set to the number of fields on the input line, `$NF` will pick off the last column on each line. However, things are a little trickier if I want to accurately pick off the first column in the file. The command

```
$ awk '{print $1}' log
```

won't work properly because the data that should be in column one is sometimes spread into two or more columns. It's possible to make `awk` do the right thing by sticking the columns together using a sequence of commands that feed data into the `awk` command.



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However, life is too short and the answers to the questions that I posed above are not materially affected by the slight inaccuracies caused by occasional failure to pick up the complete URL from each line. So my judgment in this case is that using the `$1` selector to pick off the first column is good enough.

The `uniq` Command

Well, having selected the data, what next? I can look at the raw data, but that's tedious. It's better to process it somehow to reduce the amount of information that I need to look through. One obvious way of looking at data with replicated entries is to generate output that omits duplicates. The `uniq` command can do this.

The `uniq` command is designed to output exactly one instance of any lines that are repeated in its input stream, so simply using the raw command as a filter will ensure that we only see each data item once. However, I prefer to see output that contains the data and the number of times that a particular data item is repeated. When `uniq` is supplied with the `-c` switch, it will print a count of each repeated line along with the data. So if we have a data stream like

```
one
two
two
three
three
three
```

then `uniq -c` will print

```
1 one
2 two
3 three
```

counting the frequency that each repeated line occurs. However, to use this counting ability on raw data, we first need to sort the data so that all identical lines are next to each other. We'll type

```
$ awk '{print $NF}' | sort | uniq -c
```

and will see the frequency counts and the data being output. The output from this command line is still not as helpful as it might be, so as a final touch, I will usually pass the data into the `sort` command again. This time I will tell the command to sort numerically on the first field, the count, by supplying the `-n` switch. So, when typing the line above, I'll usually append

```
... | sort -n
```

or

```
... | sort -nr
```

depending on how I want the output to be sorted. The first

variant of the command will sort into ascending numerical order, so the items with the most access frequency will be printed last. I usually prefer the data to be sorted into descending frequency order and use the `r` option to the `sort` command to reverse the order of the sort. It's often true to say that the data of most interest is at the start and the end of the frequency spectrum.

So processing column three of the referrer log to generate a frequency list will answer some of my original questions, the queries about the targets of other people's links. I can also use `grep` to find out about direct links to images from this output, and identify the source of the direct links to images by looking through the original data.

If the visitor came to my pages from a search engine, then the arguments to the search are contained at the end of the URL, after a question mark. This can be helpful. I can deduce what people were looking for in the search engines when they ended up at my pages.

To answer the other questions about the source of links, I'll need to look at column one of the log, the source URL. When looking at column one of the data, it helps to know a little about URL construction. If the visitor came to my pages from a search engine, then the arguments to the search are contained at the end of the URL, after a question mark. This can be helpful. I can deduce what people were looking for in the search engines when they ended up at my pages.

However, if I am examining the first column to deduce the most frequently used links to my pages, I am not interested in the search information, I just want to see the base URL. The trick is to massage the data from the log file before it's passed into `sort`, `uniq` and `sort -n`. Simply deleting any data after a question mark will ensure that only the URL is left from the source data, so I'll type something like

```
$ awk '{print $1}' log | sed -e 's/??.*$//' |
  sort | uniq -c | sort -nr
```

Here, the argument to `sed` deletes all data on any input line that starts at a question mark and extends to the end of the line. Using this preprocess technique to suppress or alter the data, there are various other refinements that I can make to give me the answers to other questions that I may ask.

Using `uniq -c` and `sort` to obtain frequency counts of data is applicable in many situations. It's a common method to reduce information to a form that allows you to appreci-

ate the raw data in a more meaningful way. For example, the `du` command generates two columns of data: a number relating to the disk occupancy of the directory and the name of the directory. You can sort this output using `sort -n` to give yourself a feel for what is happening on the file system. However, beware that the `du` command prints the sizes in kilobytes on SunOS and in 512-byte units on Solaris. The trick here is to use the `-k` switch to `du` on Solaris.

More on sort

If you look at the manual page on your system, you'll find that the `sort` command has several useful switches that can help you look at data in different ways. For example, the `-f` option treats lower- and uppercase letters the same for sorting, and can be helpful if you want to look at a directory using `ls`, placing files of similar names next to each other.

```
$ ls | sort -f
```

This command will revert to the original form of `ls`, giving you one file name per line. If you want a columnar listing, then pass the output from the above command through `pr`, supplying the `-t` option to suppress headers:

```
... | pr -t -6
```

The `-6` will give you six columns. My shell has an environment variable called `COLUMNS` that is set to the number of

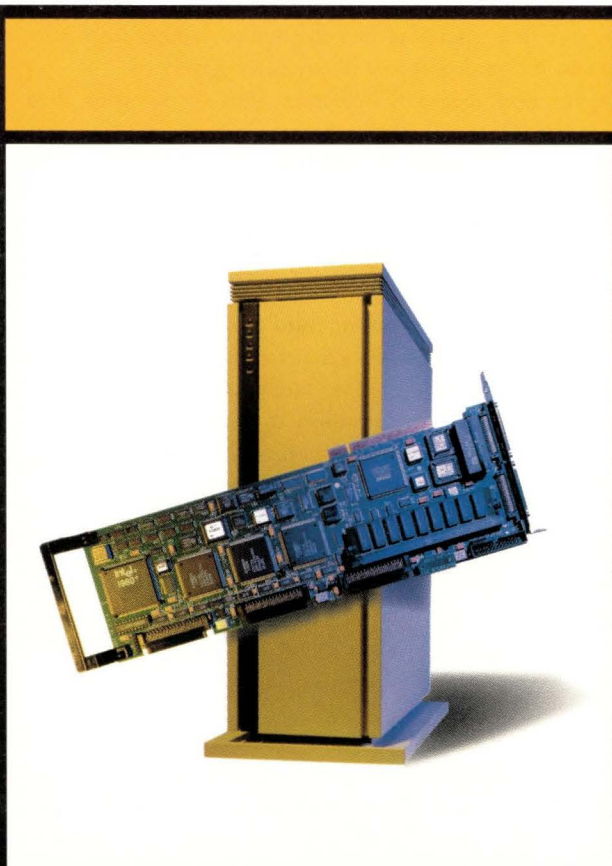
columns in the current window, so

```
... | pr -t -8 -w $COLUMNS
```

will print eight columns across the width of the screen. You do need to be careful of the output from `pr`; it will truncate data that doesn't fit into its precomputed column space, so file names can appear shorter than they are.

Of course, it's harder to sort the output of an `ls -l` command into case-independent name order, because the output lines have all the other file information, such as file permissions, owner identity, size and so on. By default, if you just sling the data from the `ls -l` command into the `sort` program, then the whole line will be used as a key and the output will probably not be what you want. You need to tell the `sort` command to use some part of the input line as the sorting key.

How the user specifies the sorting key is an area that has changed in Solaris from SunOS because, I suspect, the POSIX standard defines some new syntax. The POSIX committee meddled with existing practice, largely because the original method of specifying sort keys was hard to grasp and was prone to error. In fact, there was already some divergence in the System V world from the original specification that was in use in the BSD (and hence the SunOS) world. Also, the original syntax assigned special meaning to arguments starting with `+` and `-`, and the POSIX committee has tried to stamp out these types of



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special meanings in argument introduction characters.

If you look at the output from `ls -l`, you will see that there are nine white-space separated fields. The file name is in the ninth field, and if you wanted to sort the output into case-independent order using the old arguments to `sort`, you would say

```
$ ls -l | sort -f +8 -9
```

You could read this as “use a sort key starting *after* the eighth field and stopping at the end of the ninth field,” i.e., use the ninth field as the primary sort key.

Alternatively, you could start counting the fields from zero, and arrive at number eight for the value for the name field. You can choose how to think about the arguments; the effect is the same.

Had we not given a stopping point for the field, then `sort` would use a sorting key commencing from the starting point and terminating at the end of the line. In the example above, the stopping position is not necessary, but I’ve included it for completeness.

The new specification for `sort` arguments uses the `-k` option followed by a comma-separated range. Also, it starts numbering the fields from one, so

```
$ ls -l | sort -f -k 9,9
```

will start the field at the beginning of the ninth field and finish it at the end of the ninth field. This seems a little more intuitive.

The question then arises about what happens when the fields are identical. This can happen naturally in other data sets and can still be relevant when looking at file names that are guaranteed to be unique. For example, `Fred` is a different file from `fred`, but `sort` will treat the two names as the same when we are using the `-f` option. If you have selected a field and `sort` finds that the fields in two lines are the same, then the default follow-up action is to use the whole line as a sort key to order the two lines.

There are obviously situations where different follow-up actions are needed, and `sort` supplies some further options. The first option is to supply the `-u` argument, suppressing records with identical fields, which allows the `sort` command to take on some of the functionality of the `uniq` command.

If you want to see the replicated data, then the second option is to apply the `sort` modifier just to the field, by putting the magic control letter after the field specification rather than making it apply to all fields by placing it before the `-k` on the command line. We can then provide several different sort criteria for different fields and add multiple field selections:

```
$ ls -l | sort -k 9,9f -k 6,6M
```

Here, we will sort files into case-independent order based on field nine. Then if the names are the same, we will sort based

on field six using month name comparison. The `M` modifier sorts the field by recognizing a three-character month name and sorting into month order. Of course, we can go on adding fields to make a better job of sorting on the date in the `ls` output. Incidentally, the `M` modifier is not standard POSIX.

Field Separators

Field separators have always been a problem for `sort`, and they don’t seem to have been completely rationalized by POSIX. POSIX says that in the default case, field separators are treated as part of the sort key. Therefore, spaces and

tab characters that will appear to be the same white space on the screen will mysteriously sort into what appears to be a strange order.

The folks who wrote the *UNIX Power Tools* book (see Further Reading) came to the conclusion that in the default case you always had one “free” blank character that was not included as part of the field. I

suspect that you need to experiment with your implementation to find out what happens, if the separator behavior seems to be causing problems.

One possible light at the end of the separator tunnel is the `-b` option, which tells the `sort` command to fold multiple occurrences of the separator character into one. The general advice in difficult cases where tabs and spaces are used for separators is to replace all the tabs with spaces and use

```
$ sort -t ' ' -b ...
```

to ensure that separators are collapsed to a single character that is not regarded as part of any sorting field.

If you need to specify byte insets into sorting fields, then this is possible with a further piece of syntax. An offset into a field is given by supplying a number after a period in the key definition field, so

```
$ sort -k 2.3b,2.3b
```

will sort the data based on the third nonblank character of the second field. I do suspect that I am now entering realms of the `sort` command that are rarely used, largely because people don’t know that the ability to do the job is available, and also because it seems hard to prove that the sorting you need is actually being done by the program.

Further Reading

As I have mentioned, there’s a whole section on sorting in *UNIX Power Tools* by Jerry Peek, Tim O’Reilly and Mike Loukides et al. It’s published by O’Reilly & Associates (ISBN 0-553-35402-7). ➔

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@cpq.com.

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World Domination

Most of us are inundated with announcements for talks, seminars, conferences and trade shows. My own case may be a bit extreme, due to my proximity to Silicon Valley and my efforts as a trade journalist. Of course, many of these events aren't all that enticing. Some are of questionable quality; some are related to areas of marginal interest. A large remainder, however, looks worthwhile and interesting, but (alas) unreachable due to location, cost or time constraints. In short, we all hear about far more events than we could possibly attend; the trick is to make the best choices.

One of my favorites, the USENIX Conference, has gotten a miss for the last couple of years. The usual excuses applied, but I still regretted missing it. Consequently, I am pleased that I was able to attend the 1997 USENIX Annual Technical and USELINUX Conference in Anaheim, CA, in January.

USENIX Conference

USENIX isn't a gigantic organization. The Annual Technical Conference and the LISA (Large Installation Systems Administration) Conference both attracted about 1,500 attendees (up 25% on the last two years). The topic-specific workshops (electronic commerce, object-oriented programming, etc.) are designed to be much smaller. The high quality of the talks more than makes up for any lack of size. The Birds of a Feather meetings, Guru-Is-In sessions and informal conversations are also valuable sources of information.

At the conference, I heard James Gosling (Sun's lead engineer and key architect for Java) and Rob Pike (a principal developer of Lucent Technologies' Inferno) give somewhat disparate views on network-oriented language design. Bell Labs' Bill Cheswick gave a delightful talk on "Stupid Web Tricks," sharing some Internet security holes and performance issues that may show up in the mass media one of these days, along with some fun things to do—and avoid doing—with Web browsers. UNIX notables such as Ken Arnold, Keith Bostic, Andrew Hume, Mike Karels, Sam Leffler, Kirk McKusick, Dennis Ritchie, Henry Spencer and Larry Wall sat in the audience for these talks (and chatted in the corridors during the breaks). Pretty heady stuff for a techno-groupie like me.

If you are interested in the future of open computing systems, you owe it to yourself to join USENIX, get copies of its



proceedings and newsletter, and attend the occasional conference or workshop. For more information, contact USENIX via email to office@usenix.org or via the Web at <http://www.usenix.org> (tell them Rich sent you :-).

A Brief History

As a small, but relevant, digression, I would like to acquaint you with some of my own peculiar views on the history of UNIX. For the purposes of discussion, I will divide this into three overlapping epochs. The first epoch (research) began in the late '60s and ran into the late '70s. During the first part of this period, UNIX use was restricted to the confines of Bell Laboratories in Murray Hill, NJ. Over time, it spread to other laboratories and educational institutions.

As I understand it, this period was characterized by a spirit of free and open cooperation. Members of the UNIX community passed ideas (and source code) back and forth at the drop of an email message, and life was good.

The second epoch (deployment) began in the early '80s. Sun Microsystems, for instance, made its debut at the Boston

USENIX Conference in 1982. Although the Sun booth was the highlight of the show, it was a far cry from the company's present-day extravaganzas. Instead, it was a small booth featuring a prototype workstation. Sun co-founder Bill Joy and company scurried back and forth, trying to get everything working, pass out photocopied literature and answer questions.

At that trade show, talks were given by many of the notables mentioned above. Most of these had to do with ways of improving kernel features or performance. Detailed questions were commonly answered with an admonition to "read the source code." By and large, this advice was given with helpful intent. Any hint of a patronizing attitude lay in the RTFM-like use of the source code as a screening process: If a newbie wasn't willing to study the code, he obviously wasn't worth much of the hacker's time.

As a nonaffiliated UNIX user, however, I had no access to the fabled source code, so the advice was more annoying than useful. Even if the hacker was sympathetic to my situation, there was little he could do about it, so useful interchange tended to die off at that point.

With the growth of the commercial UNIX industry, access to source code became even less common. Many commercial vendors considered their additions and modifications to be proprietary, so even the folks from universities and research laboratories started to feel "out of the loop." Generally, most UNIX systems were being sold with binary-only licenses.

These changes had a predictable effect on the flow of com-

munication. Lacking access to the source code, new users turned to books and magazines. Without freedom to exchange source code, many programmers became isolated from their peers at other companies. The USENIX conferences helped, of course, but far too many talks concerned developments for which the source code was "not presently available."

Recently, however, I have started seeing signs of a third epoch (freeware). In this epoch, we have returned to the free and open sharing of ideas and technology, but, this time, everybody gets to play! There are still a number of commercial products, to be sure, but there are also entire operating systems and suites of tools freely available for inspection, modification and even (gasp!) productive use.

Some of this use has to be hidden from corporate executives and lawyers ("Freeware? On *our* computers?"), but it is definitely taking place. With increasing frequency, programmers are able to present convincing arguments for freeware-based solutions. If your company needs to install a few thousand inventory-control systems, then commercial UNIX licenses could add millions of dollars to the cost. If you can propose a way to save this money and, at the same time, have complete control of the source code, you might just get your company to buy in.

Although early versions of freeware operating systems were limited to Intel-based hardware, Linux and some others are now available for Apple, DEC, Sun and other platforms. In fact, some companies are finding out that the highly efficient Linux kernel has a way of rejuvenating their older machines.

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USELINUX

The growth of the freeware community is not lost on the USENIX Association. At this year's conference, a parallel set of tracks was set up for Linux-related topics. This allowed Linux and UNIX devotees to hear about each others' activities and exchange ideas and opinions. I hope that the experiment is repeated in some form at future events.

The Linux community is developing its own notables, many of whom were in attendance. This gave me an opportunity to chat with Jon "maddog" Hall, Phil Hughes, Adam Richter, Ted T'so and many other Linux enthusiasts. All of us, of course, attended Linus Torvalds' talk on the future of Linux.

Torvalds' goal for Linux is very simple: World Domination. Although he presents this objective with a smile, he is quite serious about building up the system until it can be a viable alternative to Windows NT, etc. He spoke about issues like binary compatibility modes, technical support and user interfaces. Linux may have started as a late-night hack, but Torvald has his eyes on long-term possibilities.

I find the social phenomenon of Linux far more interesting than the exact kernel technology being used. A few years ago, Bill Joy said something like, "I don't know what UNIX will look like in 10 years, but it will be called System V." I suspect a similar situation is developing in the freeware community.

The Linux kernel is solid, efficient and increasingly capable. The Linux community is doing the hard work that is needed to meet the assorted POSIX standards, as well as implementing new developments such as IPv6 (often long

before they are put into commercial systems).

The GNU Project's General Public License allows Linux to import university-licensed and public-domain code, so Linux tends to absorb useful code from the rest of the freeware community. What's more, Linux has a large, enthusiastic and very cooperative band of developers, technical writers and users.

Most of the technology in Linux, however, lies above the kernel. The command set is largely drawn from the BSD, GNU and X11 communities. If I were to place these same tools on the Hurd or a BSD-based kernel, you would be hard-pressed to detect any differences. Apple's Mach-based MkLinux system is, in fact, indistinguishable from a vanilla Linux system, save that it runs on a Power Macintosh.

So even if your computer in 2005 is called a "Linux" system, it may not run anything like today's Linux kernel. On the other hand, as long as it works well and remains true to the spirit of free and open interchange, I don't imagine you'll be very concerned. And, by retaining that spirit, it will continue to attract and inspire the kinds of programmers that created (and continue to develop) the UNIX system. ➔

Richard Morin operates Prime Time Freeware (ptf@cfc1.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@cfc1.com.

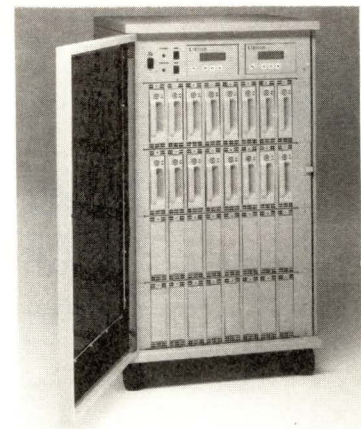
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Ignoring your Kernel

Question: In 25 words or less, how do you tune your kernel in Solaris 2.x?

Answer: Don't bother.

In most cases, there is little you need to do, little you can do, to improve performance on your system by fiddling with kernel parameters. Because the kernel is now dynamically linked at runtime, there is no configuration file to edit and compile. And because the kernel is divided into a core image file and modules it loads as needed, there's no longer any need to pare down an overkill "generic" kernel to get one that is as small and efficient as possible. Instead, there are a number of configuration parameters you can change in the `/etc/system` file, but even these are limited in scope.

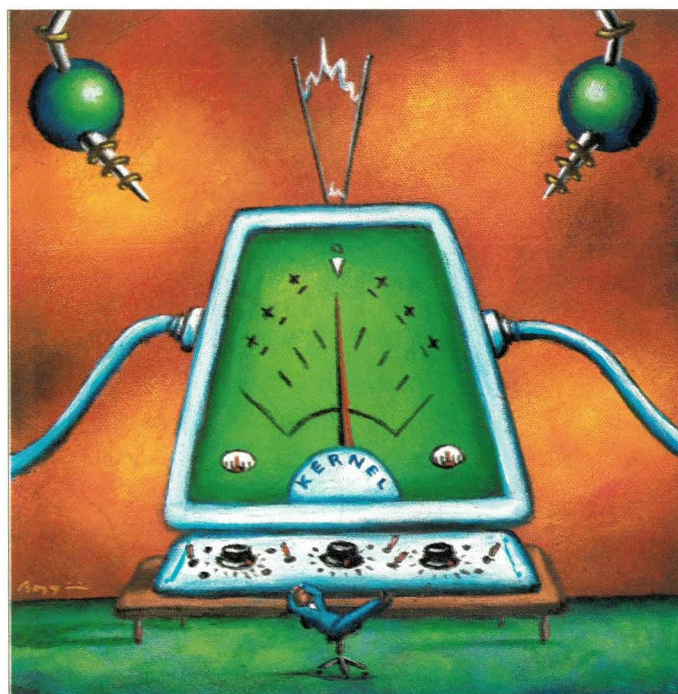
Most of the system tables we worried about in our SunOS days are now dynamically, rather than statically, allocated. Whereas in SunOS, the size of the tables was fixed at kernel compilation time, in Solaris, space for the tables is initially allocated at boot time but can continue to grow until the maximum (specified) size is reached.

As in SunOS, the most frequently altered parameter is `maxusers`, which continues to be the value from which many other parameters are derived (e.g., the size of the process table, which limits the number of running processes). Generally related to the amount of memory on the system, `maxusers` will likely be set to 8, 16, 32 or 40. The default is likely to be reasonable, but if you have a system that runs out of process space often (e.g., if it has very little memory), it's probably a good idea to increase the value and reboot the system with `boot -r` so that the new value takes effect.

Another value you might want to consider changing is `pt_cnt`, which sets the number of pseudo terminals. This is especially true if you are running a lot of X terminal sessions.

You can sometimes improve performance fairly dramatically by increasing the amount of swap space, even though the amount of swap most appropriate in Solaris 2.x is no longer tied proportionally to the amount of RAM in the system. In fact, you could run without any swap at all, given adequate memory. For those of us (like me!) who aren't quite so bold, going with at least 64 MB of swap is probably a good bet.

It is also possible to increase the amount of swap space on the fly. By using the `mkfile` and `swap` commands, you can



create a file of a specified size and use it in addition to the existing swap. The command

```
mkfile 40m /apps/swap
```

would create a file that is 40 MB in size. The command

```
/usr/sbin/swap -a /apps/swap
```

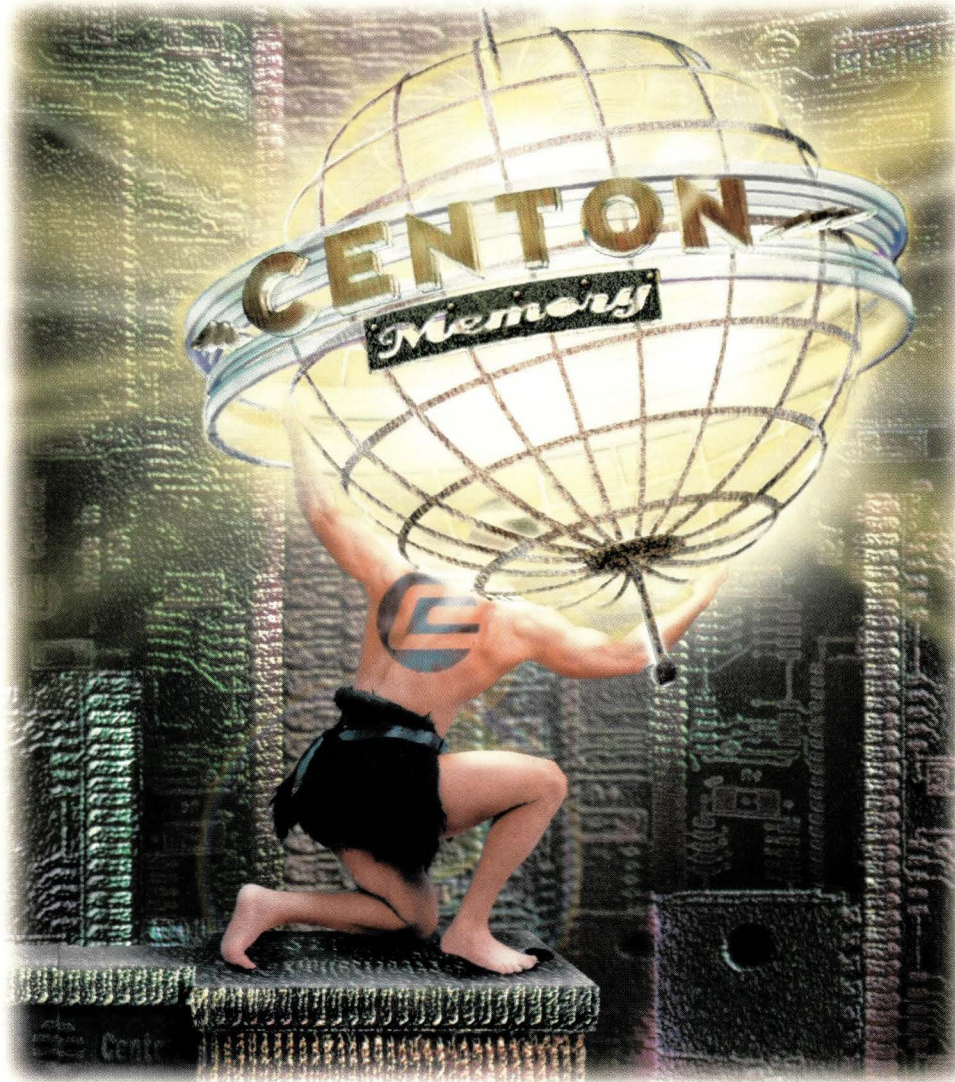
would add this file to the active swap space. You can then verify the overall swap space in use with the command

```
/usr/sbin/swap -s
```

Because you'll very likely want to make this additional swap space permanently available, you will also want to add it to the `/etc/vfstab` file as shown here:

```
/apps/swap -- swap - no -
```

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Monitoring System Performance

Now that you're spending less time tuning your kernel (and so you don't think me an anarchist for dissuading you from the venerable art of kernel tuning), let's take a look at some of the things you can do to monitor performance.

With system commands and a few useful add-on tools, you can get a good handle on what's happening with your system and pinpoint where bottlenecks might be occurring.

If a lot of processes are waiting for time on the CPU, system response in general is going to be slow. One way to monitor CPU activity is with the `sar` command. For example,

```
sar -q 1 10
SunOS chaos 5.5 Generic sun4c 01/27/97
16:27:11 runq-sz %runocc swpz-sz %swpocc
16:27:13      1.0      91
```

This command reports the average queue length as well as the percentage of time that X is occupied. `runq-sz` and `%runocc` report on the processes in memory and runnable processes. The fields `swpq-sz` and `%swpocc` are no longer reported by `sar`.

The `vmstat` command will also reveal a lot of detail about the activity of your CPU. Try using `procs r` and `procs b` to determine whether processes are waiting on the CPU or on I/O (disk or terminal). Processes waiting for I/O might simply be waiting for responses from your users. Imagine suggesting to your management that one way to improve system perfor-

mance might be to replace your users with faster typists! Just don't mention that you got the idea from this column.

One of my favorite tools for monitoring performance is the `top` utility, which provides an extremely useful glimpse into the top running processes as well as the run queue (processes waiting to be run).

The amount of actual memory that you have on a system might make a dramatic difference in performance. After all, the more memory you have, the more data might be available without having to fetch it from the disks, which are much slower than memory. Adding memory can make order of magnitude differences in the performance of a system.

Generally, it is a good idea to configure systems with a generous amount of memory from the start. Adding memory somewhere down the line is almost always harder to do than purchasing it with the system. Preferably, memory use will not be so high as to make its use inefficient. Use the `sar -g 10 2` command to take a look at how full your memory is. If less than 10% of your available memory is free when you examine it, you might consider adding more.

The command `vmstat 5` is also very useful. The `sr` column tells you how busy the page daemon is. If the number is higher than about 20 page operations per second, additional memory will improve performance quite a bit.

Disks, in spite of other throughput improvements or maybe because of them, tend to be the system components most likely to be responsible for sluggish performance, especially on systems with many active users. The command

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`iostat -x 30` will tell you how long disks are taking to service requests for data.

When analyzing the performance of any system, don't forget to consider the effect of network performance. If a system is waiting for long periods of time to access files that are Network File System-mounted from elsewhere on the network, the performance may have less to do with the configuration and peripherals of the system itself, but more to do with performance of the system where the accessed files are stored or on the network that the data has to traverse.

NFS performance is, by its nature, considerably slower than local disk access. After all, it is composed of disk accesses and network transmissions. Some estimates say that runtimes of processes using files accessed via NFS can increase as much as five times over the same processes running against local files. Minimizing file accesses via NFS by storing data on local disks rather than file servers, however, generally lessens the manageability of the overall network. This trade-off must be considered carefully before distributing files to make them "closer" to the users.

Keep in mind that NFS servers do not generally need to have vast amounts of memory because the client UNIX systems will cache files that they use often. Also, if you can export file systems read-only, you will avoid some of the overhead of NFS by not requiring the write-back times. NFS performs fairly well with read operations but is often poor in performing writes.

Depending on what version of Solaris you are running,

you may be using NFS Version 2 or NFS Version 3. An NFS Version 2 server will not send an acknowledgment back to a client until all the data have been written to disk; this adds a delay in the write operation that is not incurred if programs write to local disks rather than to the file systems that are mounted from the file server. NFS Version 3 servers, on the other hand, will cache client write requests until the client requests the write from memory to disk, improving the performance of client write operations.

Wrapping Up

Analyzing and monitoring the performance of your system has always been an art simply because there are so many things to consider, many of which impact one another. In addition, any time one component of a system undergoes a significant improvement in performance, other components stand the risk of being the next bottleneck. Then add to that the impact that changes in each version of the operating system have on which operations are most efficient and which are most costly. Managing system performance will require even the most adept systems administrator to keep on top of many issues that contribute to overall performance. ➔

S. Lee Henry is on the board of directors of the Sun User Group and is a UNIX and networking consultant for TASC, Reston, VA. She is also a part-time adjunct professor in Electrical Engineering for Virginia Tech.

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UNIX-VERSE

by Paul Korzeniowski

Sun Microsystems Inc. has long been at the forefront of networking innovations. That position, and the reputation that goes with it, has served the company well, especially as customer interest has shifted to the Internet during the past few years. The firm's SPARC and UltraSPARC systems have emerged as popular intranet and Internet servers.

Sun's position seems secure in the short term, because shifts in customer interest play to the strengths of the company's servers. Recently, corporations have begun to move mission-critical, daily business applications from proprietary computer platforms to Internet solutions. Because of the change, features such as reliability, scalability and security are becoming more important to potential buyers. According to users, Sun's products are stronger in these areas than competitors' platforms—especially PC servers.

But any hold on a top position in the Internet server space is tenuous because this area is so new, and just about every hardware vendor has made Internet development a top priority. With competition increasing, Sun's ability to differentiate its

products will become more difficult, but the company has a strong foundation on which to build.

Good fortune as well as market acumen have helped Sun achieve its lofty standing. Historically, the company has fared well among users interested in UNIX, and this group has led the charge into the Internet.

Grassroots Campaign

Santa Clara, CA-based National Semiconductor Inc.'s experience provides a good illustration of how Internet usage has sprouted. "Intranet acceptance swelled from the bottom up, not from the top down," says Mary Holland, the manager of library technology at the semiconductor supplier.

The library had been on the lookout for software that would enable users to more easily share information stored on different types of computers. The task had always been difficult because information was tied to specific operating systems and network protocols. In 1994, the department started to pass around shareware copies of the Mosaic user interface and the Hypertext Markup Language (HTML), which had both sprung from the UNIX community. The department worked with a Sun server because software developers focused first on that platform and later on other variations of UNIX.

Holland's group provided space on its server for other departments to place their Web pages, and hundreds now run off of its server. After testing Internet concepts, departments installed their own World Wide Web

servers by simply porting their software to another Sun system. Another plus for Sun was many of National Semiconductor's engineers had already worked with Sun servers and were comfortable with them.

The shareware was enticing because it was free, but it required that users become responsible for support and enhancements. As the number of Internet users grew, National Semiconductor decided to move from Mosaic to Navigator, a commercial browser from Netscape Communications Corp., Mountain View, CA.

Glenn Newell, a senior engineering manager for intranet technology at National Semiconductor, says the company next decided to standardize on common Web server software. National Semiconductor examined its options and selected Netscape's SuiteSpot product line.

Now the semiconductor supplier has approximately 180 servers running hundreds of applications on a variety of hardware platforms. Departments have designed applications such as shared calendars that make it simpler to schedule group meetings. Employees have also built a system that tracks how much labor is deployed for different projects.

The company would like to push

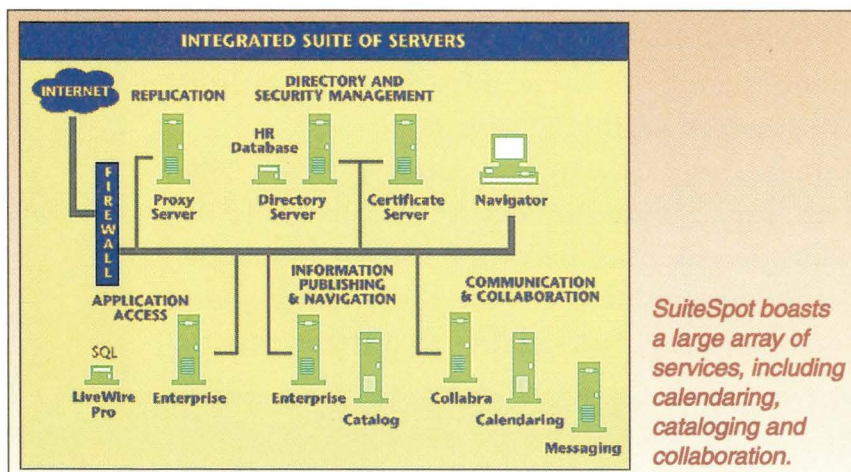
TravelWeb chose a SPARCstation server and standardized on Netscape's SuiteSpot server software line for its Web site.

daily business applications off IBM mainframes to an Internet infrastructure. "Internet technology has gone as far as it can as a grassroots movement; now we have to put more structure in place so we can push it to support more daily business applications," Newell says.

As companies attempt such a transformation, a need for standards emerges. Initially, companies develop Internet applications in a willy-nilly fashion, and departments run applications on a variety of computers. Maintenance becomes a problem because central technicians need to know how to troubleshoot many systems. Organizations are trying to bring order to the chaos by narrowing the number of supported hardware platforms.

Westinghouse Electric Corp., Pittsburgh, PA, plans to follow such a course. In 1994, its engineers became the first employees to deploy Web servers. They designed applications to share engineering documents or access information, such as engineering specifications and regulations. Gary Ellis, manager of engineering information technology at Westinghouse, says Sun SPARCstations are popular among the company's engineers and became the foundation for many applications.

At first, the groups worked with the Mosaic user interface but then moved to Netscape's Navigator browser.



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Westinghouse was so impressed with the software that the firm began using Netscape's SuiteSpot product line for its server software.

The conglomerate has put up three types of applications, which are accessed by approximately 8,000 users. The first application posts internal information, such as dates and times for training sessions; the second supports internal business, such as engineering data flowing from one department to another (a select group of outside customers, such as the firm's refrigeration dealers and distributors, have access to this information); and the third helps market products and services to potential customers.

The number and variety of servers have grown. In addition to Sun SPARC-stations, Westinghouse runs Web applications on Hewlett-Packard Co. HP-UX servers, IBM AIX workstations and PCs running the Microsoft Corp. Windows NT operating system.

Ellis says Westinghouse plans to standardize its server hardware to ease maintenance. The company expects to select either IBM or Sun UNIX systems for complex applications and PCs running Windows NT for department applications.

Making it onto the Web

The first Internet application in many companies is often a simple, static system that enables employees to access common information, such as human resources data. If these applications are successful, corporations build more dynamic, daily business systems on the Internet.

For example, TravelWeb Inc., Dallas, TX, provides networking services to airlines and hotels and has been at the forefront of Internet application deployment. In 1994, the company wanted to place information such as hotel names and telephone numbers on a Web server so that customers could access them.

In order to do this, the company had to select a computer platform. "We found that new Internet software was coming out first on Sun systems and then ported to other systems," says Trae Chancellor, director of tech-

nical services at TravelWeb. Thus, the company purchased a SPARC-station server and downloaded shareware software.

Customer response was positive, so in the summer of 1995, the company looked at building sophisticated applications, such as on-line billing systems, on Web servers. The firm wanted to choose the best possible servers and examined products from Digital Equipment Corp., HP, Pyramid Technology Corp. and Sun. Chancellor says the Sun system seemed more reliable and offered better performance than competing offerings. On the software side, TravelWeb standardized on Netscape's SuiteSpot server software line. Business has been so brisk that the number of servers has grown from one to five.

But keeping pace with customer demand has been a challenge. "Customers can access a server whenever they want, so our traffic patterns can vary wildly," Chancellor says. "We can go through a slow time, and then there will be a dramatic uptick. Gauging our future hardware needs has proven to be quite difficult."

Historically, performance monitoring has been associated with complex mainframes, which are expected to be available seven days a week, 24 hours a day. Gradually, corporations are seek-

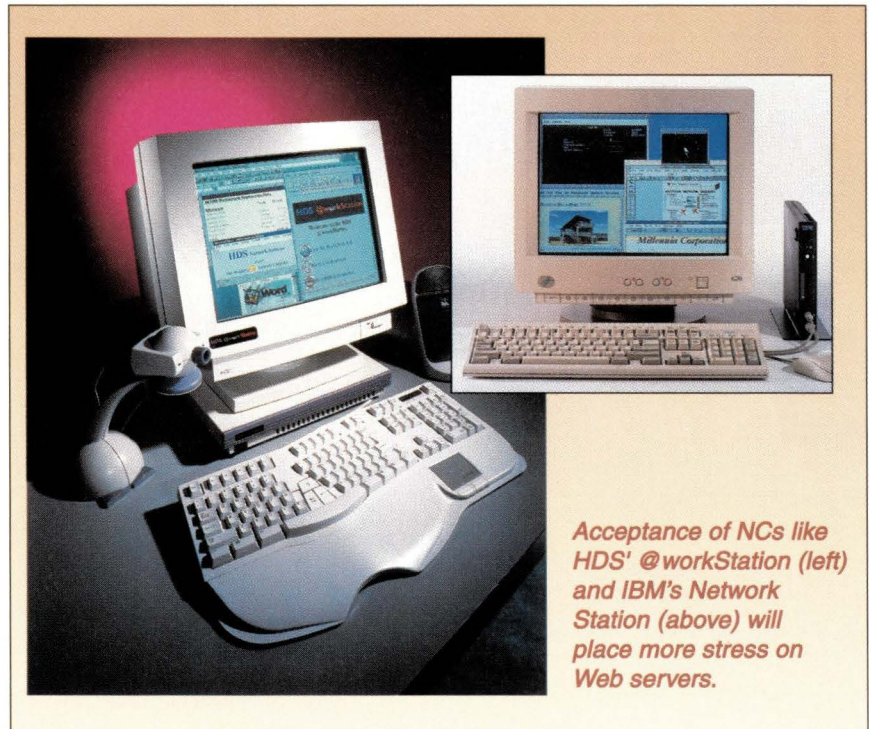
ing the same level of consistency from their Web servers. Monitoring dozens of servers spread throughout an organization is difficult. To ease maintenance, corporations are moving servers from departments to central locations, which have begun to resemble traditional data centers.

As part of this transformation, scalability is becoming an important consideration for a few reasons. Because of the popularity of intranets, the amount of information stored on Web servers and the number of persons accessing them has been increasing quickly. Many organizations now have servers that can handle millions of server hits per day.

Clients on a Diet

The numbers should continue to grow. Vendors have begun promoting a new computing paradigm called the Network Computer (NC). If it is accepted, Web server processing loads could grow significantly during the next few years. Currently, most computing tasks are performed on desktop machines, and servers are used only for complex tasks. NCs should alter the workload.

IBM, Netscape, Oracle Corp. and Sun have all been promoting NCs, which have low prices, selling at between \$500 to \$750. These systems,



Acceptance of NCs like HDS' @workStation (left) and IBM's Network Station (above) will place more stress on Web servers.

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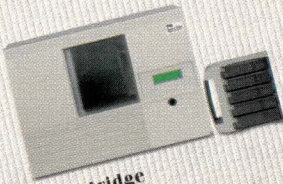
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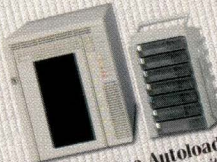
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Q2 Libraries—Desktop, desk-side, or rackmount versions hold 15 cartridges and 1 or 2 drives.

which remove the CD-ROM, hard disk and floppy disk drives from desktop devices, are referred to as "thin clients" because they place few processing functions on client systems and, instead, rely on Web servers to deliver services to users.

Customer interest is high because corporations think the new model can relieve them of tedious programming chores. Typically, programmers have to be concerned with operating system and network infrastructure idiosyncrasies. Building an intranet application is simpler because a browser isolates programmers from those differences. A programmer can work with one interface and develop an application that runs on Apple Computer Inc. Macintoshes; PCs running IBM's OS/2 or Microsoft's many variations of Windows; and UNIX systems from DEC, HP, IBM and Sun.

NCs offer other benefits. They are well suited to applications that require a high degree of security. Because no software is stored locally, a hacker cannot walk up to a computer, copy information and then walk out the front door with it. Because no passwords are transmitted between server and client sys-

tems, an intruder cannot intercept and use them to gain network access.

Maintenance chores are also simplified. NC desktop software is much easier to operate than full operating systems, such as Microsoft's Windows NT and Windows 95. NC hardware is also easier to oversee. If a PC breaks down, a company usually has to send a technician out to fix it. With NCs, only one central service needs to be up and running.

NC acceptance will place more stress on Web servers. If a client gets thinner, then a server gets fatter and will need more processing power. Sun's servers are in a strong position to take on more work. While a Sun system can scale to operate with up to 64 microprocessors (see News), PC servers max out far below that.

Customers have discovered that Sun systems have the scalability to support even the most complex Internet applications. In 1995, Infoseek Corp., a Santa Clara, CA-based company providing tools to surf the Web, needed a hardware platform to support its services and selected Sun SPARC and UltraSPARC servers.

Steve Kirsh, Infoseek's chairman,

says the company was impressed with Sun's disk storage capabilities and spent several months benchmarking Sun's RAID system against systems from specialists such as Seagate Technology Inc., Scotts Valley, CA. Infoseek completed a random 8-KB read test that achieved more than 100 disk I/O per second on each physical drive on a Sun system, and the results were higher than the alternatives.

Another appealing feature was that the disks, fans and power supplies are redundant and work with full-duplex Fibre Channel interface and the dual Fibre Channel interface cards. Infoseek's business has expanded, so the company now has 400 GB of RAID storage.

The number of servers grew from a couple in 1995 to approximately 25 by the end of 1996. Kirsh found the Sun systems offer robust performance. Infoseek's Ultraseek search service runs on an UltraSPARC with eight CPUs and 2 GB of RAM. A single CPU can download and digest about 10 Web pages a second, so the eight-CPU system can handle about 8 million Web pages per day.

Yet the company is not close to maxing out the Sun systems. The

Companies Mentioned in this Article

Apple Computer Inc.

1 Infinite Loop
Cupertino, CA 95014
Circle 150

Business Driven Solutions Inc.

1950 Stemmons Freeway
Ste. 2016
Dallas, TX 75207
Circle 151

Digital Equipment Corp.

146 Main St.
Maynard, MA 01754
Circle 152

Hewlett-Packard Co.

3000 Hanover St.
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Circle 153

IBM Corp.

Contact local sales office

Infoseek Corp.

2620 Augustine Drive
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Microsoft Corp.

One Microsoft Way
Redmond, WA 98052
Circle 155

Netscape Communications Corp.

501 E. Middlebrook Road
Mountain View, CA 94043
Circle 156

Oracle Corp.

500 Oracle Pkwy.
Redwood Shores, CA 94065
Circle 157

Pyramid Technology Corp.

3860 N. First St.
San Jose, CA 95134
Circle 158

Seagate Technology Inc.

920 Disc Drive
Scotts Valley, CA
Circle 159

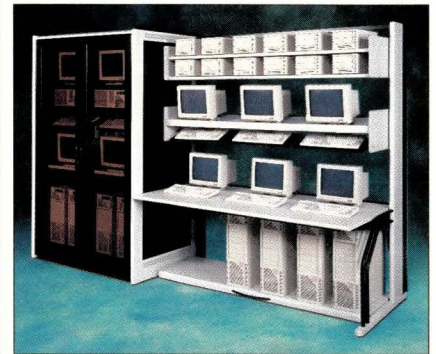
Sun Microsystems Inc.

2550 Garcia Ave.
Mountain View, CA 94943
Circle 160

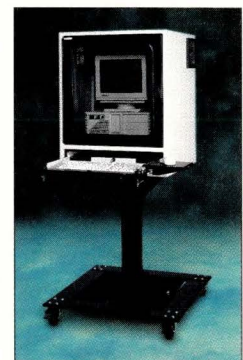
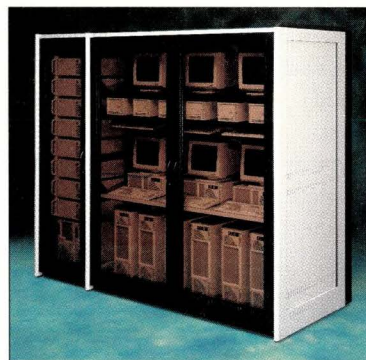
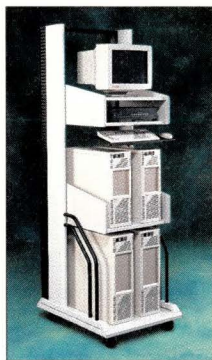
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UltraSPARC can be upgraded to work with 14 CPUs and 14 GB of RAM. "We feel comfortable that the Sun systems will offer sufficient computing power to sustain our business requirements as the company expands in the future," Kirsch says.

Tickets, Please

Scalability was also a key consideration for Business Driven Solutions Inc., a Dallas, TX-based systems integrator that has been in business for 11 years. In the summer of 1995, the company decided to shift its attention to Internet application development. The firm had always worked with large companies building on-line transaction processing systems. So it was not interested in Web page design but wanted to build complex applications.

One project involved working with SportsNet Inc., a Dallas, TX-based start-up that is building a business disseminating sports information over the Internet. Jewel Brenner, president and chief executive officer at Business

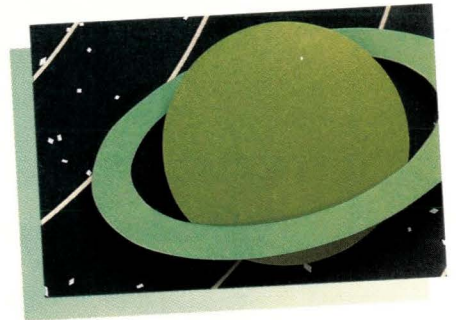
Driven Solutions, says SportsNet needed a computer infrastructure capable of handling 2 million transactions per hour, and each transaction was based on five to seven completed database functions.

Business Driven Solutions examined PC and UNIX servers and selected Sun UltraSPARC systems and Netra software, which includes Netscape's SuiteSpot product line. "We felt the Sun systems were robust enough to support high processing loads," Brenner says. SportsNet went on-line in the fall of 1995 and now has 75,000 Web pages running on its six UltraSPARC servers.

The company crossed the line from running business applications on the Internet to using it for electronic commerce, where customers actually place orders via the Web. Customers pay for basic service and can take advantage of special offers, such as creating their own fantasy football game, with credit cards.

Because of the electronic money

exchange, the firm needed security features initiated at the application level and not at the physical level typically supported by firewalls. SportsNet based its electronic commerce applications on Netscape's Merchant Server. This server software encodes credit card numbers using public key encryption.



tion and transports information via Secure Sockets Layer, a protocol that works at the TCP/IP networking layer and ensures that no one can tap into a data transmission.

When a customer places an order, data packets travel over a private leased line (which is not accessible to outsiders) to a credit card authorization service. The Merchant Server waits for a transaction to be completed and then sends the order off to the appropriate merchant.

SportsNet is at the cutting edge of technology; few companies are currently doing business via the Internet. Eventually, corporations are expected to move from using the Internet to market their products to making it a key component of the sales cycle. Sun has put the pieces in place so its servers can support these applications.

But there will be challengers. "Sun will have to match PC suppliers' price/performance ratios," says Ted Julien, an industry analyst with International Data Corp., a Framingham, MA-based market research firm. "To date, the company has done well in the Internet space, but the technology is moving so fast that competitors will have the opportunity to overtake Sun in the future." →

Paul Korzeniowski is a freelance writer based in Sudbury, MA, and specializes in Internet issues. His email address is paulkorzen@aol.com.

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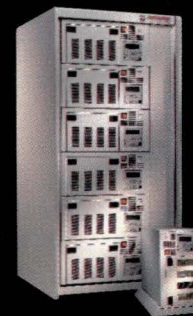
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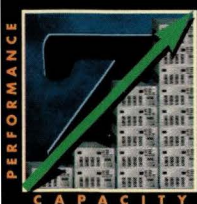
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An Introduction to Firewalls

by Paul Korzeniowski

Security always concerns MIS managers, and many have closely monitored the risks that the Internet presents. Initially, companies were comfortable using routers to control Internet access, but their security features are limited. Routers check IP addresses and make network connections, but they do not determine if a device requesting a connection has the proper authorization. Hackers have designed programs that trick routers into making connections even though end devices do not have proper clearance.

A firewall presents a more sophisticated shield against hackers. All Internet traffic passes through a firewall, although each user does not see the wall. A network administrator establishes security policies so the system determines which users should and should not pass through the network. A handful of small start-up companies have been at the forefront of firewall development.

At first, companies were interested in firewalls for Internet applications, where outsiders accessed corporate data. The threat of an outsider coming in through an Internet gateway and destroying corporate information is obvious, but companies also need to safeguard internal data. More breaks occur from insiders, such as disgruntled or malicious employees, than from outsiders.

Also, companies should be aware of legal ramifications when deploying intranet applications. If a company puts human resources data on a Web server, access to that information may need to be restricted. Companies must also guard against insider trading and may need to block access to sales or manufacturing data.

Firewalls can be deployed in a couple

of ways. Sun Microsystems Inc. bundles firewall software with its Netra Web server software line. In this case, the company supplies users with a complete Internet system so the customer is not forced to take on the role of systems integrator. This approach can also cut costs. A company buys one server, rather than one for its Web applications and a second for its firewall. Management chores are made simpler because the corporation has one less device to oversee.

But stationing firewall and Web server software on one device can create problems. Sun competitors Digital Equipment Corp., Hewlett-Packard Co. and IBM Corp. recommend that companies place firewall software on a separate computer running in front of a Web server. Processing power needed to run the firewall software takes away from the resources available to run Web applications. The server software can become a security hole. A hacker could send out a network probe, the probe would identify the Web server, and the hacker could then use the server to bypass the firewall. In addition, firewall software can limit the amount of functions a Web server can perform, and a company does not want its security system shutting off access to its server.

A firewall offers a line of defense to keep outsiders from accessing a network. Companies are building electronic commerce intranet applications where financial data flows across their networks. Third parties such as Netscape Communications Corp. are building application-level security systems. They support smart cards, devices that generate random passwords, and other authentication systems to ensure that financial information is secure.

(Continued on page 60)

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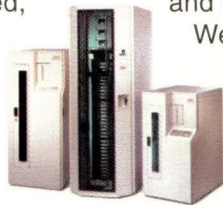


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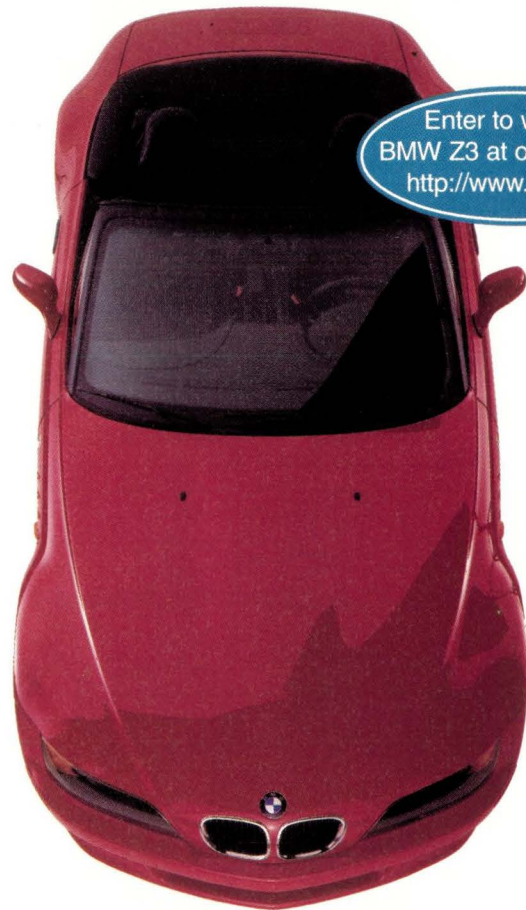
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Firewalls

compiled by MAUREEN MCKEON

KEY

Enet = Ethernet
 TR = Token ring
 VPN = Virtual private network
 PRI = Primary Rate Interface
 NCSA = National Computer Security Association
 IPsec = Internet protocol security (IETF)

	ANS Communications Interlock Service 4.1	AbhiWeb AFS 2000	AltaVista Internet Software Firewall 97	Ascend Secure Access for Pipeline P50-SO-ASA*	Atlantic Systems Group Turnstyle Firewall System V. 3.2
Operating systems supported	Solaris 2.5.1	Proprietary	DEC UNIX, BSD/OS, Windows NT	Hardware based	Solaris, DEC UNIX, HP-UX
Platforms supported	SPARC	SPARC	Intel, Alpha	Ascend Remote Access Switches/Routers	Intel x86, Sun, HP, DEC
Cross-platform support	Yes	No	Yes	Yes	Yes
Network interfaces supported	Enet, Fast Enet, FDDI, TR	10BaseT, ISDN, T1, PPP	Any network card the OS supports	AUI, 10BaseT, SLIP, PPP, IPX, Frame Relay, more	SLIP, 10BaseT, 100-MB Enet, TR
Maximum interfaces supported	2 Enet, 2 Fast Enet, 2 FDDI, 2 TR	1 serial, 2 Enet, 1 WAN, 4-16 port serial remote access	2 network interfaces	1 Enet, 1 WAN	2 Enet
LOGGING:					
Logging of nonfiltered packets	Yes	No	Yes	Yes	Yes
Logging of violations	Yes	No	Yes	Yes	Yes
NOTIFICATION:					
Paging	Yes	No	Yes	No	Yes
Email	Yes	No	Yes	Yes	Yes
SNMP traps	Yes	No	Yes (UNIX only)	No	Yes
REPORTING:					
Reporting tools included	Yes	Yes	Yes	Yes	Yes
Export formats	ASCII, HTML, CSV form	ASCII, HTML	ASCII	UNIX syslog, Windows logging	ASCII
OTHER SERVICES:					
Network address translation	Yes	Yes	Yes	No	No
Timed sessions on port	Yes	No	No	Yes	Yes
Timed security policies	Yes	No	No	Yes	Yes
Virtual encrypted networks	No	No	Yes	Yes	Yes
Encryption schemes available	None	—	RSA, RC4	DES, Triple DES	DES, IDEA, more
AUTHENTICATION:					
Applications supported	UNIX password, Kerberos, FTP, gopher, Telnet, SSL, NTP, more	PAP/CHAP on dial-in	Telnet, SMTP, FTP, HTTP, NNTP, Finger, circuit support for TCP, more	All TCP/IP, FTP, HTTP, Login, more	Telnet, Login, FTP
Time-based user access	Yes	No	Yes	Yes	Yes
Secure ID	Yes	No	Yes	Yes	Yes
FILTERING:					
Ranges of IP addresses	—	Yes	Yes (UNIX only)	Yes	Yes
Ranges of ports	—	Yes	Yes (UNIX only)	Yes	Yes
SESSION TRACKING:					
FTP	Yes	Yes	Yes	Yes	Yes
X11	Yes	No	No	Yes	No
RealAudio	Yes	No	Yes	Yes	Yes
PROTOCOLS FILTERED:					
TCP/IP	Yes	Yes	Yes	Yes	Yes
Novell	No	No	No	Yes	No
DECnet	No	No	No	No	No
AppleTalk	No	No	No	Yes	No
Others	No	—	—	No	—
Automatic filters	No	Yes	Yes	Yes	No
Custom bit offset filters	Yes	No	No	Yes	No
Port scanning detection	Yes	Yes	Yes	Yes	No
Certifications	NCSA	NCSA	NCSA	NCSA	NCSA
Disk space required	1 GB	1 GB	2 GB	—	1 GB
Memory required	1 GB	16 MB	64 MB	—	32 MB
Hardware requirements	SPARC 5	None, proprietary turnkey	2 network interface cards	None, hardware included	None
Secure remote access	Yes	Yes	Yes	Yes	No
VPNs for creating secure "tunnels" over unsecured public networks	No	No	Yes	Yes	Yes
Media delivery format	CD-ROM, Internet delivery	—	CD-ROM	Diskette, FTP downloadable	Diskette, CD-ROM, data tape
Price (\$)	14,800 (software only), 15,900+ (turnkey system)	3,995+	3,995 (50 nodes), 7,995 (200 nodes), 14,995 (unlimited)	500	7,000 (software only), 11,000 (unlimited session)

*Ascend makes a specific firewall for each of its communications products.

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RAID

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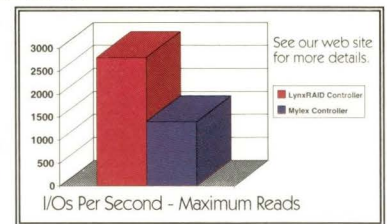
If you need the protection RAID has to offer, but the expense has been holding you back, then Artecon's new desktop LynxStak is your solution. For about the same price as many standard 3.5" drive subsystems, LynxStak gives you all the benefits of RAID. By purchasing the RAID system to fit your needs, you can expand incrementally without the limitations or cost of a pre-configured box. And LynxStak is the only desktop RAID solution that offers the high availability and redundancy once available at the more expensive enterprise level.

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LynxStak gives you the utmost in reliability with features like true hot plug removable disk drives. Independent front-removable power supplies and rear removable cooling fans provide both high availability and easy serviceability. Optional hot plug removable LynxRAID controllers can be configured for dual failover providing you with the extra redundancy needed for mission critical applications. LynxStak supports RAID levels 0, 1, 0+1, 3 or 5 for complete flexibility and optimal performance in your environment.

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Circle No. 6 on Inquiry Card

	BinTec USA Bianc/Brick	CheckPoint Software Technologies Firewall-1	Cisco Systems PIX Firewall	Cyberguard Firewall 3.0	Cylink SecureGate Remote Access Firewall
Operating systems supported	OS-independent	Solaris, SunOS, HP-UX, Windows NT	OS-independent	MLS UNIXware 2.1	Solaris
Platforms supported	Platform-independent	SPARC, HP 9000, Intel Pentium, Intel x86	Cisco-embedded system	IBM, Unisys, ALR, Compaq, HP	Sun SPARC/Solaris, Intel PC/Solaris
Cross-platform support	Yes	Yes	Yes	Yes	Yes
Network interfaces supported	PPP, 10BaseT, TR	Enet, Fast Enet, FDDI, ATM, TR, ISDN, T1, T3	10/100-Mb/s Enet, TR	Enet, Fast Enet, FDDI	10BaseT
Maximum interfaces supported	Up to 4 PRI modules	Firewall unlimited, dependent on hardware platform	2 LAN	8 10BaseT/ 100BaseT	2 Enet
LOGGING:					
Logging of nonfiltered packets	Yes	—	Yes	Yes	—
Logging of violations	Yes	Yes	Yes	Yes	Yes
NOTIFICATION:					
Paging	Yes	Yes	Yes	Yes	No
Email	Yes	Yes	Yes	Yes	No
SNMP traps	Yes	Yes	Yes	Yes	No
REPORTING:					
Reporting tools included	Yes	Yes	Yes	Yes	Yes
Export formats	ASCII	ASCII	ASCII	ASCII	ASCII
OTHER SERVICES:					
Network address translation	Yes	Yes	Yes	Yes	—
Timed sessions on port	Yes	Yes	No	Yes	—
Timed security policies	Yes	Yes	No	Yes	—
Virtual encrypted networks	Yes	Yes	Yes	Yes	Yes
Encryption schemes available	None	DES, RC4, SKIP, Manual IPSec, more	DES	DES, proprietary	DES, Triple DES, proprietary
AUTHENTICATION:					
Applications supported	TCP/IP, Login, FTP, HTTP, more	TCP, UDP, RCP, more	TCP/IP, Login, FTP, HTTP	FTP, Telnet, Gopher, HTTP, SNMP, more	All TCP/IP
Time-based user access	Yes	Yes	No	Yes	No
Secure ID	Yes	Yes	Yes	Yes	No
FILTERING:					
Ranges of IP addresses	Yes	—	Yes	Yes	—
Ranges of ports	—	—	Yes	Yes	—
SESSION TRACKING:					
FTP	Yes	Yes	Yes	Yes	—
X11	Yes	Yes	Yes	Yes	—
RealAudio	Yes	Yes	Yes	Yes	—
PROTOCOLS FILTERED:					
TCP/IP	Yes	Yes	Yes	Yes	Yes
Novell	Yes	Yes	No	No	No
DECnet	No	Yes	No	No	No
AppleTalk	No	Yes	No	No	No
Others	Bridging	—	—	No	—
Automatic filters	Yes	—	Yes	Yes	—
Custom bit offset filters	Yes	—	Yes	No	—
Port scanning detection	Yes	No	No	No	—
Certifications	Contact vendor	—	NCSA, SRI Consulting	NCSA, ITSEC E3	X.509, FIPS140-1, more
Disk space required	None	26 MB	—	2 GB	30 MB
Memory required	None	64 MB	Flash RAM	32 MB	48 MB
Hardware requirements	None	Sun SPARC, HP 9000, Intel x86/Pentium	—	Pentium 166 or faster	1-GB hard disk, 1-4 processors
Secure remote access	Yes	Yes	Yes	Yes	Yes
VPNs for creating secure "tunnels" over unsecured public networks	Yes	Yes	Yes	Yes	No
Media delivery format	CD-ROM	CD-ROM	Diskette, down- loadable via Web	Diskette, CD-ROM, 4mm DAT	CD-ROM
Price (\$)	1,500+, dependent on modules plugged in	4,990 (50 nodes), 9,990 (250 nodes), 18,900 (unlimited)	9,000 (software & hardware)	9,995 (50 users), 14,995 (250 users), 19,995 (unlimited)	6,000-50,000



The Daytona RAIDarray

Storage that gives you peace of mind

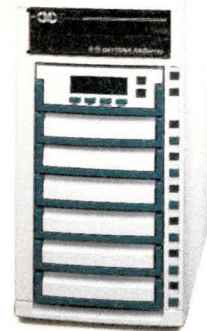
The Daytona RAIDarray is welcome news if storage problems have been weighing on your mind. That's because the Daytona gives you peace of mind both during and after installation. The Daytona takes just thirty minutes to install and is so reliable, once you're up and running, you can forget it's there.

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.

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

- High availability RAID
- Cache memory for performance
- Redundant, fault tolerant power supplies
- Hot swappable spare disks
- Redundant cooling fans
- Operating system independent; no drivers required



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.

In other words, it's storage that will put your mind at ease. Just what you'd expect from CMD, a leader in high performance storage interface and fault tolerant RAID controller technology for PCs and mid-range open system markets. Register to win a Daytona by visiting our web site at www.cmd.com, or calling us at 800-426-3832 or 714-454-0800.



	Global Technology GFX Internet Firewall System	Global Technology GNAT Box	IBM Secure Network Gateway V. 2.2	International Transware InterTalk MP	Karlnet KarlBridge
Operating systems supported	BSD/OS (provided with system)	OS-independent	AIX	MacOS	Solaris, SunOS, HP-UX
Platforms supported	Turnkey Intel Pentium	Intel 80386 Pentium, Windows 95/NT, HTTP	IBM RS/6000	Macintosh	Sun, HP, Intel x86
Cross-platform support	Yes	Yes	No	Yes	Yes
Network interfaces supported	10/100-Mb/s Enet, FDDI, TR, Frame Relay, DDS Lease Line	10/100-Mb/s Enet, FDDI	10BaseT, 100BaseT, TR, FDDI, ATM, Async, ISDN, x.25, S/390 Channel	AUI	10BaseT, 10Base2, AUI
Maximum interfaces supported	10 Enet, 12 Fast Enet, 4 FDDI, 4 TR, 84 WAN (56K), 4 WAN (T1), 4 Frame Relay	3 network interfaces (any combination)	16 Enet	2 Enet	4 Enet
LOGGING:					
Logging of nonfiltered packets	Yes	Yes	Yes	No	Yes
Logging of violations	Yes	Yes	Yes	No	Yes
NOTIFICATION:					
Paging	Yes	No	Yes	No	No
Email	Yes	No	Yes	No	No
SNMP traps	Yes	No	No	No	Yes
REPORTING:					
Reporting tools included	Yes	No	Yes	No	Yes
Export formats	ASCII, Comma Delimited, Tab Delimited, Email, more	Syslog	ASCII	—	ASCII
OTHER SERVICES:					
Network address translation	Yes	Yes	Yes	—	No
Timed sessions on port	Yes	No	No	—	No
Timed security policies	Yes	No	No	—	No
Virtual encrypted networks	No	No	Yes	—	Yes
Encryption schemes available	None	None	DES, CDMF	None	DEC, IDEA, proprietary
AUTHENTICATION:					
Applications supported	Telnet, FTP	None	FTP, Telnet	All TCP/IP, Login, FTP, HTTP, more	Login
Time-based user access	No	No	No	No	No
Secure ID	No	No	Yes	No	No
FILTERING:					
Ranges of IP addresses	Yes	No	Yes	Yes	Yes
Ranges of ports	Yes	No	Yes	Yes	Yes
SESSION TRACKING:					
FTP	Yes	Yes	Yes	No	Yes
X11	Yes	Yes	Yes	No	No
RealAudio	Yes	Yes	Yes	No	No
PROTOCOLS FILTERED:					
TCP/IP	Yes	Yes	Yes	Yes	Yes
Novell	No	No	No	No	Yes
DECnet	No	No	No	Yes	Yes
AppleTalk	No	No	No	Yes	Yes
Others	—	—	—	Bridging	Bridging
Automatic filters	Yes	Yes	Yes	No	No
Custom bit offset filters	No	No	No	No	Yes
Port scanning detection	No	No	Yes	No	Yes
Certifications	NCSA	None	NCSA	None	None
Disk space required	1 GB	None	6 MB	—	—
Memory required	16 MB	8 MB	64 MB	—	1 MB
Hardware requirements	None, turnkey system	386 minimum, 8-MB RAM, 2 network cards, 3 1/2-inch floppy drive	Any IBM RS/6000	Stand-alone router	PC/UNIX machine to do remote configuration
Secure remote access	Yes	No	Yes	Yes	Yes
VPNs for creating secure "tunnels" over unsecured public networks	No	No	Yes	No	Yes
Media delivery format	Shipped installed, backup on DAT	CD-ROM	Diskette, CD-ROM	Diskette	Diskette
Price (\$)	14,000-19,000 (turnkey software & hardware system)	995 (software only for unlimited users)	1,999 (software only for unlimited users)	1,499 (stand-alone node on network)	1,695 (software & hardware) 200 (encryption option)

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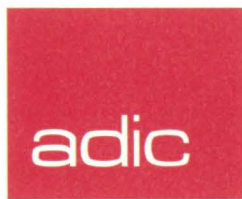
	Livermore Software Portus Secure Firewall Version 2	Micro Computer Inetix	Milkyway Networks Black Hole	NEC Technologies PrivateNet Firewall	Network Engineering Telaxian Shield 3.0
Operating systems supported	Solaris, AIX, HP-UX	Solaris	SunOS, BSDI	BSD/OS (provided with system)	Solaris, Linux
Platforms supported	Sun SPARC, Intel x86, IBM RS/6000, PowerPCs, Apple Network Servers	Sun, Intel x86	Sun, Intel x86	Intel	Sun, Intel x86
Cross-platform support	Yes	Yes	Yes	Yes	Yes
Network interfaces supported	PPP, Enet, Fast Enet, TR, FDDI	PPP, TR, 10BaseT	10Base2, 10BaseT, TR	10BaseT	Any interface using TCP/IP
Maximum interfaces supported	Firewall unlimited, dependent on hardware platform	4 Enet	3-6 Enet (Sun), 4 Enet (x86)	3 Enet	Firewall unlimited, dependent on hardware platform
LOGGING:					
Logging of nonfiltered packets	Yes	Yes	Yes	Yes	Yes
Logging of violations	Yes	Yes	Yes	No	Yes
NOTIFICATION:					
Paging	Yes	No	Yes	No	Yes
Email	Yes	No	Yes	No	Yes
SNMP traps	No	No	No	Yes	No
REPORTING:					
Reporting tools included	Yes	Yes	Yes	No	No
Export formats	ASCII	ASCII, HTML, Common Log	ASCII	ASCII	ASCII
OTHER SERVICES:					
Network address translation	Yes	Yes	Yes	Yes	Yes
Timed sessions on port	Yes	Yes	Yes	Yes	Yes
Timed security policies	Yes	Yes	Yes	No	Yes
Virtual encrypted networks	Yes	No	Yes	Yes	Yes
Encryption schemes available	DES	—	DES, CAST	DES, Triple DES	DES, Triple DES, RSA, Link Encryption
AUTHENTICATION:					
Applications supported	All TCP/IP, including SQL, multiple HTTP	All TCP/IP, including Login, FTP, HTTP	All TCP/IP	Login, FTP	All TCP/IP, including Login, FTP, HTTP
Time-based user access	Yes	Yes	Yes	No	Yes
Secure ID	Yes	No	Yes	Yes	Yes
FILTERING:					
Ranges of IP addresses	—	Yes	Yes	Yes	—
Ranges of ports	—	Yes	No	Yes	—
SESSION TRACKING:					
FTP	Yes	Yes	Yes	Yes	Yes
X11	Yes	No	No	Yes	Yes
RealAudio	Yes	Yes	Yes	Yes	Yes
PROTOCOLS FILTERED:					
TCP/IP	—	No	Yes	Yes	—
Novell	—	Yes	No	No	—
DECnet	—	No	No	No	—
AppleTalk	—	No	No	No	—
Others	—	Bridging	—	—	—
Automatic filters	—	No	Yes	Yes	—
Custom bit offset filters	—	No	No	No	—
Port scanning detection	Yes	No	Yes	No	—
Certifications	NCSA	None	NCSA, EAL-1	NCSA	None
Disk space required	2 GB (for log storage)	2 MB	—	—	1 GB
Memory required	32 MB	200 Bytes/client	—	—	8-16 MB
Hardware requirements	2 network cards minimum	Intel or SPARC	None	All hardware included	2 network interfaces, console for installation
Secure remote access	Yes	No	Yes	Yes	Yes
VPNs for creating secure "tunnels" over unsecured public networks	Yes	No	Yes	Yes	No
Media delivery format	CD-ROM, diskette	Diskette	CD-ROM	CD-ROM	CD-ROM, diskette, downloadable via FTP or WWW
Price (\$)	3,000-10,000 (software only/dependent on number of users)	995-5,995	2,950 (10 users/software only), 20,500 (unlimited users/software only)	3,650 (software & hardware for 50 users)	7,995-11,995 (software only)

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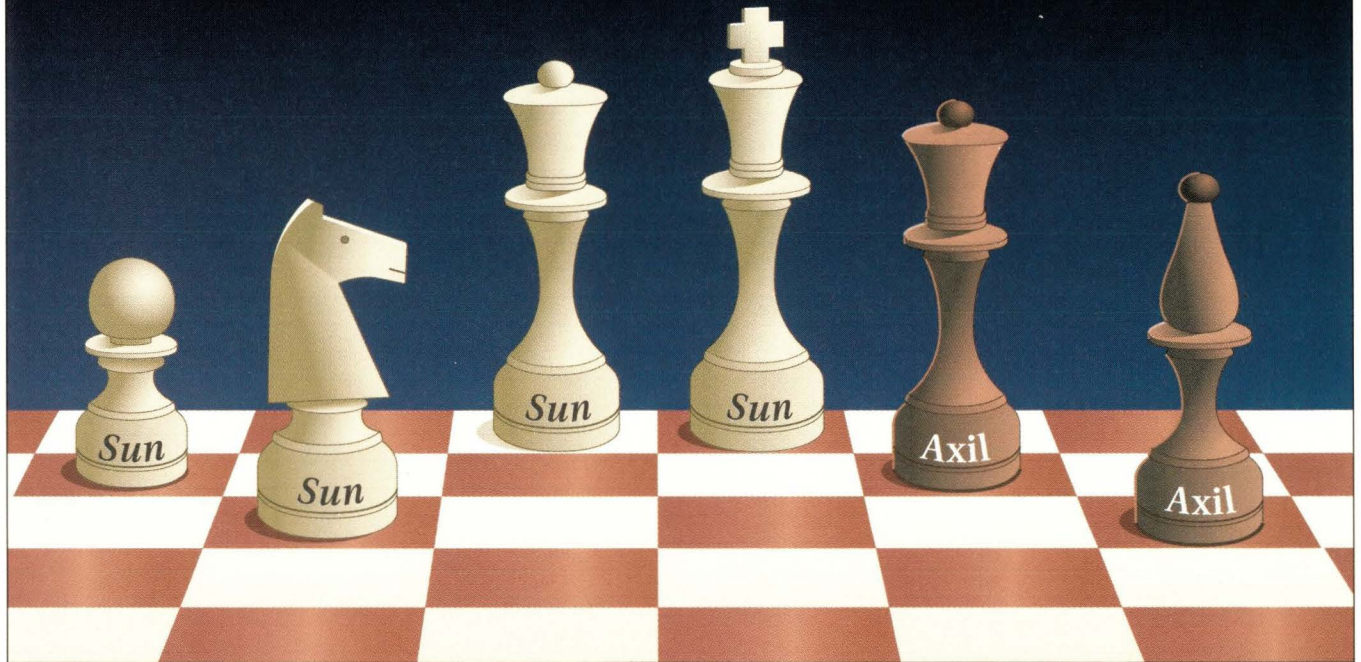
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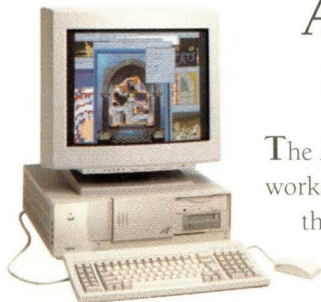
	Network Information UniShield 2.0	ON Technology ON Guard Internet Firewall 2.0	Radguard PyroWall	Radguard CryptoWall	Raptor Systems Eagle 4.0
Operating systems supported	SunOS, Solaris, HP-UX, AIX, IRIX, DEC UNIX, Windows NT	32OS (proprietary)	All (stand-alone hardware)	All (stand-alone hardware)	SunOS, Solaris, HP-UX, Windows NT
Platforms supported	Sun, HP, SGI, IBM, DEC, Pentium PCs	Intel x86	All	All	Sun, HP
Cross-platform support	Yes	No	Yes	Yes	Yes
Network interfaces supported	Any interface using TCP/IP	10BaseT, AUI	10BaseT, AUI, TR	10BaseT, AUI, TR	Serial (T1), TR, 10BaseT, 10Base2, FDDI, Fast Enet, ISDN, Frame Relay
Maximum interfaces supported	—	2 Enet	2 Enet, 2 TR	2 Enet, 2 TR	Unlimited
LOGGING:					
Logging of nonfiltered packets	—	Yes	Yes	Yes	Yes
Logging of violations	—	Yes	Yes	Yes	Yes
NOTIFICATION:					
Paging	Yes	Yes	Yes	Yes	Yes
Email	Yes	Yes	Yes	Yes	Yes
SNMP traps	No	Yes	Yes	Yes	Yes
REPORTING:					
Reporting tools included	Yes	Yes	Yes	Yes	Yes
Export formats	ASCII	Comma separated ASCII (CSU)	ASCII	ASCII	—
OTHER SERVICES:					
Network address translation	—	Yes	Yes	Yes	Yes
Timed sessions on port	—	No	Yes	Yes	Yes
Timed security policies	—	No	Yes	Yes	Yes
Virtual encrypted networks	—	Yes	No	Yes	Yes
Encryption schemes available	—	DES, IPSec	None	DES	DES, more
AUTHENTICATION:					
Applications supported	Login, FTP	—	All TCP/IP	All TCP/IP	TCP/IP, Login, FTP, HTTP, S/Key, more
Time-based user access	Yes	No	Yes	Yes	Yes
Secure ID	Yes	No	Yes	Yes	Yes
FILTERING:					
Ranges of IP addresses	—	Yes	Yes	Yes	Yes
Ranges of ports	—	Yes	Yes	Yes	—
SESSION TRACKING:					
FTP	—	Yes	No	No	Yes
X11	—	Yes	No	No	No
RealAudio	—	Yes	No	No	Yes
PROTOCOLS FILTERED:					
TCP/IP	—	Yes	Yes	Yes	Yes
Novell	—	Yes	No	No	Yes
DECnet	—	Yes	No	No	Yes
AppleTalk	—	Yes	No	No	Yes
Others	—	Bridging	—	No	No
Automatic filters	—	Yes	Yes	Yes	Yes
Custom bit offset filters	—	No	Yes	Yes	Yes
Port scanning detection	—	No	No	No	Yes
Certifications	None	NCSA	NCSA	NCSA	NCSA
Disk space required	16 MB	25 MB	—	—	1 GB
Memory required	16 MB	8 MB	—	—	64 MB
Hardware requirements	—	486/66-MHz PC minimum	None (hardware included)	None (hardware included)	SPARC
Secure remote access	Yes	No	No	Yes	Yes
VPNs for creating secure "tunnels" over unsecured public networks	—	Yes	No	Yes	Yes
Media delivery format	Diskette	Diskette	Hardware	Hardware	—
Price (\$)	Contact vendor	Contact vendor	6,000-13,000	10,000-15,000	7,000 (50 UX nodes), 6,500 (50 NT nodes)

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Circle No. 39 on Inquiry Card

	Seattle Software WatchGuard V. 2.1	Secure Computing Sidewinder Security Server V. 3.1	Secure Computing BorderWare Firewall Server	Sterling Commerce CONNECT: Firewall 2.5	Sun Microsystems Solstice Firewall-1 V. 2.1
Operating systems supported	Hardened Linux kernel	Proprietary OS (based on BSD/OS)	Proprietary OS (based on BSD/OS)	Solaris	Solaris, Windows NT, Windows 95
Platforms supported	Intel x86	Intel x86	Intel x86	Sun	SPARC, Intel x86, Intel
Cross-platform support	Yes	No	Yes	Yes	Yes
Network interfaces supported	10BaseT	Enet, Fast Enet, FDDI	Enet, Fast Enet, TR, FDDI, CSU/DSU	Enet, TR	Enet, 10BaseT, TR, ATM, PPP
Maximum interfaces supported	3	4 Enet, Fast Enet, and/or FDDI	3 of any interface user chooses	Dependent on hardware	32
LOGGING:					
Logging of nonfiltered packets	Yes	Yes	Yes	Yes	Yes
Logging of violations	Yes	Yes	Yes	Yes	Yes
NOTIFICATION:					
Paging	Yes	Yes	No	Yes	Yes
Email	Yes	Yes	Yes	Yes	Yes
SNMP traps	—	Yes	No	No	Yes
REPORTING:					
Reporting tools included	Yes	Yes	Yes	Yes	Yes
Export formats	—	ASCII	ASCII	ASCII	ASCII
OTHER SERVICES:					
Network address translation	Yes	Yes	Yes	Yes	Yes
Timed sessions on port	No	Yes	Yes	No	No
Timed security policies	No	Yes	Yes	No	No
Virtual encrypted networks	No	Yes	Yes	No	Yes
Encryption schemes available	—	DES, RC4	DES, Triple DES, RC4, RC40	DES, S/WAN	DES, SKIP, IPsec
AUTHENTICATION:					
Applications supported	—	Telnet, FTP	FTP, HTTP, PPP, NTP, SMTP, more	FTP, Telnet, HTTP, UDP, NNTP, more	All TCP/IP, UDP
Time-based user access	No	Yes	No	No	Yes
Secure ID	No	Yes	Yes	Yes	Yes
FILTERING:					
Ranges of IP addresses	Yes	Yes	Yes	Yes	Yes
Ranges of ports	Yes	Yes	Yes	Yes	Yes
SESSION TRACKING:					
FTP	Yes	Yes	Yes	Yes	Yes
X11	No	Yes	No	No	Yes
RealAudio	No	Yes	Yes	No	Yes
PROTOCOLS FILTERED:					
TCP/IP	Yes	Yes	Yes	Yes	Yes
Novell	No	No	No	No	No
DECnet	No	No	No	No	No
AppleTalk	No	No	No	No	No
Others	No	No	Bridging	No	No
Automatic filters	Yes	Yes	No	Yes	Yes
Custom bit offset filters	Yes	Yes	No	No	No
Port scanning detection	Yes	Yes	Yes	No	No
Certifications	None	NCSA	NCSA	None	NCSA
Disk space required	—	200 MB	1 GB	1 GB	15 MB
Memory required	—	32 MB	32 MB	32 MB	16 MB
Hardware requirements	None (hardware included)	Intel Pentium, 2 NICs, 2-GB hard drive, DAT, 3 1/2-inch drive, video card	Pentium or Pentium Pro, SCSI adapter, CD-ROM drive, PCI & ISA boards	SPARC w/ CD-ROM	SPARC, x86 supporting Solaris/Intel, Intel supporting NT
Secure remote access	No	Yes	No	No	Yes
VPNs for creating secure "tunnels" over unsecured public networks	No	Yes	Yes	Yes	Yes
Media delivery format	CD-ROM	Diskette, DAT	Diskette, CD-ROM	CD-ROM	CD-ROM
Price (\$)	3,495 (hardware & software)	6,900 (1-100 users), 19,900 (unlimited)	3,000- 13,000	4,500 (software only)	4,995-39,000 (software only)

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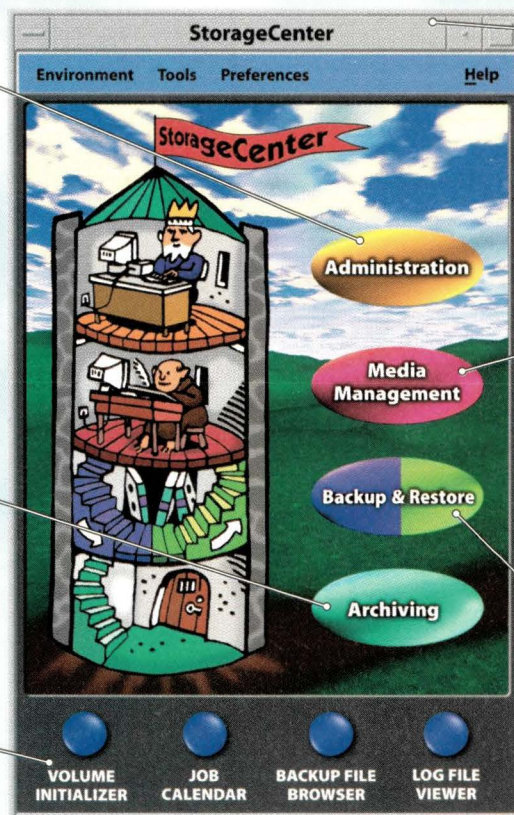
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Cross-platform support	Yes	Yes
Network interfaces supported	PPP, 10BaseT, TR, FDDI	Enet, Fast Enet, TR, FDDI, ATM
Maximum interfaces supported	4 Enet, TR, FDDI, 26 serial	Firewall unlimited, dependent on hardware
LOGGING:		
Logging of nonfiltered packets	No	Yes
Logging of violations	Yes	Yes
NOTIFICATION:		
Paging	Yes	Yes
Email	Yes	Yes
SNMP traps	No	No
REPORTING:		
Reporting tools included	Yes	Yes
Export formats	ASCII	ASCII
OTHER SERVICES:		
Network address translation	No	Yes
Timed sessions on port	Yes	Yes
Timed security policies	Yes	Yes
Virtual encrypted networks	Yes	Yes
Encryption schemes available	DES, CBC	DES
AUTHENTICATION:		
Applications supported	Telnet/rlogin, FTP, HTTP	FTP, Telnet, HTTP, SMTP, NNTP, Gopher
Time-based user access	Yes	Yes
Secure ID	Yes	Yes
FILTERING:		
Ranges of IP addresses	Yes	Yes
Ranges of ports	Yes	Yes
SESSION TRACKING:		
FTP	Yes	Yes
X11	Yes	Yes
RealAudio	Yes	Yes
PROTOCOLS FILTERED:		
TCP/IP	Yes	Yes
Novell	No	No
DECnet	No	No
AppleTalk	No	No
Others	No	Bridging
Automatic filters	No	No
Custom bit offset filters	No	No
Port scanning detection	Yes	Yes
Certifications	NCSA	NCSA, NSA
Disk space required	500 MB	512 MB
Memory required	16 MB	16-32 MB
Hardware requirements	486/66-MHz PC or faster	486/66-MHz PC, SPARC, HP PA-RISC
Secure remote access	Yes	Yes
VPNs for creating secure "tunnels" over unsecured public networks	Yes	Yes
Media delivery format	CD-ROM	Diskette, CD-ROM
Price (\$)	5,995 (50 users), 11,495 (unlimited users)	11,500 (software only) 16,500 (software & hardware)

Late entry: Ukiah Software Inc., 2155 S. Bascom Ave., Ste. 210, Campbell, CA 95008. Contact vendor for product details regarding NetRoad Firewall V. 1.1.

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**Livermore Software
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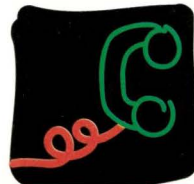
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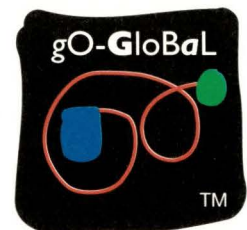


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Distributed NT Wrap-Up

by IAN WESTMACOTT, Technical Editor

Looking to incorporate a multiuser NT server into a UNIX network? If you have client platforms other than Intel Corp. microprocessor-based PCs, then you need to look at WinCenter Pro, NTrigue and WinDD.

Over the past several months, Computer Publishing Lab has been looking at distributed Microsoft Corp. Windows NT desktop products based on the Citrix Systems Inc. WinFrame technology, including Insignia Solutions Inc.'s NTrigue, Network Computing Devices Inc.'s WinCenter Pro and Tektronix Inc.'s WinDD.

Since we last looked at NTrigue and WinCenter Pro, both have had major new versions released. All of these products take the base WinFrame product, add several features, and possibly supply Intelligent Console Architecture (ICA) clients for various platforms. Consequently, these products differ only in price, supported features and performance, while providing essentially the same functionality—that of WinFrame.

With its Windows NT Server product, Microsoft gained a nod from the traditional UNIX client/server community for taking a step in the right direction for PC-based LAN environments. However, there are several basic features many UNIX users consider essential to a network operating system

that are not supported by the Windows NT Server. These include a true multi-user environment and a distributed user interface protocol.

Multiple-user support—that is, multiple *concurrent* interactive user support—in the Windows NT Server

product may seem like a contradiction. The NT Server is, after all, a *personal* computer operating system. There are plenty of users who are hungry for this functionality, however, and Citrix, with its WinFrame product, intends to feed those customers.

WinFrame is based on the Citrix-developed MultiWin technology, which extends the NT Server with true multiuser functionality. This is accomplished by running multiple virtual sessions on the WinFrame/



Access Server. Each virtual session behaves just like a normal NT session, with the familiar desktop, applications and services you would expect. However, several sessions may be running concurrently.

Just like a UNIX server, these sessions may be started in a number of ways: on the actual computer console (the keyboard and monitor attached to the server), over a dial-up serial connection from a client machine, or over a network connection from a client machine. In order to support the latter two connection types, WinFrame incorporates the second Citrix core technology added to the NT Server: the ICA protocol.

The ICA protocol, similarly to the X protocol, allows the user interface of an application to be separated from the execution logic and distributed to remote ICA clients. This allows an application to be run on the NT Server, with its GUI—its window, including menus, scrollbars, etc.—appearing on another machine altogether, perhaps very far away. Just as you might configure a large UNIX server to be used by 50 X terminal clients, you might configure a WinFrame NT server to be used by 50 ICA clients. The key is what might be used as an ICA client.

In the X protocol, an X server manages the display and input of a machine to allow multiple X client applications to access these resources. In contrast, in the ICA protocol, an ICA “server” provides the GUI of multiple applications to an ICA client, which uses the native GUI of the machine to manage display and input. Whereas X requires an X server to run on the remote machine accessing the server, ICA requires an ICA client application to be running on the remote machine accessing the server. Citrix has developed ICA clients for all Windows platforms, OS/2 and a Web browser plug-in. This means you can use just about any Intel Corp. microprocessor-based PC computer as a client.

The combination of Microsoft Windows NT Server and Citrix WinFrame provides multiuser support, dial-up Remote Access Services, access to various other PC LAN operating systems such as Novell Inc. NetWare and Microsoft LAN Manager, Macintosh

print and file services, account and process control, and the ICA protocol. This functionality is available from Citrix with its WinFrame products.

Vendors such as NCD, Insignia Solutions and Tektronix add services, utilities and possibly additional ICA clients to integrate WinFrame technology with a wider set of client machines and other network operating systems, most notably UNIX and X.

There are two approaches to enabling UNIX/X client machines to access a WinFrame NT server. The first is to develop an ICA client for the particular architecture, which requires no modification of the WinFrame server itself. The second is to add X support to the WinFrame server, essentially enabling applications on the server to become X clients and access remote X servers, which doesn't require any



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real modification to the client.

In addition to simple access, various other services may be implemented. Examples include XDMCP, RSH, NFS and various naming services such as NIS and DNS. The XDMCP and RSH services are important if the X protocol is used to access the Win-Frame server, while NFS and naming service support are useful to integrate the server into a UNIX-based LAN environment. The various services and clients supported by WinDD, NTrigue and WinCenter are listed in Table 1.

X vs. ICA

There is much debate over the relative merits of the X protocol versus the ICA protocol for use as a distributed user interface protocol. All three vendors we consider here have performed numerous benchmarks and tests comparing the two protocols and their respective implementations of them in various configurations. To get a handle on these results and understand exactly what is being tested requires an understanding of X and ICA and what they are being used for.

As mentioned, the idea is to separate the application interface from its execution logic, then to take that interface and ship it across a network to another node. In this way, the application is actually executing on one computer, while the user is interacting with it on another computer. Whenever the application produces some kind of output, such as drawing to the screen (which includes displaying menus, scrolling, etc.) or sounding a beep, this must be packaged on the computer running the application and sent to the computer

Table 1. Clients and Features

ICA Clients	UNIX	Macintosh	Intel PC	X Terminal			
Insignia Solutions NTrigue Global 3.0	Optional (2)	Optional (2)	Included	N/A			
NCD WinCenter Pro 3.0	N/A	N/A	Included	N/A			
Tektronix WinDD 3.0	Optional	Optional	Optional	Bundled with X support (1)			
* (1) Tektronix Netstations only (2) Either five UNIX or five Mac clients included							
ICA Clients	X Support	XDMCP	Naming Service Support	RSH Support	NFS Support	BOOT/TFTP/DHCP Support	Client Peripheral Support
Insignia Solutions NTrigue Global 3.0	Included	Included	NIS client included	Included	Optional (3)	BOOTP/TFTP support	Some floppy, printer
NCD WinCenter Pro 3.0	Included	Included	NIS client included	Included	Included	Included	Floppy, audio
Tektronix WinDD 3.0	Optional	In beta	NIS client optional	Included	Optional (1)	DHCP, TFTP in beta	Floppy, audio, serial/parallel (2)
* (1) NetManage NFS (2) ICA clients (3) FTP's InterDrive or Samba							

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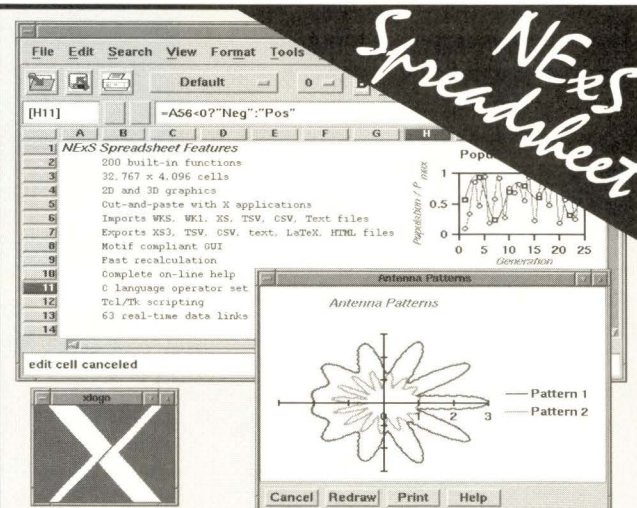
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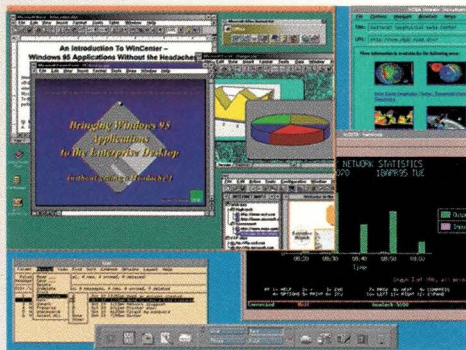
where the user is actually sitting. Likewise, any time the user creates input, such as clicking a mouse button or typing text at the keyboard, this must be packaged on the user's computer and sent to the computer running the application.

Because the application itself does not know where its interface is being displayed, the application cannot be responsible for this packaging and transmitting of user interface data. Instead, whenever the application creates output, this output is intercepted by another process, which packages it and sends it to the user's computer. On the user's computer, some process must be responsible for receiving the interface data, unpackaging it and displaying it on the screen.

When comparing the X and ICA protocols, there are several metrics of interest. There are two resources consumed by these protocols when distributing an application interface: network bandwidth and processing to package and unpackage interface data. Both impact performance. When an application displays something on the screen, say, a menu, when the user clicks on it, the computer running the application must send this to the user's computer. How many bytes are necessary to communicate this information? Fewer bytes mean less required network bandwidth and, possibly, faster transmission rates. And how fast can such messages be created on the application's computer and displayed on the user's computer?

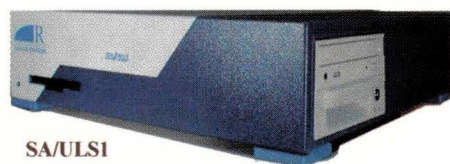
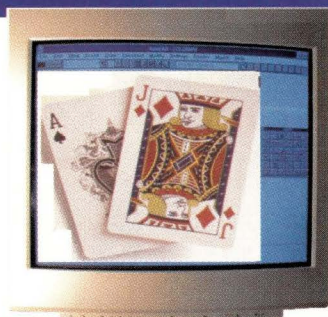
The X protocol was designed to be used on Ethernet networks—that is, networks with 10 Mb/s bandwidth—and to be very general in functionality. ICA, on the other hand, was designed with low-bandwidth connections in mind, such as dial-up serial connections of 2,400 or 9,600 baud, and specifically for the Microsoft Windows interface. Consequently, the X protocol is not bandwidth-efficient. Its designers assumed plenty would be available.

Tektronix has conducted a number of tests that indicate that, in most cases, the X protocol generates much more network traffic (total bytes transmitted and number of Ethernet packets) than the ICA protocol, as much as

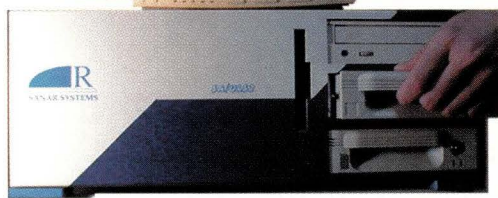


NCD, with WinCenter, has implemented optimizations such as caching and compression to make the X protocol more efficient with its product.

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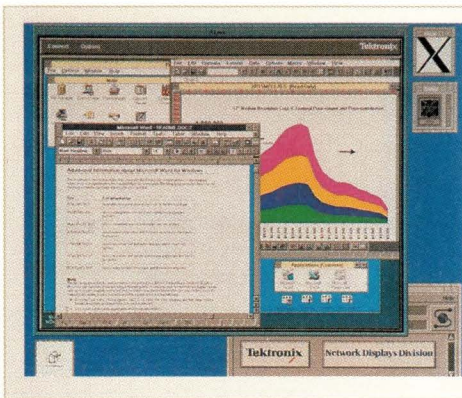
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All three of the distributed NT products we reviewed are based Citrix Systems' WinFrame, which incorporates the ICA protocol. Shown here is WinDD's UNIX ICA client.

seven times more. All else being equal, this would indicate that ICA is more appropriate than X in low-bandwidth situations, such as dial-up connections.

However, with the recent popularity of the Internet, there has been a high demand to make X more efficient for low-bandwidth connections. The Broadway release of X (currently X11R6.3) has addressed this demand by including X.Fast, a protocol targeting the use of X over low-bandwidth connections. This technology uses caching and short-circuiting to optimize the X protocol in such situations. However, many existing computers implementing the X protocol have not been upgraded to Broadway and so do not have the X.Fast technology.

To overcome this, NCD, with its WinCenter product, has implemented a number of similar optimizations, such as caching and compression, to make the X protocol more efficient with its product and the Windows GUI. For example, WinCenter is equipped with compression algorithms specific to Windows image formats. These dynamically compress images based on CPU and network load.

Tektronix, on the other hand, has taken the track of optimizing ICA clients for use with UNIX/X computers, on the assumption that ICA can be made more efficient at distributing the Windows interface than X ever could, which has much more general functionality.

The other side of the coin is how much work must be done on the application side to convert the interface into network messages, and how much work must be done on the user side to reconstruct the interface. The WinFrame server implements the ICA protocol directly, so all these products automatically have the ability to distribute the interface via ICA. However, WinFrame does not know about X, and so to use the X protocol, X support must be added to the server to enable applications to become X clients.

For the user's computer, the work necessary depends on how the computer's interface is controlled. For computers implementing X, the X server is controlling the interface, and if the X protocol is used, the X server

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receives the messages from the network and displays them directly. If the ICA protocol is used, an ICA client program must be run on the user's computer, which receives the ICA messages and converts them into X calls. If the user's computer is not running X, but Microsoft Windows or the Macintosh interface, for example, then it must either run an X server to use the X protocol, or an ICA client to use the ICA protocol. For these vendors to integrate WinFrame with UNIX/X computers, they must either implement X support in the server, or develop ICA clients for UNIX and X terminals, or both.

Performance Testing

We tested the relative performance of the Windows NT Server desktop distributed to client machines using both the X and ICA protocols. For the NT Server, we used an Intel 200-MHz Pentium Pro-based PC with 64 MB of RAM and 400 MB of virtual memory. For clients, we used UNIX/X workstations, Microsoft Windows and Apple Macintosh

PCs, and several X terminals. The test consisted of timing a number of basic graphics primitives and comparing the results across the various platforms.

By testing graphics primitives, we are essentially measuring the cost of distributing the graphical user interface over a network. And by comparing the results between protocols and client platforms, we can obtain a feeling for what combinations provide the best performance. It should be stressed that this type of test only measures application interface speed, and not application execution speed. We first ran the tests on the server console, which gives us a baseline timing of server performance. We then ran the tests on the various clients, to obtain a ratio indicating the relative performance of the client system.

Across all platforms, relative performance ranged from 5% to 50% as fast as the server console. This does not mean that applications ran only 50% as fast, but rather interface operations, such as displaying a menu or

scrolling a page, were at best 50% as fast. For the X protocol, there was little difference between the three vendors' products. For the ICA protocol, we only had UNIX/X ICA clients from Tektronix, and so could not compare implementations.

However, in our configuration, X outperformed ICA on our UNIX/X client. The best client configuration was a UNIX workstation running X and using the X protocol, while the worst configuration was a Macintosh computer running an X server and using the X protocol. X terminals using the X protocol also performed well, but we did not have any X terminal ICA clients for comparison.

Application speed is not affected by distributing the interface but is affected by multiple users running applications at the same time. For example, if five users are logged into and using the server simultaneously, then five users are competing for CPU time and memory. Because all three products are based on WinFrame, there is essentially no differ-

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ence among them when it comes to handling server load (number of users/running applications). This is affected mostly by server configuration, such as amount of memory and disk and number of CPUs.

Summary

If all you have are PCs, and you don't need any UNIX network integration, then go straight to the source and get WinFrame from Citrix. However, if you want to incorporate a multiuser NT server into a UNIX network and are interested in client platforms other than Intel-based PCs, then you need to look at WinCenter Pro, NTrigue and WinDD. Exactly how you would use such a system needs careful consideration, however. One metric we did not measure is how well these systems scale with number of users, and this will have a direct impact on cost/benefit analysis.

As to the X vs. ICA debate, our feeling, after months of testing in a number of environments, is that choices should be made based on the intended implementation environ-

ment, and not the relative performance of the protocols. The differences are small enough that issues of protocol and software maintenance outweigh them. In a mostly PC environment, ICA today has the edge, while in a mostly X environment, X has the edge. For low-bandwidth situations, ICA performs well, but X protocol optimizations, such as those in X.Fast, will close the gap. To add more fuel to the fire, according to Citrix, both Microsoft and Sun Microsystems have licensed the ICA protocol—Microsoft for inclusion in the NT Server product, and Sun for use with its JavaStation Network Computers.

WinCenter has the best X protocol support. Apart from various optimizations, WinCenter supports "pausing" a session, which can be resumed later on the same or a different computer. WinCenter also supports multiple clients of a session, so that two different computers can attach to the same WinCenter session, which can be useful for help desk-type applications. WinDD has the best ICA client sup-

port and optimizations, but Insignia has begun producing these, including a Java client, and has implemented some security features as well.

In addition, according to Insignia, Sun has agreed to bundle NTrigue clients with every SPARCstation and UltraSPARC workstation.

When it comes to UNIX integration, all three products do a fairly good job. Your configuration will determine which options are most important, but we consider X (with XDMCP) and NFS support to be crucial. Full NIS client support is very convenient. With these protocols, it is straightforward to insert a WinFrame NT server into a UNIX environment quickly and easily.

Overall management of these systems is easy, and there is plenty of security and accounting support for user management. One feature that would be nice to see is the ability to send NT event and error log data to a syslog daemon on the loghost. All our UNIX systems log to a central location, and it would be convenient to have NT servers log here as well. ➔

NTrigue Global 3.0

Company

Insignia Solutions Inc.
2200 Lawson Lane
Santa Clara, CA 95054

Phone

(408) 327-6000

Fax

(408) 327-6105

WWW

<http://www.insignia.com>

Best Feature

ICA client support

Worst Feature

Peripheral support

Price

NTrigue Global \$7,495
UNIX/Macintosh ICA clients \$69 (5-pack)
NFS support \$995

Circle 164

WinCenter Pro 3.0

Company

Network Computing Devices Inc.
350 N. Bernardo Ave.
Mountain View, CA 94043

Phone

(800) 866-4080

Fax

(415) 961-7711

WWW

<http://www.ncd.com>

Best Feature

X support

Worst Feature

ICA support

Price

WinCenter \$1,495
(optional WinFrame server pack)
+ \$395 per user

Circle 165

WinDD 3.0

Company

Tektronix Inc.
14180 SW Karl Braun Drive
Beaverton, OR 97077

Phone

(503) 682-7370

Fax

(503) 682-2980

WWW

<http://www.tek.com>

Best Feature

ICA clients and peripheral support

Worst Feature

Lack of UNIX network protocols

Price

Server \$2,495
NIS support \$500
NFS support \$995
X support \$2,995 (includes Tektronix
X terminal ICA client)
UNIX ICA client \$70/seat in quantities of 100
Intel PC ICA client \$200

Circle 166

THE UNLIMITED POTENTIAL of I/NETS

Most large organizations are reporting that they are in the process or have already deployed Internet/Intranet (I/NET) applications. In most cases, these initial I/NET applications publish information on the public World Wide Web (WWW) or on internal Intranets. However, many organizations are beginning to use I/NETs for deploying large scale "self-service" order entry and customer service applications targeted towards WWW users who want direct Internet connections to products and services. The travel, brokerage, air freight, real estate, and banking industries are leading the way in deploying these types of customer-driven I/NET applications.

At this point in time, there doesn't seem to be much that cannot be done on I/NETs. I/NET scalability is proven. Individual I/NET applications are capable of supporting hundreds, thousands, and even millions of users. I/NETs can be used to deliver all types of applications including groupware (e.g., Lotus Domino), front-office suites (e.g., word processors, spreadsheets), and back-office mission-critical systems. Intranets can be made highly secure since data and applications are centralized and therefore securable. New security software makes it possible to perform highly sensitive transaction processing (e.g., credit card purchases) on the Internet.

Organizations are using I/NETs to deploy traditional applications such as order entry, human resource, and financial applications. The I/NET's "server-centric" approach has many advantages over the desktop-centric, "fat client" client/server model. I/NET applications, by utilizing Web browsers and Java applets, can still take full advantage of the GUI interface and desktop computing power that have made PCs so popular.

I/NETs are both revolutionary and evolutionary. The architecture is new and exciting. I/NETs address the maintenance issues associated with client/server technology and offers many new ways to deliver information, services, and products to customers. But I/NETs do not force organizations to completely overhaul their existing technology infrastructure. Instead, I/NETs allow organizations to leverage their existing hardware, databases, applications and knowledgebase. Organizations can incrementally add new capabilities to their existing applications without disturbing current operations. While the I/NET model may not immediately replace all client/server development it is certainly a strategy that all organizations should consider as they move forward with new application development and deployment.

Rich Finkelstein
President, Performance Computing
Chairman, Network Computing
DCI's Database & Client/Server World
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CLIENT/SERVER
WORLD**

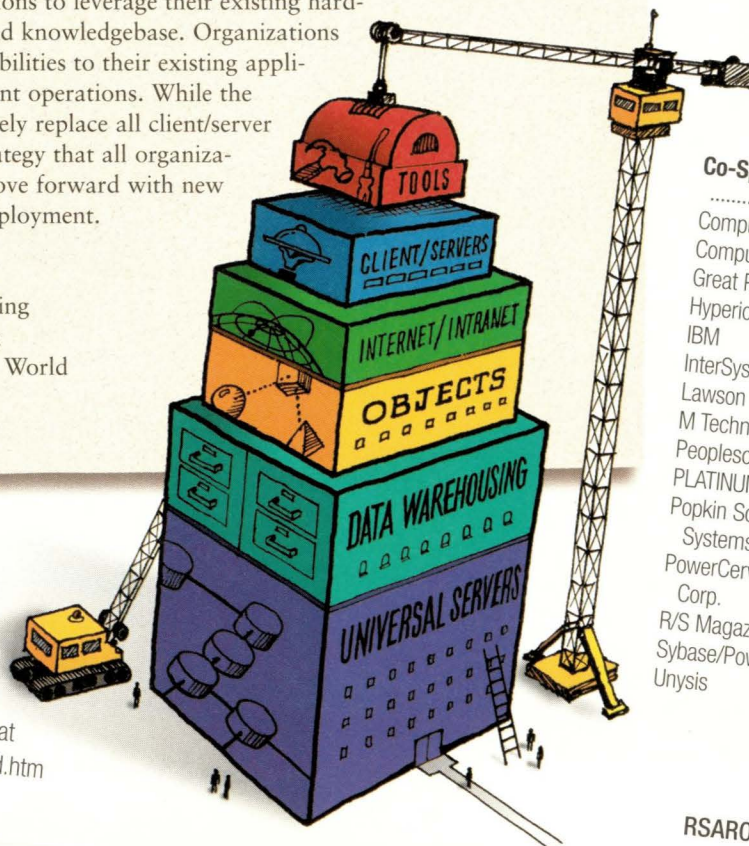
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NEW PRODUCTS

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 the magazine.

Tools to Create, Maintain Data Marts

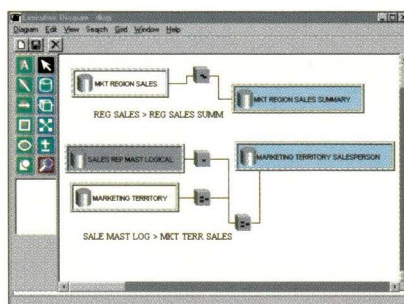
Prism Solutions is offering two new tools—Prism Warehouse Executive and Prism Warehouse Directory—to aid in the design, construction and maintenance of data warehouses and marts.

Prism says both tools address issues affecting data warehousing today, including scalability, design implementation and metadata directories.

The Prism Warehouse Executive is used for rapid modeling and design. It features a drag-and-drop GUI; a Diagram Editor, for graphically modeling the flow of data into the warehouse; and a Document Editor, for creating and editing textual warehouse and project documents. The Document Editor is integrated with the

other components, Prism says, which allows for tight links between workflow diagrams and textual project documents.

Prism Warehouse Executive can extract data from both UNIX and mainframe databases, and can perform data conversions, structural changes and summarizations. It also supports custom business rules and exit routines, affording users the flexibility they need, Prism says.



Prism Warehouse Executive designs are accompanied by a layer of “metadata,” which describes the warehouse source files, output tables, data mappings and transformations. Prism Warehouse Executive captures the metadata, and Prism Warehouse Directory stores it.

The Prism Warehouse Directory

allows users to manage rapid, incremental construction and design of the database, across different warehouses found in the enterprise. This metadata can be read by industry-standard Web browsers and several decision support tools, Prism says.

The Prism Warehouse Executive client is available for Windows NT and 95. Supported database platforms include DB2/MVS, DB2 Parallel Edition, Informix, Oracle, Rdb, Red Brick Warehouse, Sybase, Tandem nonStop SQL and Teradata.

Prism Warehouse Executive and Prism Warehouse Directory are sold as part of the Prism Scalable Data Warehousing Solution, which is priced between \$70,000 and \$225,000.

Prism Solutions Inc.
1000 Hamlin Court
Sunnyvale, CA 94089
Circle 101

Beyond-the-Firewall Security Unveiled

Haystack Labs has unwrapped WebStalker-Pro 1.0, which it says is designed to address the problem of Web server security.

WebStalker-Pro 1.0 is said to provide protection for individual intranet and

Java-Powered Storage Management Solution

Legato has announced a Java-powered storage management product called GEMS (for Global Enterprise Management of Storage), which is based on the company's NetWorker product but encompasses products licensed from other companies. Legato says that with GEMS' browser-based interface and Java applets, administrators will be able to configure and monitor all the separate storage management nodes in an organization.

This first release of GEMS, Legato says, allows users to apply consistent policies across different platforms. In particular, Legato lists storage management; management of different storage media (tape drives, optical jukeboxes, autoloaders); and software licensing and distributing as all benefiting from GEMS' Java-based framework. Future versions of GEMS will feature centralized library management, and will be integrated with leading systems management frameworks, Legato says.

GEMS technology is a result of technology alliances Legato has made with several leading open system software providers. These include SunSoft Inc.'s Java Management API, to which GEMS conforms; Redcape Policy Software Inc.'s Policy Manager; Silicon Graphics Inc.'s OpenVault; and MTI Technology Inc.'s Robotic

Library Manager (RLM).

Version 1.0 will be widely available in the second quarter of 1997. Pricing is to be announced.

Legato Systems Inc.
3210 Porter Drive
Palo Alto, CA 94304
Circle 100



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Internet Web servers by monitoring them seven days a week, 24 hours a day, detecting and responding to hackers.

Features include protecting multiple Web servers on a single machine and active responses like shutting down the hacker's connection or restarting the Web server when security incidents are detected, the company says.

WebStalker-Pro supports Sun Solaris, IBM AIX and Windows NT servers. An OEM version is bundled with all Sun Netra Internet servers. The list price is \$4,995 per single seat. Quantity discounts are also available.

Product information and a free 30-day evaluation of WebStalker-Pro can be downloaded from <http://www.haystack.com>. Users who download the trial software will receive a \$100 coupon toward the purchase price.

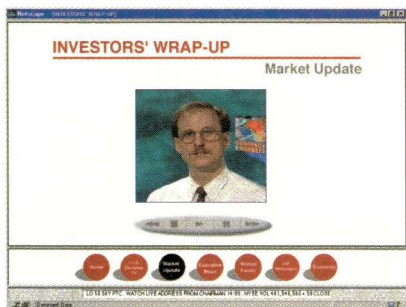
Haystack Labs Inc.

10713 RR 620 North, Ste. 512
Austin, TX 78726

Circle 102

Video Networking Software for Solaris

Starlight Networks has announced Version 3.0 of its StarWorks for Solaris product, which delivers recording and playback of video streams at speeds of up to 200 Mb/s on pure Solaris networks. With these kinds of speeds, users on corporate Solaris networks can take advantage of today's multimedia applications, including broadcasts, training videos and certification courses, Starlight says.



StarWorks achieves these speeds by taking advantage of Sun's 64-bit UltraSPARC-based line of Enterprise Servers. StarWorks for Solaris supports SPARC/Solaris SMP servers running Solaris 2.5.1, which provide 100 Mb/s and 200 Mb/s aggregate streaming configurations, the company says.

StarWorks can store up to 250 GB of multimedia content directly on the server, which improves content management and data access times. In addition, stream-specific management reportedly allows StarWorks to scale the streams according to user demand.

Streamed media is said to be interoperable with traditional applications and data types, including client software for Windows 3.1, 95 and NT, Macintosh and UNIX systems; or through Netscape Navigator browser plug-ins. Pricing for StarWorks for Solaris is \$6,495 per 15 Mb/s aggregate streaming throughput.

Starlight Networks

205 Ravendale Drive
Mountain View, CA 94043

Circle 103

Email Log Tool Unveiled

Newland Data, a start-up specializing in UNIX network traffic log software, has announced the utelLEM email log tool, which is said to identify the source and destination of all email traveling across a network.

utelLEM can be configured to log all email traffic, or only traffic between those IP addresses that you specify. Doing this helps you identify how much of your network traffic is generated by email and what your peak times are, the company says.

Newland Data says utelLEM is equipped with email debug and security facilities, in addition to search facilities. utelLEM cannot, however, read the content of the email it logs.

utelLEM is available for a free 30-day trial via anonymous ftp to ftp://www.std.com/Newbury/newland/utelLEM/*. It runs on SPARC Solaris 2.x platforms and lists for \$499 per license.

Newland Data Inc.

P.O. Box 30144
Bethesda, MD 20824

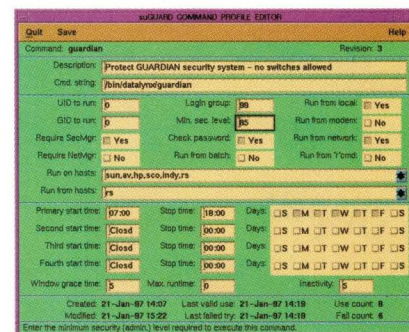
Circle 104

suGUARD Steps Up Access Control

For systems administrators who wish to fine-tune access to programs and applications across their UNIX network, DataLynx offers suGUARD, which allows sysadmins to define how,

where, by whom, by which access methods, and at what times given programs or applications can be run.

Programs placed under suGUARD control are executed by running a command, or a script. First, suGUARD ascertains whether or not the user running the script has the appropriate permissions by interpreting the user's profile. Privilege levels run between zero and 99 and correspond to the privilege levels required to run a program. suGUARD also builds an audit log that records all command activity, including user name, time, date, originating location and argument list, DataLynx says.



Pricing for suGUARD ranges from \$500 to \$2,400, depending on the configuration. The product is available for a free trial download from the company's Web site (<http://www.dlxguard.com>). suGUARD runs on SunOS, Solaris, IBM AIX, DG-UX, HP-UX, NCR System V Release 4.x, Digital UNIX, SCO UNIX and SGI IRIX, with plans to port to additional platforms under way.

DataLynx Inc.

6633 Convoy Court
San Diego, CA 92111

Circle 105

Free Multiport Serial Guide Offer

Aurora Technologies, a supplier of off-the-shelf and custom-developed serial connectivity products, is offering a free 40-page guide on multiport serial connectivity for Sun systems.

The guide is said to provide an overview of alternative approaches and key considerations for linking concentrations of modems, DSUs, data entry terminals, serial printers, instrumentation, point-of-sale terminals and real-time data feeds.

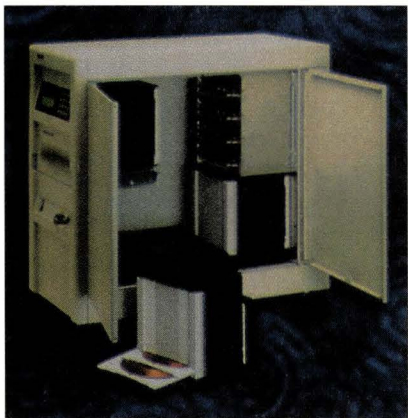
Topics covered in the guide include a comparison of SBus, SCSI and Ethernet-based serial connectivity; using serial connectivity for WAN synchronous communications; why two connectivity solutions with seemingly similar features can offer dramatically different performance; and installation, administration and data security considerations.

The guide can be requested at Aurora's Web site, <http://www.auratek.com>.

Aurora Technologies Inc.
176 Second Ave.
Waltham, MA 02154
Circle 106

8X CD-ROM Speed in a Jukebox

NSM Jukebox has equipped its CD-ROM jukeboxes with 8X CD-ROM drives. The Mercury 8X series now provides more than 150,000 loads without failure, or three times the life expectancy of off-the-shelf 8X CD-ROM drives, NSM says.



The Mercury 8X CD-ROMs hold 150 CDs in three magazines of 50 CDs each. CD exchange can be performed by an external system, so that users need not take the drive off-line. Also, NSM's SERVEready program reportedly facilitates CD-ROM management via outside management software.

The jukeboxes are designed for Novell Inc. NetWare environments. Through a simple Ethernet connection, NSM says, the jukeboxes can connect with most network environments, including various flavors of UNIX, Windows and Macintosh.

Pricing for the Mercury 8X series is \$16,000 each, with special upgrade

prices for current Mercury 4X Jukebox customers.

NSM Jukebox
1158 Tower Lane
Bensenville, IL 60106
Circle 107

Security Tool Monitors for Intrusion

Internet Security Systems has announced RealSecure, network monitoring and security software that transparently sits on the network waiting for attempted security attacks.

RealSecure is said to be versed in most known methods of intrusion. For example, it pays close attention to the following potential security holes: TCP/UDP connection triggering, duplicate IPs, ping flooding, sendmail bugs, RIP route changes, WIZ attempts, `cwd ~root`, `bootparam` and `statd`, the company says.

Once a security breach has been detected, RealSecure can respond in one of several administrator-defined ways. For example, it can display the connection data in a terminal window, kill the connection, log the connection, send an administrator email or any combination thereof, the company says.

RealSecure runs on SunOS 4.1.x and Solaris 2.3 or above, as well as Linux kernel 1.3 or above. In addition, it is a member of the SAFESuite line of security monitors. It costs \$4,995.

Internet Security Systems Inc.
41 Perimeter Center E., Ste. 660
Atlanta, GA 30346
Circle 108

Load Testing Software Performs

QA Performer is Segue Software's new multiplatform load testing tool designed to predict the reliability and performance of client/server applications before they deploy. This product is the latest addition to the QualityWorks family of distributed testing products.

Organizations using QA Performer are reportedly able to create load and performance tests for use during the design, implementation, operation and maintenance of client/server applications. In the design stages of application development, database designers

and SQL developers can use QA Performer to predict the implementations that will optimize performance. In later development stages, engineers can use QA Performer to verify the performance of existing applications, Segue says.

Key features include an easy-to-use wizard, which guides users through a point-and-click process, automatically generating and running a load test; automatic data creation, which generates test data to populate databases automatically; and graphical reporting, which provides a level of drill-down detail designed to avoid costly redesigns by pinpointing exactly where problems occur, the company says.

The product runs on Windows 95, 3.x and NT. It supports all ODBC-compliant databases on UNIX, IBM AS/400, OS/2 and NT servers. Pricing starts at \$10,000 and is based on the number of simulated users.

Segue Software Inc.
1320 Centre St.
Newton Centre, MA 02159
Circle 109

CD-R Autoloader Unveiled

Young Minds and CopyPro have jointly announced the CD-R 5000, an autoloader system that allows users to copy up to 400 CD-Rs before requiring user intervention, the companies say. CopyPro will manufacture the product, and Young Minds will provide the technology.

The CD-R 5000 works with both 2X and 4X drives, eight at a time, and can be configured for UNIX, Novell Inc. NetWare or Microsoft Corp. Windows environments.

CD-R 5000 can reportedly reproduce CD-Rs quickly because of its multiwrite



capabilities, simultaneous disk duplication and large CD-R disk storage capacity. The eight-drive autoloader also features 32 disk/hour duplication speeds and a disk labeling option.

CD-R 5000 is fully networkable and does not require a separate workstation. UNIX platforms supported include SunOS, Solaris, HP-UX, IBM AIX and SGI IRIX. Pricing is to be announced.

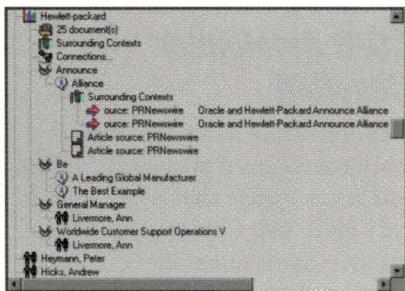
Young Minds Inc.

1906 Orange Tree Lane
Ste. 240
Redlands, CA 92374
Circle 110

Informix Add-On Module

IsoQuest has announced the NameTag DataBlade module for the Informix Universal Server. The add-on module provides users of the object-relational database with advanced data extraction capabilities, IsoQuest says.

For example, the NameTag DataBlade module allows users to find, index and interpret the names of people, places or organizations as found in text-based documents stored in the database.



It reportedly returns a browsable index of the proper nouns found in the search, extracting structured information from unstructured sources.

The index generated by the NameTag DataBlade can then be stored directly within the Universal Server, allowing developers to access server-side DBMS features for storage and retrieval, the company says. The index can be stored either as SGML or plain text.

In addition, IsoQuest says that the NameTag DataBlade module knows how to differentiate between ambiguous proper nouns, for example, Monte Carlo, which is a city, car and a mountain, or "Bush," which is a small shrub and a former U.S. president.

The NameTag DataBlade module costs \$1,995, and is available for all

platforms supported by the Universal Server, i.e., Sun Solaris.

IsoQuest Inc.

3900 Jermantown Road
Ste. 400
Fairfax, VA 22030
Circle 111

Distributed Object Technology to MVS

Iona Technologies has introduced a new product designed to integrate a distributed client/server system and mainframe technology running on OS/390 (MVS SP5.2.2).

According to Iona, Orbix/Enterprise allows client/server solutions to interact with mainframe data across a network in real time.

The product was developed by Iona with help from BellSouth Corp. to create the technology for deploying distributed client/server solutions within MVS environments.

The new application works with Microsoft Windows NT and 95, Sun Solaris, IBM AIX and Java clients running with Web browsers. Through the use of the CORBA standard, Orbix/Enterprise can provide an interface between mainframe objects and client objects, the company says.

The Orbix/Enterprise is priced according to machine group starting at \$41,500. The company also offers what it calls an "Early Adopter" program. This program is available to companies currently using Orbix and who want to integrate MVS into their CORBA environments.

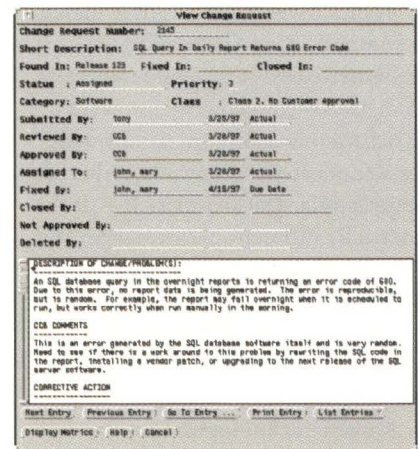
Iona Technologies Inc.

60 Aberdeen Ave.
Cambridge, MA 02138
Circle 112

Tools for Efficient Software Development

+1 Software Engineering has introduced +1CR and Metrics4Project, tools for process management and analyzing report metrics, respectively. The company says that, together, these tools can help software developers increase the quality of their work while decreasing the resources needed to develop that same software.

+1CR is a problem report management facility for working with change



requests. In particular, +1CR provides developers with an automatic change request number and a short description of the problem. It also keeps track of version information, status, priority and other criteria associated with a problem, the company says. Users can reportedly customize the information stored in change requests, can query +1CR change requests with wildcards (e.g., *core*), or qualifiers (e.g., "<"), and can view reports in tabular, summarized or detailed formats.

Metrics4Project, on the other hand, sorts reports based on status (open or closed), priority, category, owner and so on. Metrics4Project also has the ability to run cron jobs and output its data to a spreadsheet, the company says.

The two tools are offered together for \$695 per floating license. Both programs run on SunOS and Solaris, under Motif, OpenWindows or CDE.

+1 Software Engineering

2510-G Las Posas Road
Ste. 438
P.O. Box 6041
Camarillo, CA 93011
Circle 113

HA Clustering for Distributed Environments

High-availability (HA) clustering software for distributed enterprise platforms has been announced by Qualix Group. The QualixHA+ Solutions provides multinode configurations, intelligent HA monitoring, as well as recovery and load-balance failover of system resources, the company says.

The QualixHA+ Solutions is said to improve the availability of individual systems, data, applications and net-

works through modular configuration options. According to Qualix, the product supports linear growth to survive multiple failure for up to eight servers per cluster. This means that, for example, customers can start with two servers and add more as they grow.

QualixHA+ Solutions reportedly determines the most appropriate server within a cluster to take over and continue providing a given service when a failure is detected. It monitors for individual service failures for applications, storage and network communications environments.

The product supports clustering for Oracle, Informix, Sybase, CA-Open-Ingres, Tivoli/TME Web and NFS servers. Additional applications or other critical resources can be defined as QualixHA+ service groups via an open API, the company says.

In addition, QualixHA+ Solutions can be integrated with several RAID products from manufacturers such as Sun Microsystems Inc., Digital Equipment Corp., Baydel Ltd., Clariion Corp., Box Hill Systems Corp., EMC Corp. and Storage Dimensions. QualixHA+ supports a full range of networking technologies that can be monitored, restarted and failed over as part of the cluster, including Ethernet, Fast Ethernet, Token Ring, ATM, FDDI and CDDI environments.

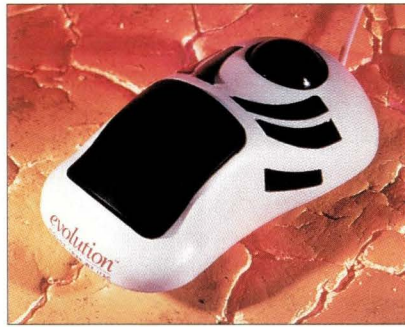
Pricing for QualixHA+ Solutions starts at \$8,000 per node and is based on the number of nodes in the QualixHA+ cluster. It is available on Solaris 2.4, 2.5 and 2.5.1, and will soon support HP-UX and IBM AIX. Current QualixHA customers with a maintenance agreement can request a free copy of the new software.

Qualix Group Inc.

1900 S. Norfolk St., Ste. 224
San Mateo, CA 94403
Circle 114

Feature-Rich Mouse Needs No Special Drivers

Users who need accurate cursor control, or who experience wrist strain from using a mouse, might consider evolution Mouse-Trak from Itac Systems. This latest "precision control input device" features elevated wrist and palm support and six programmable keys,



which together reduce strain on individual tendons, spreading mouse control over the entire forearm, Itac says.

With evolution Mouse-Trak's six keys, users can click, double-click, right- and middle-click, drag and control mouse speed. These keys are fully customizable, Itac says. In addition to these features, evolution Mouse-Trak takes up half the desk space of a traditional mouse and pad, Itac says.

Of interest to systems administrators is the fact that evolution Mouse-Trak does not require any special drivers, the company says. It plugs into either the serial or PS/2 port of the user's machine and uses the operating system's default drivers.

evolution Mouse-Trak costs \$199 and is available directly from Itac Systems or through distributors.

Itac Systems Inc.

3113 Benton St.
Garland, TX 75042
Circle 115

System Monitoring Software Unveiled

Bellcore has announced a commercial version of FireWatch, its network security monitoring system. FireWatch is a software package that helps systems administrators verify firewall configurations and analyze firewall traffic.

FireWatch works with CheckPoint FireWall-1, a network security software tool from CheckPoint Software Technologies Ltd. that provides secure enterprise connectivity for businesses and organizations, the company says.

FireWatch is said to extract information on network traffic logged by CheckPoint FireWall-1 and enable systems administrators to send this information to a database or create a detailed, formatted report. The analysis and reporting on network traffic can

include potential hacker activity, network problems and inappropriate access to external Web sites, Bellcore says.

Administrators can reportedly use FireWatch to verify new and existing firewall configurations. It checks for any mistakes to custom configurations and pinpoints problems by monitoring incoming and outgoing network traffic, the company says.

FireWatch runs on Sun Solaris 2.4 or SunOS 4.1.3 platforms and will soon be available for Microsoft Windows NT. Pricing for FireWatch is \$1,995 for the first copy, with additional copies priced at \$1,295 each.

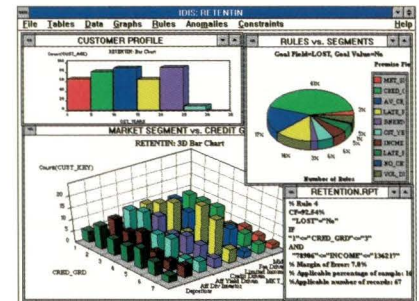
Bellcore

8 Corporate Place
Piscataway, NJ 08854
Circle 116

Engine Analyzes Data Warehouse Performance

Information Discovery has introduced the IDIS Version 3 client/server system, an upgrade of its data mining engine used for analyzing corporate data warehouses. According to the company, this latest version combines rule induction, statistic models and pattern visualization models.

IDIS Version 3 is designed to help identify performance trends based on the analysis of corporate data warehouses. The product can be installed on a single notebook computer, multi-tier client/server network or corporate intranet, the company says.



IDIS Version 3 features the ability to read both raw warehouse data or metadata. The product can reportedly use rule induction theory, numeric ranges and ratios, and statistical distributions defined by IDIS based on initial input. Logical relations, cycles and patterns of repetition are also detected in the data, the company says.

The IDIS Version 3 client server system runs on Unisys Corp., Sun Microsystems, Hewlett-Packard Co. and IBM RS/6000 platforms. On the client side, the product supports Microsoft Corp. Windows 3.1 and 95, as well as Windows for Workgroups. In addition, it works with Oracle, Sybase and Informix databases. IDIS Version 3 costs \$50,000.

Information Discovery Inc.
703-B Pier Ave., Ste. 169
Hermosa Beach, CA 90254
Circle 117

Integration Improves Server Performance

Asanté Technologies and Helios Software GmbH have integrated two of their products to provide improved server performance for prepress and

publishing, according to the companies.

Asanté's NetDoubler, a network acceleration utility, has been integrated with Helios' latest version of EtherShare. Dubbed NetDoubler for EtherShare, the companies say it will increase a user's ability to read and write files to their server. In a test conducted by Helios, the NetDoubler for EtherShare reportedly enabled a single user to read and write files to a Sun Ultra server at speeds reaching 5 MB/s over Fast Ethernet. Helios says that with six clients, the server can provide speeds of up to 17 MB/s.

According to Helios, EtherShare works as a platform for the company's open prepress interface (OPI) server, which provides throughput improvements to prepress users working with large color or grayscale images. The

Helios EtherShare OPI runs on UNIX servers including Data General Corp., Hewlett-Packard Co., Digital Equipment Corp., IBM Corp., Motorola Inc., Silicon Graphics Inc. and Sun Microsystems Inc.

The Asanté NetDoubler product is said to improve speeds for copying, opening and saving large files. With the NetDoubler, performance speeds can be improved by two to nine times over 10-Mb/s Ethernet, 100-Mb/s Fast Ethernet, FDDI and ATM local area network, Asanté says.

The NetDoubler for EtherShare is available as a free server update from the Helios Web site (<http://www.helios.de>) through May 1, 1997. After that date, the NetDoubler server can be integrated into EtherShare with prices starting at \$3,900 for 20 users.

Upgrades, Enhancements, Additions...

■ MachTen, a UNIX system for Apple Computer Inc. computers from Tenon Intersystems, now supports Objective-C and GNAT-Ada 95 tools in its CodeBuilder product, in addition to C, C++, Java and FORTRAN 77. CodeBuilder can now generate code for Macintosh, X Window and several flavors of UNIX, including Sun Solaris, SGI IRIX, NextStep and HP-UX. It has an introductory price of \$99. **Tenon Intersystems**, 1123 Chapala St., Santa Barbara, CA 93101. **Circle 118**

■ Loox Software reports that Version 2.0 of its dynamic graphics development tool Loox++ has several new features, including support for multiple views of a drawing, logical layering and auto-scrolling. Loox++ 2.0 is initially available for Sun Solaris, HP-UX and SGI IRIX. It costs \$8,950 for a single development license. **Loox Software Inc.**, 4962 El Camino, Ste. 206, Los Altos, CA 94022. **Circle 119**

■ VCOM 2.4 message-oriented middleware from Veri-Q is now available in the United States. This latest release adds SNA/APPC support to VCOM/NT, as well as support for both TCP/IP and Named Pipes. It also adds support for Reliant UNIX from Siemens Nixdorf. VCOM sup-

ports a wide range of operating systems, including Sun Solaris, IBM AIX, MVS and AS/400, HP-UX and Microsoft Windows NT/95. Pricing for VCOM 2.4 systems ranges between \$4,000 and \$20,000, depending on the number of processors in the environment. **Veri-Q Inc.**, 181 Fremont St., San Francisco, CA 94105. **Circle 120**

■ Legato Systems, maker of the NetWorker storage management software, has announced NetWorker Power Edition, especially suited to protecting very large databases, and large file systems up to several terabytes. NetWorker Power Edition is available for Sun Solaris and HP-UX, and for Oracle, SAP R/3 and Informix databases. **Legato Systems Inc.**, 3210 Porter Drive, Palo Alto, CA 94304. **Circle 121**

■ The Kermit Project at Columbia University has announced C-Kermit 6.0. This latest release adds features and fixes problems involving serial communications, networks, file transfer and script programming. C-Kermit 6.0 is also Year 2000-compliant. It is available for SunOS, Solaris, IBM AIX, HP-UX, SGI IRIX, as well as lesser known varieties of UNIX. It is freely avail-

able via anonymous ftp to <ftp://kermit.columbia.edu/kermit>.

The Kermit Project, Columbia University, 612 West 115th St., New York, NY 10025. **Circle 122**

■ Magna X, from Magna Software, can now generate Java clients as well as PowerBuilder and Visual-Basic clients. Magna X is a development tool for generating application code that spans open systems hardware, middleware and software, to create networked transaction processing applications. Pricing starts at \$50,000 for a five-user development license. **Magna Software Corp.**, 275 Seventh Ave., New York, NY 10001. **Circle 123**

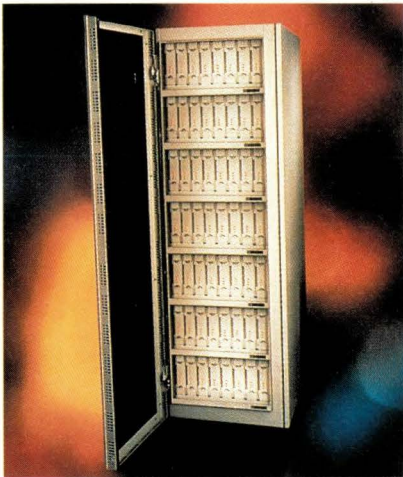
■ The latest release of Mathematica, Version 3.0, from Wolfram Research, is now available. Version 3.0 has several new features, including more than 250 new functions, Web-publishable documents, faster compilation speeds and portability of programs across platforms. Mathematica 3.0 is available on 20 platforms, including Sun Solaris and IBM AIX. Pricing is set at \$1,295, or \$139 for the upgrade. **Wolfram Research Inc.**, 100 Trade Center Drive, Champaign, IL 61820. **Circle 124**

Asanté Technologies Inc.
821 Fox Lane
San Jose, CA 95131
Circle 125

RAID Over TCP/IP WAN Unwrapped

Procom Technology has announced a new RAID subsystem—the LANForce Millennium—that can collect remote enterprise data over the Internet via a direct-to-subsystem TCP/IP Ethernet connection.

LANForce Millennium combines RAID levels 0, 1, 0+1, 4 and 5 with standard Internet protocols such as HTTP, SNMP, a Telnet server, SMTP and a TCP/IP stack, according to Procom Technology.



The LANForce Millennium chassis is said to hold up to eight half-height hard disks. An additional chassis can be added later for more than a terabyte of data storage.

LANForce Millennium features an intelligent SCSI backplane with single or dual configurations, which permits for modular configuration, Procom says. The SCSI backplane also provides power-regulated active termination, dual-mode bus (narrow or wide), individual slot protection circuitry, user-defined SCSI ID assignment and delayed drive spin-up options, the company says.

Procom says that most major LANForce Millennium components are hot-swappable, including drive shuttles, fans and air filter. A cooling system is said to ensure operation with 10,000-rpm disks, and the power supply is able to switch between North

American and European standards.

Pricing for LANForce Millennium starts at \$5,995, and it is available in tower or rackmount configurations.

Procom Technology Inc.
2181 Dupont Drive
Irvine, CA 92715
Circle 126

Quick Response Time and Data Security

The MegaRam-Shadow from Imperial Technology is a mirrored solid-state disk system designed to provide fast response times as well as data security. The MegaRam-Shadow has been developed to provide the security of mirroring while relieving the host of the performance penalty often caused by host-based mirroring software, the company says.

Imperial Technology says that by using the MegaRam-Shadow's multi-porting capability, a mirror image of the data is produced on an inexpensive SCSI hard drive. To prevent any single point of failure within the MegaRam-Shadow, data is accessed

via independent ports. The first port is attached to the host and serves as the primary data path to the solid-state disk memory. The second is attached to the external shadowing disk and creates a real-time copy of all data stored in the MegaRam-Shadow, Imperial Technology says.

The MegaRam-Shadow is said to have an internal memory bus that supports operation at 20 MB/s and a peak rate of 23 MB/s, the company says. The mirroring disk is actually a second hard disk used by the solid-state storage system. The first hard disk is built into the MegaRam-Shadow and records all the data in memory if the primary input power fails. In addition to the dual data paths, there are dual power supplies, dual batteries and dual disks for data backup.

Pricing for the MegaRam-Shadow is \$5,500.

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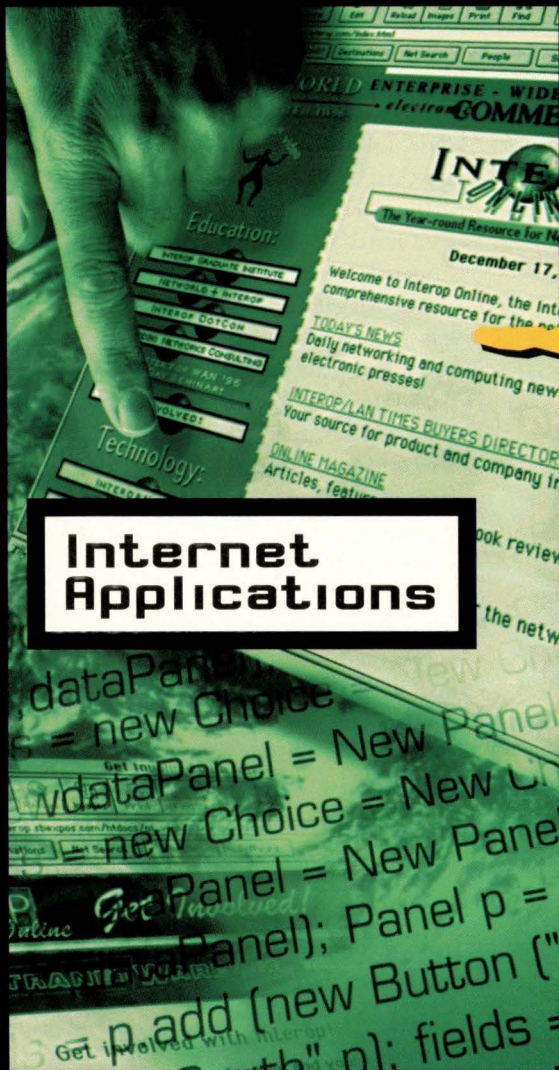
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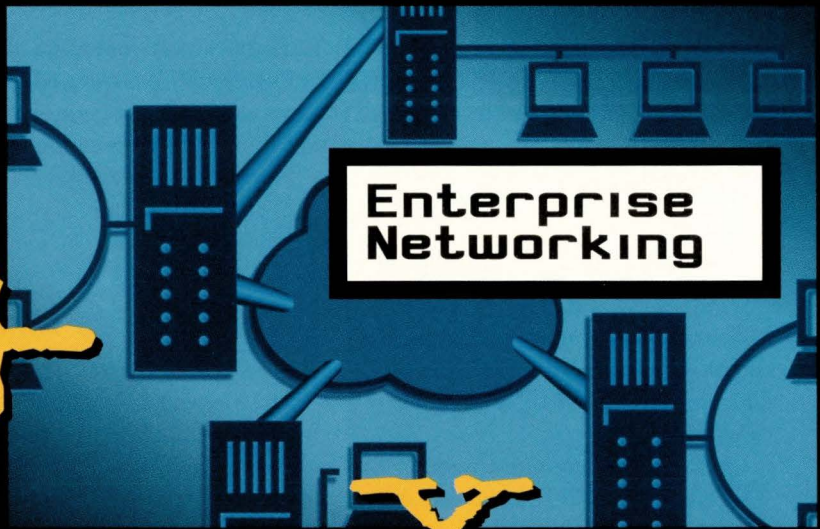
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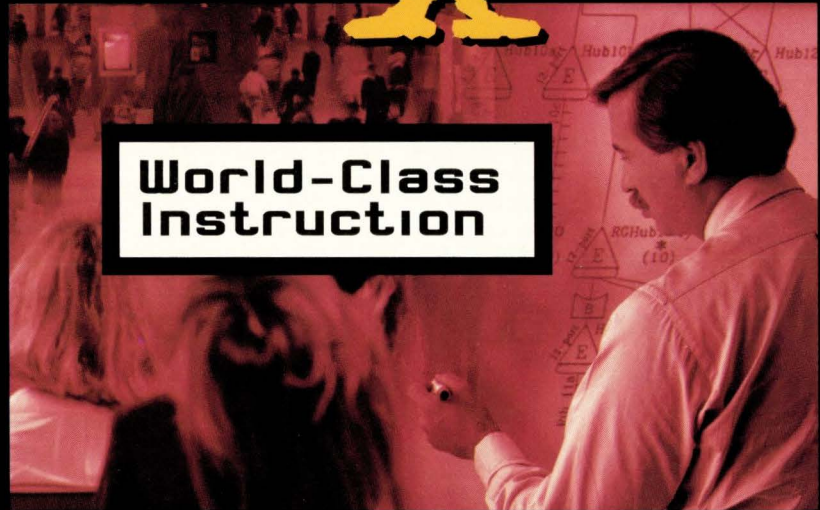




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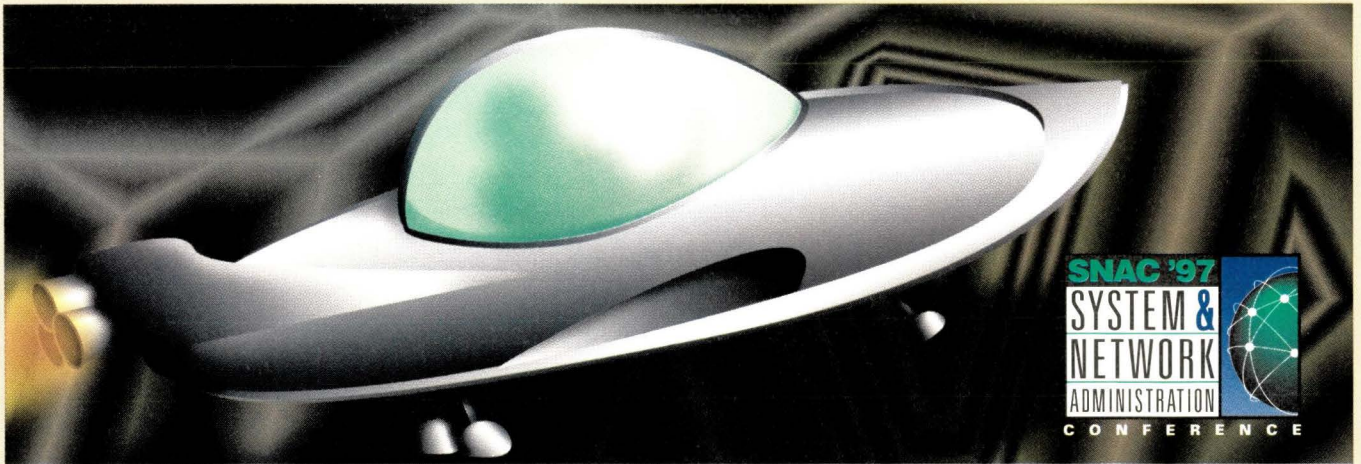
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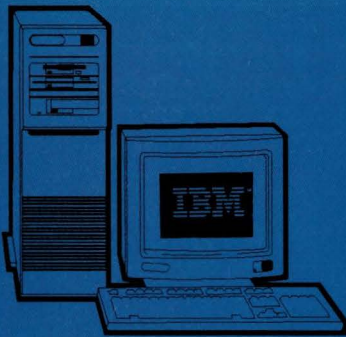
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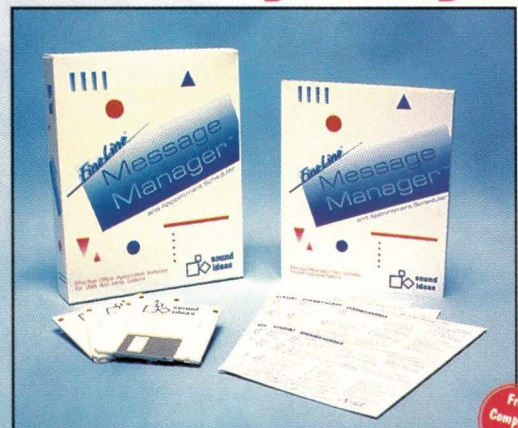
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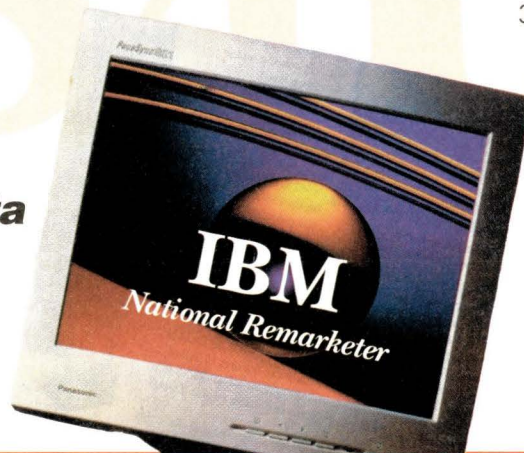
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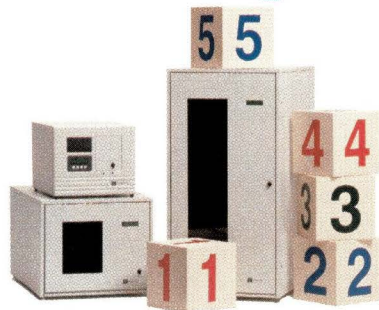
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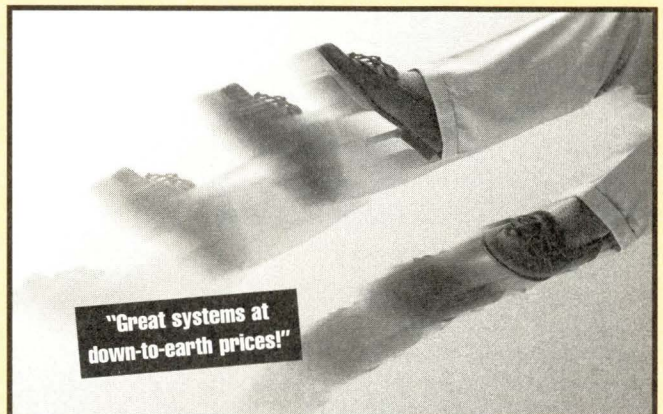
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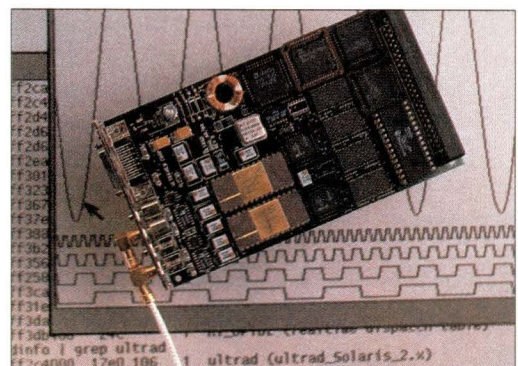
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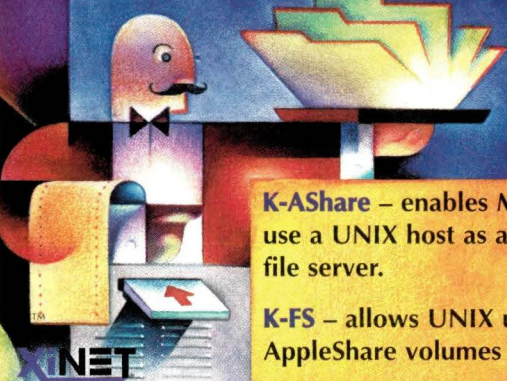
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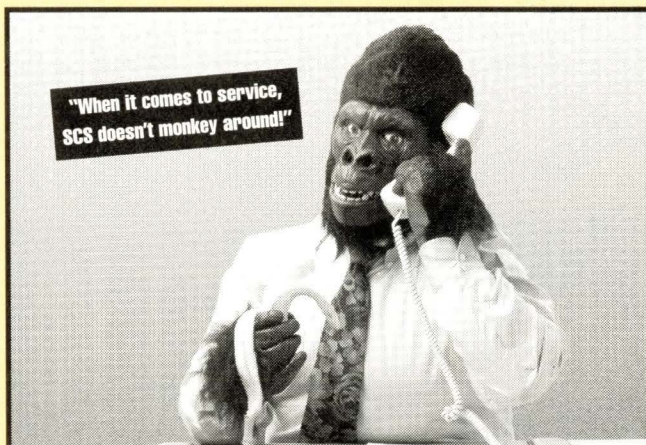
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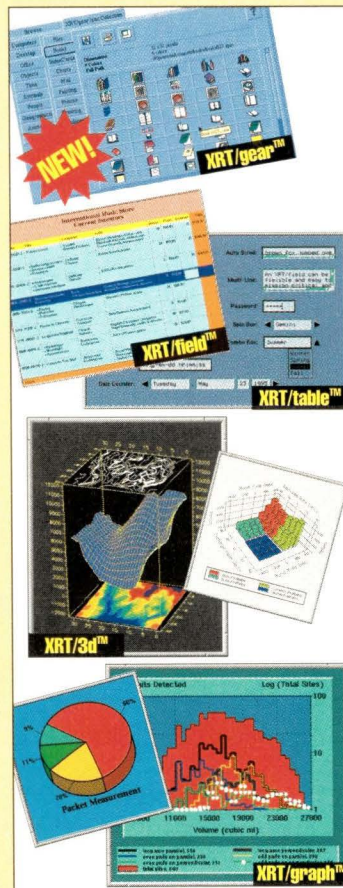
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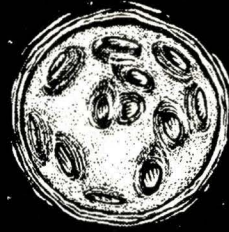
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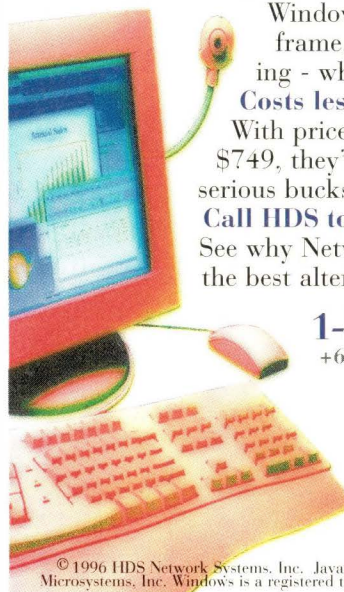
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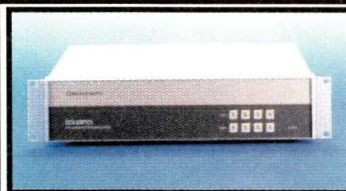
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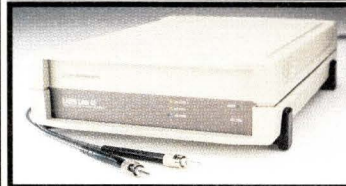
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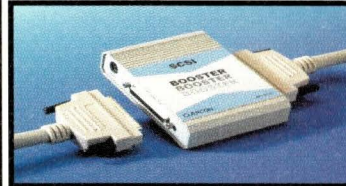
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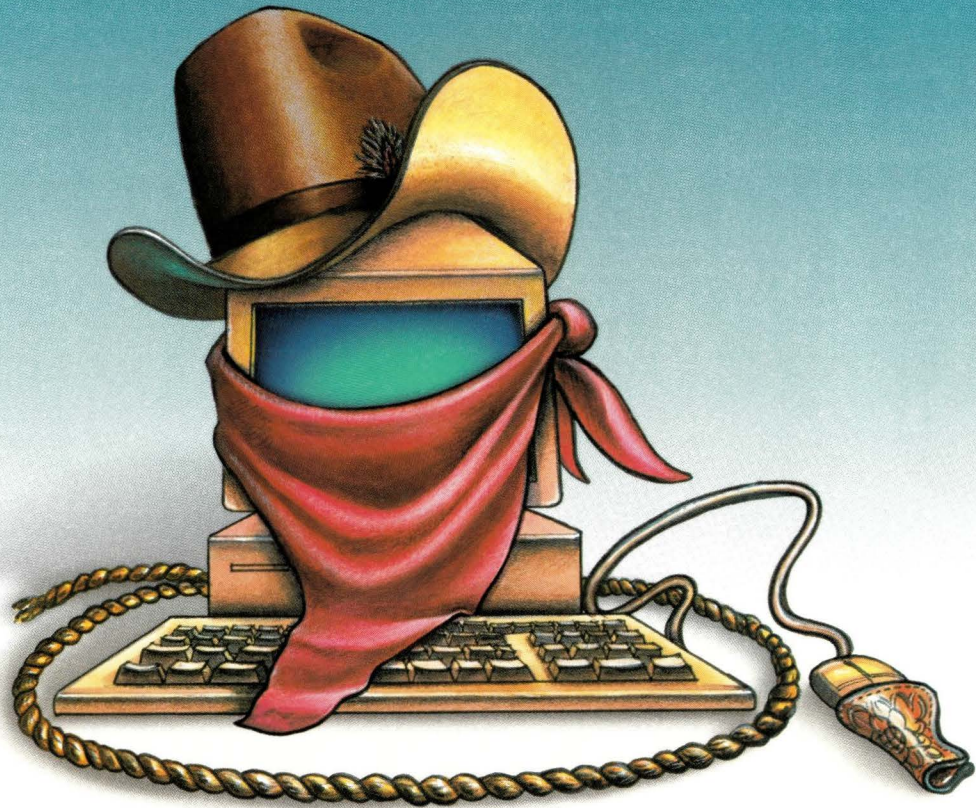
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