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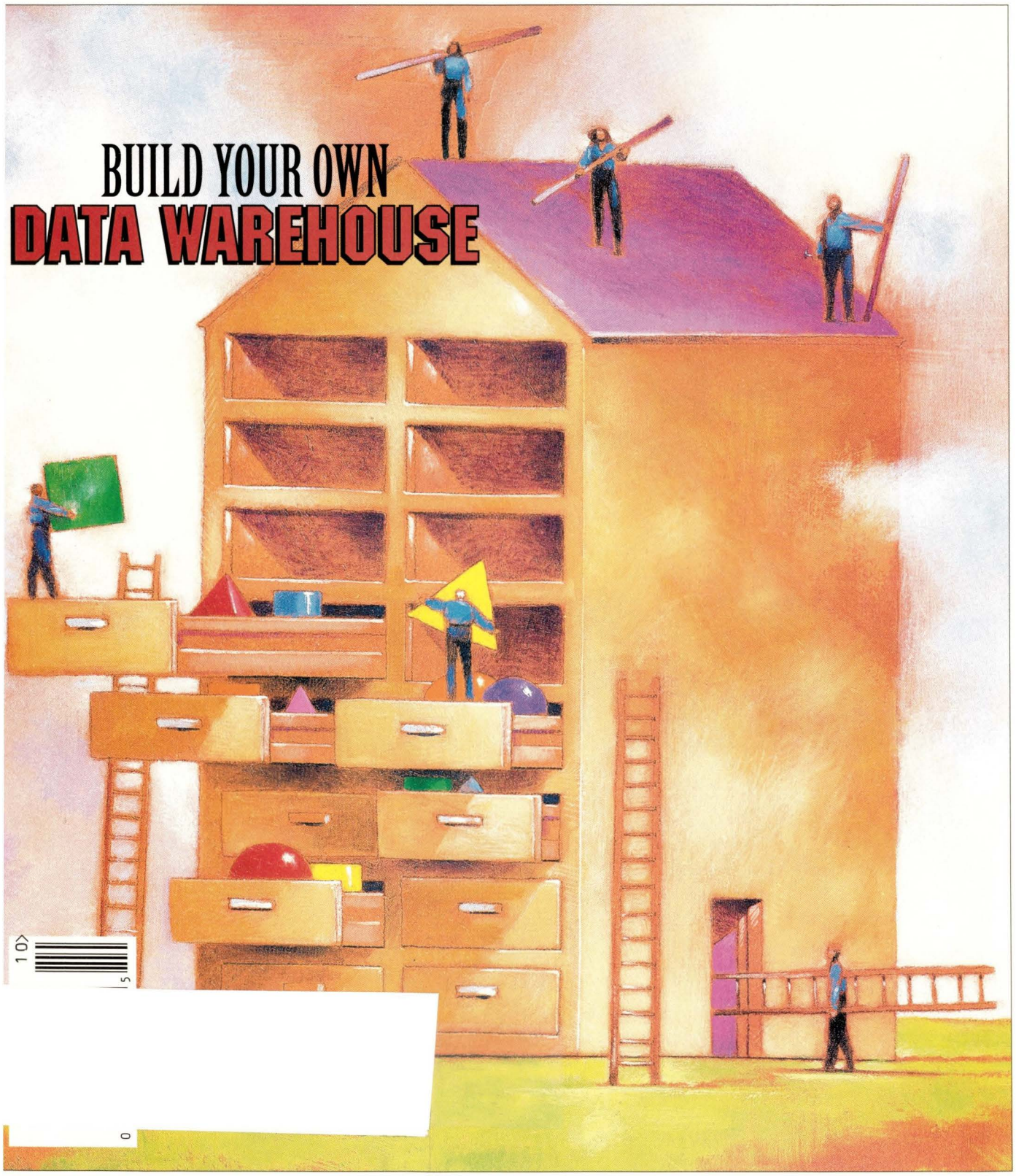

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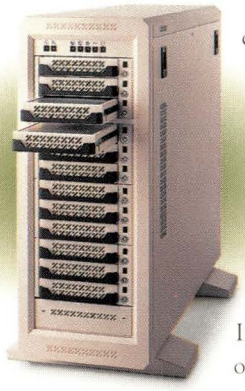

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serves the UNIX workstation environment, emphasizing Sun, SPARC and Sun-compatible systems.

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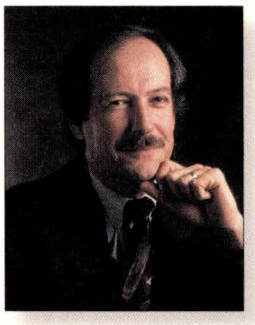
Editorial

This Old Warehouse

Is the warehouse half full or half empty–to mix a metaphor? Of course, the answer is both. At least that's the impression I take from Karen Watterson's cover story "Build your Own Data Warehouse," Page 52. Karen is an independent San Diego, CA-based writer and consultant specializing in client/server and database design issues. She has written two books for Addison-Wesley: *Visual Basic Database Programming* and *Client/Server Technology for Managers*. This feature marks her first appearance in *SunExpert*.



Because much of the data warehousing activity gravitates around the UNIX vendors, "familiar hardware and RDBMS vendors with symmetrical multiprocessing (SMP) and massively parallel processing (MPP) systems," her article drives home the message that UNIX has become an infrastructure OS. As a result, it seems to be withdrawing from the public eye into the very wiring of corporate computing. To me, that's not in and of itself a bad thing; however, it does lead to talk of a vanishing UNIX. But take heart. "By the year 2000, global purchases will be split evenly between UNIX and non-UNIX systems," according to a 1996 survey conducted by the Datapro Information Services Group. The report also suggests that the global market for UNIX-based software products continues to grow strongly. Mary Hubley, principal analyst for UNIX and open systems, says "UNIX purchases overall will grow at a healthy 8% clip through the end of the decade. Surprisingly, this will be accompanied by an 8% decline in 'non-UNIX' purchases." (So, my question is, why was Bill Gates the keynote speaker at UNIX Expo?)

Also making her debut in this month's feature section is Alex Simeonides, *SunExpert*'s new staff editor. You'll also see her work in News and New Products. Her first feature assignment, configuration management, is another of those nettlesome issues that apparently is as much about policy as technology. Take a look at "The Why's and Wherefore's of Configuration Management," Page 68, to see how she arrives at a few pretty good rules of thumb for a lot of developers and development teams.

Doug Pryor

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NEWS

JERRY COGLIANO

Sun Ships OpenGL on UltraSPARC

Sun Microsystems Inc. recently opened its doors to broader graphics application support, shipping for the first time the OpenGL application programming interface, a network-transparent graphics library for the development of interactive graphical applications.

There is widespread agreement in the UNIX community that Sun's UltraSPARC architecture has put Sun solidly at the forefront of workstation vendors in terms of performance, and OpenGL availability gives the UltraSPARC line still more ammunition.

OpenGL, developed by Silicon Graphics Inc., Mountain View, CA, is licensed by most UNIX workstation vendors and used by many UNIX-based graphics software developers. By also supporting the API, Sun stands to substantially increase the number of software applications that run on the UltraSPARC platform. This is a departure from Sun's history of stubbornly clinging to its own XGL API, a proprietary interface.

While developers still must write different versions of their applications for each hardware platform that offers OpenGL, it is far easier for them to optimize performance of their software for the various architectures using OpenGL than it is to develop OpenGL applications for some vendors, and XGL applications for the SPARC platform.

Specifically, Sun has announced the availability of the Solaris OpenGL 1.0 Ultra Creator3D Edition for the Sun Ultra Creator3D workstation, which lets users develop, deploy and manage interactive 3D applications across their networks. In native mode, Solaris OpenGL software is fully integrated in the Solaris operating environment to allow developers to take advantage of its features from within the OS when they are building advanced 2D and 3D graphics applications.

Sun officials hope the announcement will expand the company's presence in graphics markets such as MCAD and EDA, GIS, scientific visualization, medical imaging, animation and video production.

"We're excited about going after simulation and entertainment business segments, among others, by supporting applications that are only available for platforms that license OpenGL," says Susan Stearman, graphics marketing manager for the Solaris desktop group at SunSoft Inc., Mountain View, CA. "Our goal was to try to capture some new areas."

At the time of the announcement in August, eight software vendors began shipping applications written for OpenGL on the UltraSPARC platform, including Template Graphics Software Inc., San Diego, CA, and Dynamic Graphics Inc., Peoria, IL.

Stearman says the combination of high-performance UltraSPARC Creator3D hardware, the Solaris operating environment and OpenGL will help expand Sun's graphics user base, and current Sun users agree.

"This is a very important step for Sun. The release of OpenGL brings a standard graphics API to the UltraSPARC, which allows developers to port their existing applications and develop new applications for the new Sun hardware. It makes the power of the Creator3D much more accessible to users and developers," says Gerry Furseth, software development manager at Facet Decision Systems Inc., Vancouver, Canada.

Furseth adds that the release of OpenGL on UltraSPARC will help fend off advances made recently by SGI into the commercial market long dominated by Sun.

While he says that Sun's XGL API has always provided "fast, well-optimized" performance for applications running on the SPARC platform, it was proprietary, and so OpenGL is a big step toward "fast, well-optimzed and portable."

In fact, Sun and Hewlett-Packard Co. lagged behind other major workstation vendors in offering OpenGL for their platforms. Both companies signed licensing agreements with SGI last year. HP is expected to announce its OpenGL availability shortly.

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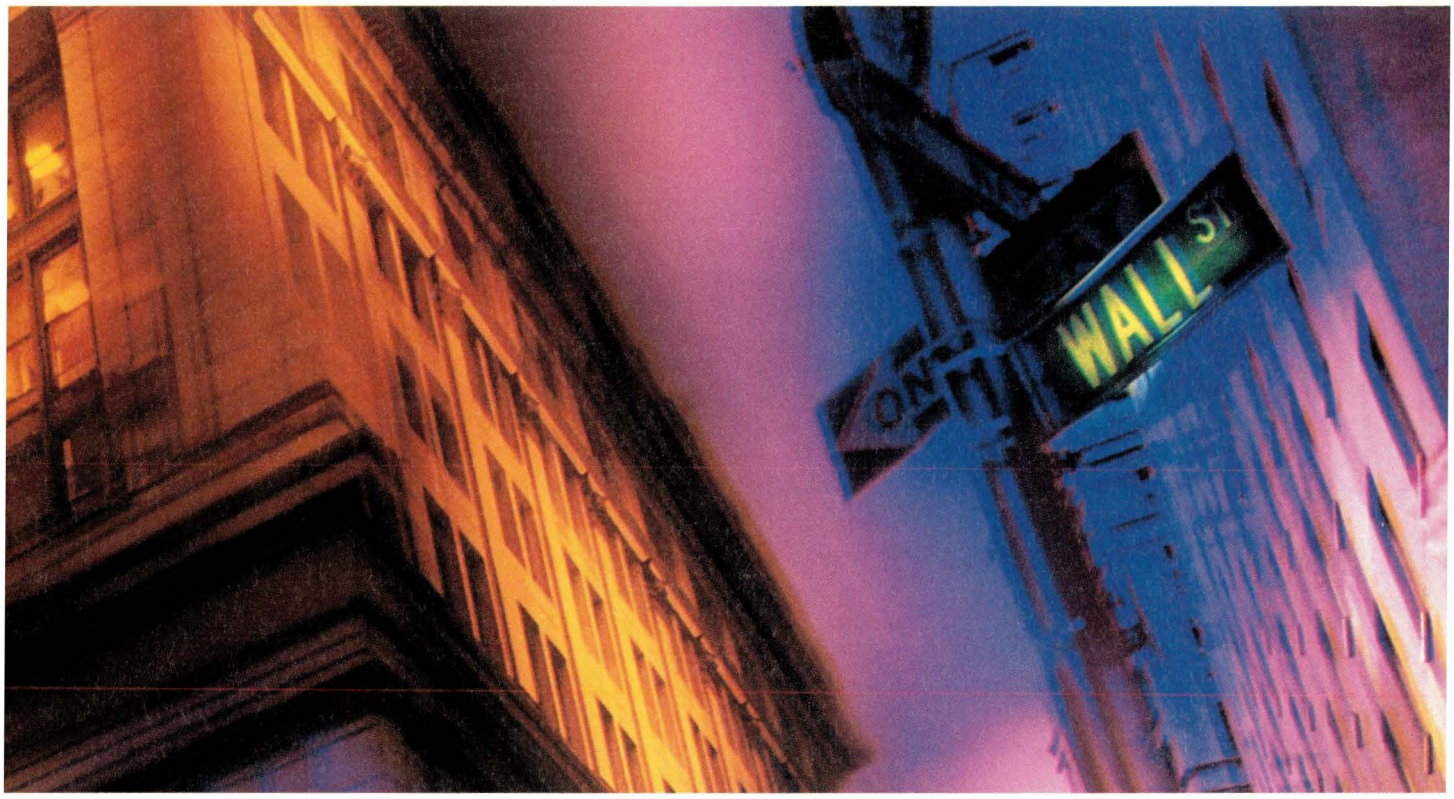

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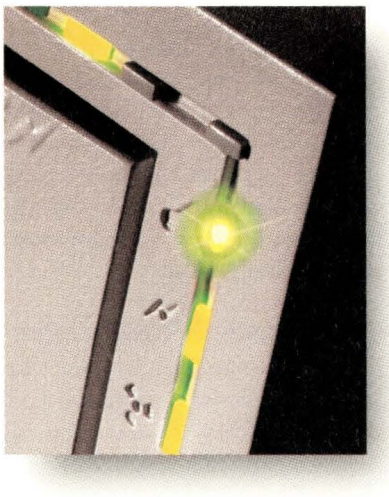

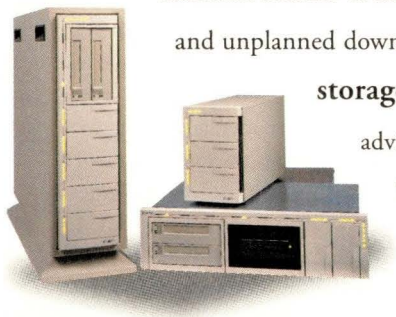

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SGI officials are pleased that their programming interface has achieved de facto standard status among major workstation vendors.

"This is great news because it's important to have alignment on a graphics programming standard so application developers don't have to target special platforms. Vendors of existing OpenGL-based applications will move to make them available on the Sun platform very readily," says John Schimpf, OpenGL product manager at SGI.–*jsw*

UltraSPARC Flirts with PC Prices

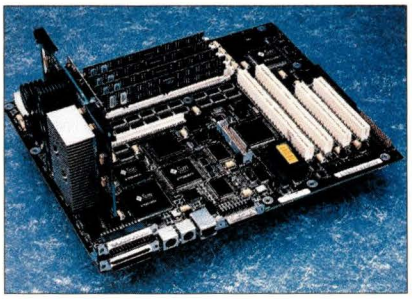
For those of you thinking of making the move from Solaris to Microsoft Corp. Windows NT on the basis of hardware prices, you might want to wait a few months. At the end of this month, Sun Microelectronics will announce its SPARCengine Ultra AX.

The motherboard, powered either by a 167- or 250-MHz UltraSPARC chip, will deliver the standard performance of any UltraSPARC-based machine. The 250-MHz UltraSPARC-II delivers 8.76 SPECint95 and 11.0 SPECfp95.

Systems based on the AX will also have Ultra Port Architecture, core crossbar memory and graphics port, which means Creator graphics and VIS support. Nothing new here for current Sun users. However, this board differs from other Sun boards in that it is delivered in standard PC/ATX form, with a PCI bus architecture.

That means systems based on the board could have components like PC-commodity memory, peripherals and power supplies. To potential Pentium customers, this could mean Ultra-class computing from machines manufactured with PC-priced components. How much savings this will mean–and how much loss of quality–remains unclear.

Who is likely to build machines based on the AX, you ask? "People interested in selling powerful intranet servers, who require a great deal of bandwidth," says Justin Smith, analyst at Framingham, MA-based market research firm International Data Corp. In other words, the Ultra AX could make its first commercial appearance



Sun's Ultra AX will deliver the standard performance of any UltraSPARC-based machine.

in the form of the proverbial network computer. This is further substantiated by Sun's prerelease literature, where the AX is touted as a "network-specific motherboard designed for network builders."

Another interesting facet of the Ultra AX is that, in adopting the industry-standard (read: cheap) PCI bus architecture over Sun's usual SBus, it is not at all clear that it will experience a substantial loss in performance. Equipped with a standard 32-bit at 33-MHz PCI bus, users can achieve data throughput rates of 132 MB/s, compared with the SBus' 64-bit at 25 MHz, for 200 MB/s. And if manufacturers adopt Sun's proposed 64-bit at 66-MHz PCI architecture, we might see data rates of up to 528 MB/s.

Consider the prospect: a (lower-priced) machine running Solaris on an UltraSPARC processor. Add to that Sun's proven ability to deliver network-ready systems, and platform-independence in the form of Java (depending on your take on the matter), this just might be one industry phenomenon worth waiting for.–*as*

Sun Chases HP, IBM Users

Since the introduction of the UltraSPARC Enterprise server line in April, Sun Microsystems Computer Co. has steadily advanced toward the front of the UNIX vendor pack both in terms of server performance and units shipped. Not content to rest on its laurels, SMCC has announced several enhancements to the server product line and has made a renewed push to woo users of IBM Corp. and Hewlett-Packard Co. server systems by offering big discounts to those customers who switch to the Sun platform.

Stepping up what users and analysts say is already a noticeable performance lead over competitive products from IBM and HP, Sun announced the availability of 167-MHz UltraSPARC CPU modules with a 1-MB external cache for its Ultra Enterprise servers. The company says this expanded cache size, which doubles the current .5-MB cache, will increase server performance by up to 26%. The new modules cost $14,000 each ($11,000 for current customer upgrades).

Along with the CPU modules, the company introduced its JumpStart Automatic OS Installation software, which reportedly simplifies Solaris operating environment installation by allowing systems administrators to configure the software on one server and distribute it throughout the network. Completing the round of announcements, Sun now offers a less expensive 17-inch monitor and frame buffer for the servers, priced at $3,295.

Regarding the expanded cache, UltraSPARC server users expect to see even better performance than they have with current UltraSPARC-based server platforms.

"Sun has already caught up to, if not surpassed, the other systems vendors in terms of I/O performance due to its backplaning alone," says Sun user Blaine Boyles, systems programmer at Delmarva Power and Light, Wilmington, DE. "They have a number of features that give them the edge, and any time you increase the cache, you'll get an additional performance increase."

These incremental performance enhancements, coupled with Sun's trumpeting of its server trade-in discounts, may help the company gain a stronger foothold in the server arena, which has traditionally been the realm of competing UNIX systems vendors. As it stands, Sun is primarily seen by the UNIX user community as a workstation vendor and, more recently, as an Internet-oriented company, rather than a server provider, according to Brian Richardson, program director for open computing server strategies at the Meta Group Inc., Stamford, CT.

"Sun should be more vocal about their server line. They weren't even in

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the race as far as server performance prior to the Ultra, but now they're in the top tier, along with HP and DEC," he says. "For several years, they were forced to compete by lowering price, rather than increasing performance. With the Ultra architecture offering a high-performance scalable architecture, they are more often considered on a customer's short list."

Now that Sun's Ultra servers have made a big splash in the UNIX workstation and server marketplace, the company hopes to ride the crest of the UltraSPARC wave by offering HP and IBM users hefty trade-in discounts on its Ultra Enterprise server and accompanying storage product line. While, like many systems vendors, Sun offers migration discounts to users of any platform, company officials say they specifically targeted this larger discount at HP and IBM customers because they sense confusion in the ranks regarding chip architectures and operating system strategies.

Called the Enterprise Upgrade Program, the initiative's objective, according to Sun, is to "enable HP, IBM and EMC [storage subsystem] customers to improve application performance and system scalability by easily and cost-effectively moving to Sun's enterprise computing platform."

While one might question just how easy it is to move an entire UNIX environment and applications from one platform to another, Sun hopes to speed the process by also providing discounts on the company's Migration Services for HP-UX and IBM AIX to Solaris, as well as on its Data Center Assessment Services and system support.

"The success of the new servers, due to their performance and scalability both within a single box and across the server line, led us to put the upgrade offer together," says Jeanette Kennedy, server product line marketing manager at Sun.

"We added discounts on the migration services because, although packaged applications such as PeopleSoft are easy to migrate between platforms, custom applications can be much more difficult."

Specifically, Sun is offering users of HP's T500 series and IBM's SP2 servers up to 40% trade-in credit on the price of Ultra Enterprise servers. The same discount applies to EMC storage subsystem users who purchase SPARCstorage Array. Trade-in discounts are usually around 20%, Sun says.

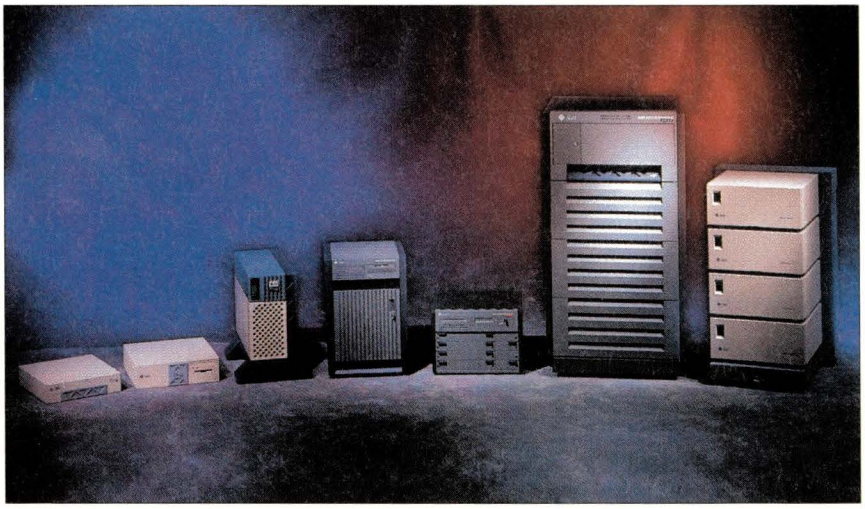
Sun is targeting the discounts at EMC storage product customers because the cost of the subsystems can make up a substantial portion of the overall cost of a server system purchase. On a related note, HP resells EMC storage units, thus making EMC users a logical target for the trade-ins.

"From a customer's point of view, storage systems are a strategic investment because when you're talking about terabytes of storage, the subsystem can cost more than the server," says Mark Davis, storage product line marketing manager at Sun.

For their part, officials at HP say the UltraSPARC server marketing move is expected, and as Sun's competitors roll out their own performance improvements and new architectures, the Ultra server platform will not appear so attractive.

"The Ultra Enterprise servers are great systems, and the discounts are not much of a surprise, since they now actually have technology and performance comparable to the top tier of systems vendors," says Bob Masson, technical computer product manager at HP.

However, he adds that HP's next-generation PA8000 architecture will boast better performance than the UltraSPARC, and the company's work with Intel to develop a chip that executes both PA-RISC and Intel instruction sets will nullify any perception that HP has an unclear chip architecture strategy. In addition, he says, the new chip will allow HP's UNIX servers to "coexist with NT."–*jsw*



Sun targets HP and IBM customers with recently announced trade-in discounts on its Ultra Enterprise server line.

Ross Plugs HyperSTATION, Hypes SPARCplug

Ross Microcomputer Corp., Austin, TX, the systems division of Ross Technology Inc., has formally introduced products–workstations and a plug-in module for PCs–based on the hyperSPARC processor. The company now moves into the systems business after having long restricted itself to CPU products.

It is also attempting to create for itself a role as chief provider of technologies that workstation buyers might want but which Sun Microsystems Inc. no longer wishes to support–specifically 32-bit processing, SunOS and the MBus module.

The workstations are the hyperSTATION 20 and the hyperSTATION 30. The 20 has dual 50-MHz MBus slots to support up to four hyperSPARC processors. It supports SunOS 4.1.3 or greater and Solaris 2.3 or greater. It also has up to 512 MB of total system memory; 16-, 32- or 64-MB memory SIMMs; a 200-watt power supply and four SBus slots. The 30, meanwhile, has all of the above plus dual 66-MHz MBus slots sup-

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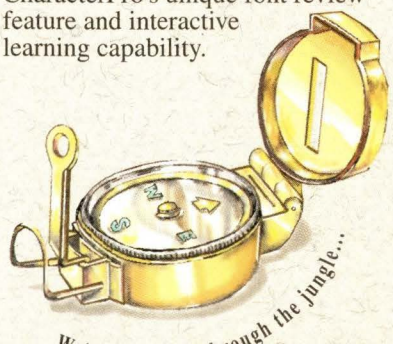

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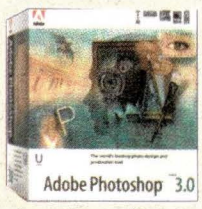

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porting up to four hyperSPARCs.

Ross says it intends to support several standards–MBus and SunOS–in which Sun has lost interest. Sun has indicated that it is going beyond the MBus and that its current 64-bit systems, based on the UltraSPARC, will not support SunOS.

This has, however, left several of Sun's customers–particularly in the traditional technical and engineering workstation markets–in a quandary. They don't wish to rewrite their applications to support Solaris, and for their purposes 64-bit processing remains an attractive but distant goal. Ross says its surveys indicate that many workstation users will migrate to 64-bit solutions, but only after their current solutions are no longer viable.

Ross believes there is a market to be served in the large numbers of scientific and technical workstation users who were Sun's original customers but who have increasingly felt abandoned as Sun has moved into commercial markets.

Moreover, Ross says it will take up the MBus as its cause. The MBus is the system and CPU bus that Sun developed to link its processors. Sun now plans to move ahead on other, network-like approaches for system bus operations. Ross will, however, take the MBus as a standard and encourage its further development, says John Rasco, the company's director of marketing communications.

Ross Microcomputer Corp. has introduced workstations based on the hyperSPARC. Ross believes there is a market for 32-bit SunOS workstations in the scientific, engineering and academic communities at a time when Sun has chosen to move into other markets.

In addition to its workstations, Ross is widely showing its SPARCplug. This is an elfin hyperSPARC-based workstation that fits into a double-height drive bay of a PC. With it, a PC user can patch back and forth between PC and SPARC-based UNIX applications.

Opus Systems has offered a SPARC-based board for PCs for years, but Ross says the SPARCplug is different because it is a full-fledged workstation in a small package. The Opus product, says Ross, was meant to give DOS users access to one or two UNIX applications at most.

Who would use the SPARCplug? Ross has talked about the device as an OEM product sold to systems integrators marketing into certain niches. For example, a value-added reseller might use the SPARCplug to give extra rendering punch to a Microsoft Corp. Windows NT-based PC designed for graphics tasks. However, the market that Ross seems to be targeting is the Internet. The company envisions SPARCplug-equipped PCs as Web servers.

In further developments, Ross has been dropping hints that while it will remain the champion of 32-bit SPARC for the foreseeable future, it does have plans for a 64-bit successor to hyperSPARC. However, the company says that no one should hold their breath waiting for it to appear. "The market just isn't there yet," says a company spokesman.

Far closer, says Ross, are chilled hyperSPARCs. The company is working with a "variety of different technologies" to cool down the processor during operation. In theory, and frequently in practice, an iced CPU is capable of a higher clock rate than a hot one. The company is not releasing any details, but says it hopes to have some sort of CPU refrigerator available by early next year.

Ross Technology Inc., Ross Microcomputer's parent company, was one of the early entrants into the SPARC

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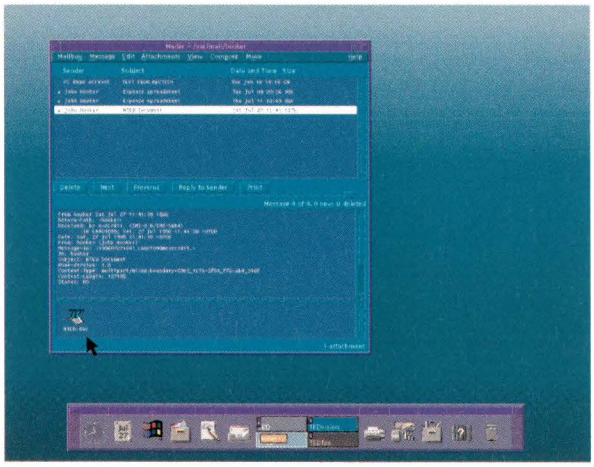

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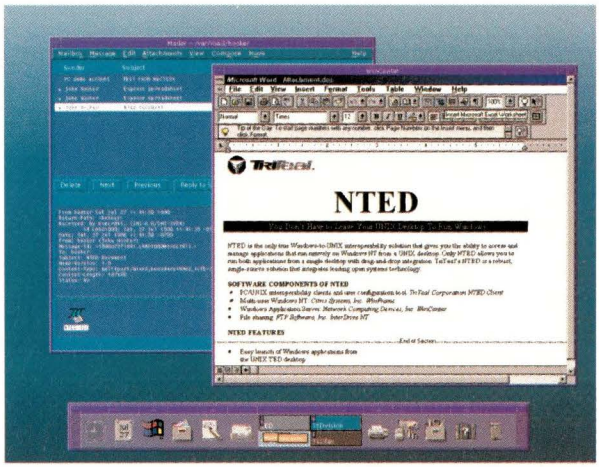

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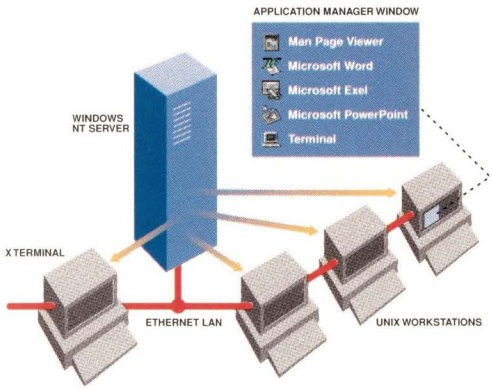

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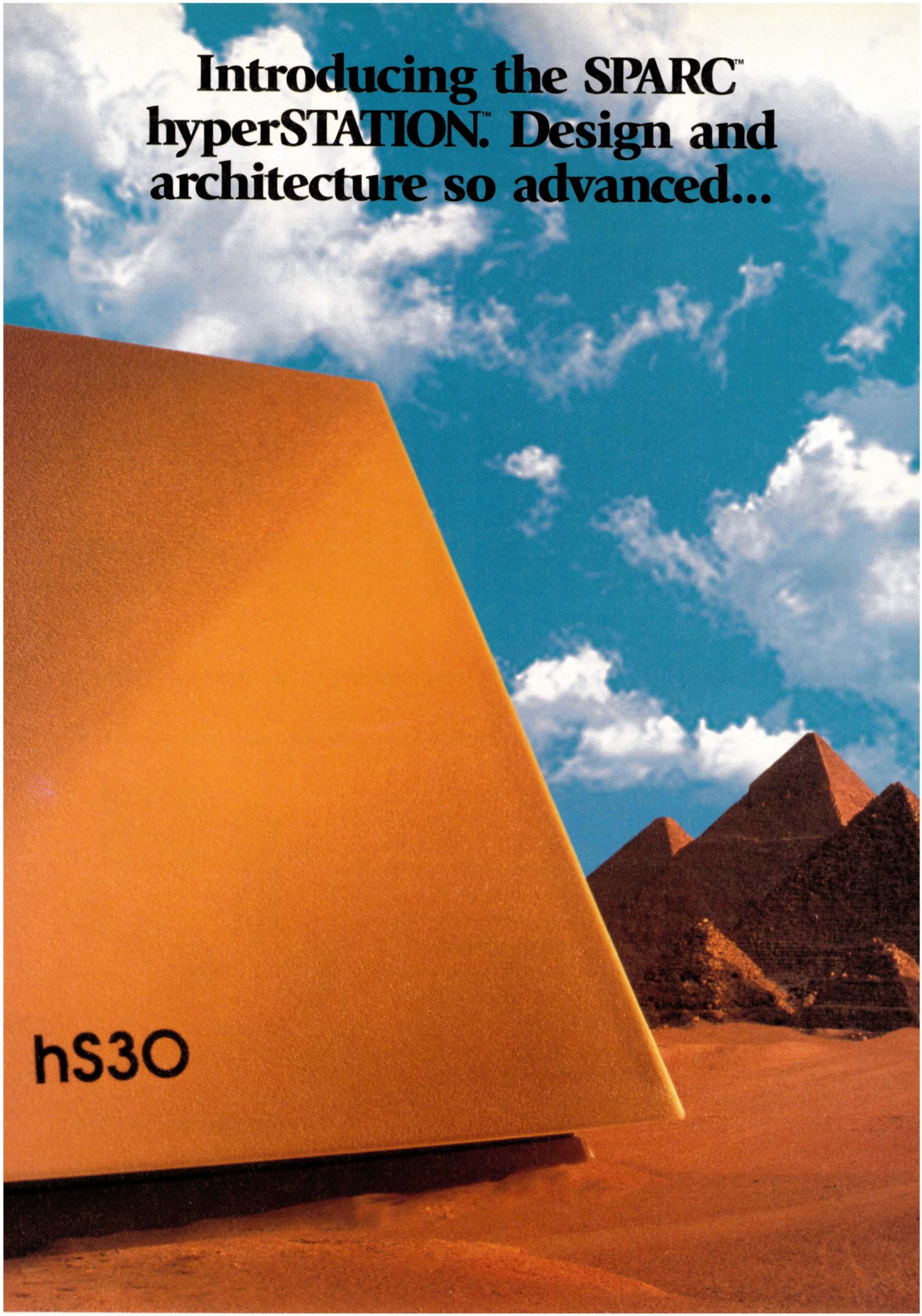
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business. Staffed largely by disaffected engineering talent from Motorola Inc.'s largely abortive 88000 RISC processor project, the company developed the hyperSPARC as a high-speed SPARC variant. In the early 1990s, however, it (along with the rest of the industry) discovered that the SPARC was not to be a merchant chip used by a large number of different systems vendors, as had been hoped. Rather, it would be Sun's largely captive processor.

The company was then in trouble when Sun (the only real buyer of SPARC processors) selected rival SuperSPARCs and UltraSPARCs as its CPUs of choice. However, Ross was able to parlay the hyperSPARC's superior floating-point performance into a Sun workstation upgrade business. Then, Sun itself selected hyperSPARCs for some of its technical systems.

Now, though, Ross believes the time is right for a SPARC-based system business. It sees a window of opportunity in the sci-tech and academic communities as Sun moves into larger markets.–*mjt*

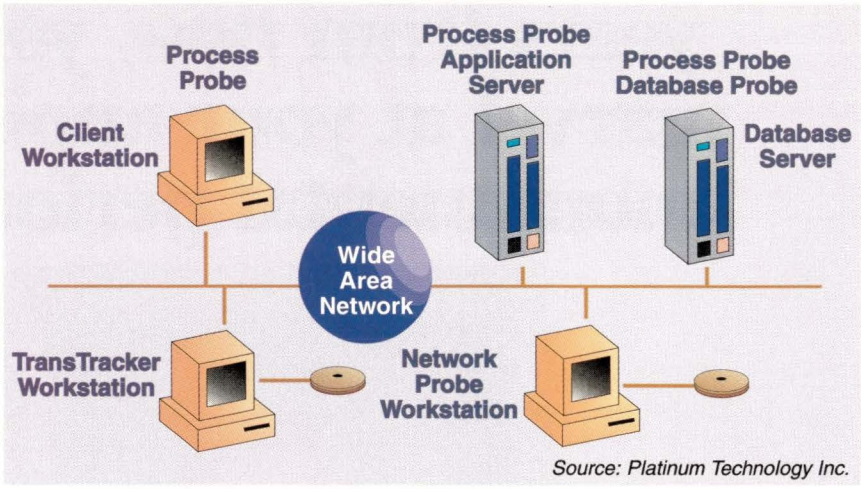
Platinum Introduces Management Tools

Platinum Technology Inc., Oakbrook, Terrace, IL, has introduced a series of tools designed to allow systems and network administrators to monitor the performance of their devices on an enterprisewide level. Among the tools are products designed for databases, networks and World Wide Web-based applications.

"Essentially, they are performance tools for the client/server setting," says Terrie Stickel, product marketing manager for Platinum Technology's Enterprise Monitor products.

And that's important, says Stickel, because what had been "mainframe applications are increasingly moving into that client/server model," but without the systems management tools that had been the norm in the mainframe environment. She argues that systems administrators are now trying to re-create in the UNIX environment what they'd had in MVS and VM.

To this end, Platinum is showing TransTracker and WireTap. TransTracker is described as a transaction measurement tool that allows application developers and evaluators to gather system, database and network performance statistics. It runs on a single device (perhaps a Sun workstation) and extracts transaction metrics from the network as a whole. Platinum says that TransTracker will be used by MIS officers to keep track of the existing networks, and to evaluate the impact of new software purchases on their existing operation.



TransTracker, from Platinum Technology Inc., is one of several performance management tools the company offers systems and network administrators.

WireTap is a network monitoring tool for Internet and intranet applications. It sits on the network and captures data on SQL transactions and HTML requests. Platinum envisions the product being used by, for example, a Web-based on-line catalog company to make certain that its operations are going on with maximum efficiency and effect.–*mjt*

MathWorks Links to Applix on Wall Street

The MathWorks Inc., Natick, MA, and Applix Inc., Westborough, MA, have announced Applix Link, an interface that will allow the former company's Matlab product to connect to Applixware software modules.

Applix Link will allow MathWorks users to access real-time data feeds through Applixware, process that information in Matlab, and then display it as an Applixware spreadsheet. Applix Link is chiefly meant for Wall Street firms.

For the past decade, the big news on Wall Street has been the migration of technical tools from the scientific and engineering disciplines to the financial ones. The rocket scientists of the business districts discovered that they used many of the same math tools as NASA. "The big picture is the convergence of many things," says Greg Panfile, market segment manager, Financial Toolbox, for MathWorks.

In the 1980s, a number of quantitative theorists began to discover that the performance of stocks, bonds and other investments over time resembled the behavior of signals and other phenomena in the physical world. They began to suspect that the analytical tools developed in physics and engineering might be applied to investments.

It also helped that relatively large numbers of engineers and scientists were on the market to be hired. "There were great social pressures," says Panfile. "There were cutbacks in defense contracts and the military. You had people who were well-trained in engineering looking for places to apply skills."

To its surprise, MathWorks found itself selling to financial markets and now has a division dedicated to just that. However, Matlab had been somewhat handicapped by the fact that it looked like a sci-tech application. Now, however, with the Applix agreement, it has a front end that will be familiar to virtually all Wall Street users–i.e., the spreadsheet. "Spreadsheets seem to be magic in the financial community," says Panfile.–*mjt*

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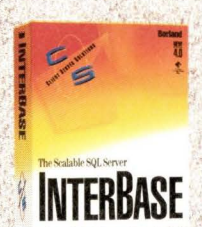

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Circle No. 10 on Inquiry Card

by MICHAEL O'BRIEN

"Basically, the problem is that CompuServe and Wow! misuse the return addressing information that accompanies an email message."
– *James Armstrong*

"Finally, and most relevantly here, reply-to should *not* be set to the whole list."– *Paul Dourish*

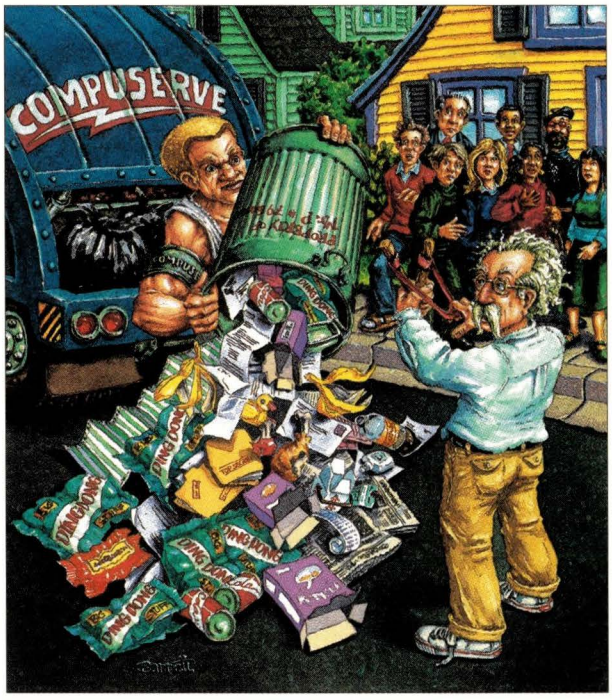
"It's time to taste what you most fear.
Right Guard will not help you here.
Brace yourself, my dear!
It's a holiday in Cambodia!"
– *James Armstrong's .signature file*

David, Goliath and Mr. Protocol

Q: *Look, I don't mean to pry or anything, but Mr. Protocol is far and away the strangest entity I've ever encountered. Where did you come up with him?*

A: Oh, good heavens, I didn't come up with him, he came up with me. I was digging around in the engine room of the first Internet service provider, the Computer Science Research Network, trying to figure out why all this electronic mail was falling on the floor, and I realized that the problem was that the network's user base had never seen email before and had no idea how to construct legal email addresses. Suddenly, Mr. Protocol appeared in a puff of...something...and started setting things straight.

Users were generally happy enough to hear what he had to say, though in those days his remarks were rather more pointed than they are today. Well, actually, that's a lie. Most of you have no idea what this fellow is really like, but I tone down his comments somewhat more today than I did then. But lately I'm thinking of taking the muzzle off.



Good Old Ignorance

In the good old days, people who violated Internet protocols did so out of ignorance, and on an individual basis. It was unthinkable to violate protocol knowingly. In the first place, there was just no point to it. What could anyone gain from doing something that would make it difficult for other people to talk to you?

Mr. Protocol took users to task not because they were evil-doers, but because their ignorance of the rules of mail and addressing led to some amazingly malformed addresses, which tended to defeat even the thoroughly bulletproof mail software the network ran on its central relay servers.

In all the history of the Internet, and of the ARPANET before that, there were almost no cases of deliberate and willful violation of Internet protocols. The community was homogeneous in that everyone was an ARPA contractor and no one was that much bigger than anyone else.

There was always the occasional oddball, of course. In the pre-IP days, electronic mail was handled via the FTP server, which had a MAIL command for this purpose. It was part of the FTP spec (you can still read it in the old RFCs) that the MAIL command was one of the FTP commands that anyone could run without logging in first. It made no sense for mailers to have this additional complexity. There was no actual human to be authenticated. The Multics crowd was having none of this. FTP couldn't do a thing without some sort of authentication.

Therefore, a separate account was set up just for exchanging mail with Multics sites, and every mailer in the world (at least, every mailer that wanted to be able to send mail to Multics users) had to have a special piece of code wired in that would check to see if the host were a Multics host, and if so, would go through the cockamamie MAIL logon procedure, using the well-known user name and password created on Multics for this purpose.

People put up with this more or less because they had to. Multics wasn't about to change, claiming it didn't have the manpower, and the Defense Communications Agency (DCA), which ran the ARPANET under con-

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tract to ARPA, was nevertheless not an active participant in the ARPANET and had only the foggiest notion of the issues. People figured that putting a hack into the mailer was a smaller price to pay than waking the sleeping dog that was DCA, especially since the last time DCA woke up, it was to threaten a major institution with loss of all ARPANET connectivity because of the existence of a mailing list about wine-tasting.

The point is that peer pressure has always been the only really effective enforcement tool on the Internet. It has always been a cooperative venture. As the Net has grown, though, the size of the partners in the venture has also grown, and enlightened self-interest as an architectural tool is beginning to show signs of strain.

Consider the latest flap. But in order to consider it, a lesson in mail headers is necessary.

Examining Headers

Generally, people ignore the lines in a mail header. Most of them are profoundly uninteresting. The Message-ID field is a particular rouser, and the Received-From lines are always eagerly inspected, of course. More modern mail user interface programs are taking the tack that most mail header lines should be suppressed, or at least hidden until asked for. Sometimes the entire mail header is suppressed, and the information in it removed and reformatted for more painless display. But these various components are there for a reason, and when someone messes with them, bad things can result. If the "someone" is very large, very large amounts of bad things can result.

What bad things? Mr. Protocol is glad you asked. Let's look at the territory we're working with, first.

Every message has a "From:" field. It's one of the few fields whose existence is really mandatory. Its meaning is simple: It is the definitive field naming whom the message is from. So far so good.

Suppose the message is some sort of automatic message. In that case, it's still "From:" the original person, but that person didn't mail it to the recipient, some program did. Hence, there is an optional "Sender:" field. If present, it names the person or entity immediately responsible for the mail having landed in your mailbox, though they may or may not be the original author.

Ordinarily, one is supposed to reply to the address given in the "From:" field, but this may be overridden if a "Reply-to:" field is present. This can be present for any reason, but if it is present, replies to the originator of the message should go to this address.

There is another header component in the "From" family, one that has its origins not in the RFCs, but in Murray Hill, where UNIX was first written. One popular format for storing mail in mailboxes has a line beginning with "From" followed by a space, followed by the originator of the message. This is called the Berkeley mail format because its use was popularized by the dispersion of the Berkeley flavor of UNIX, which stored mail this way. Until then, ARPANET/Internet mailboxes had consisted of mail messages separated by lines consisting of

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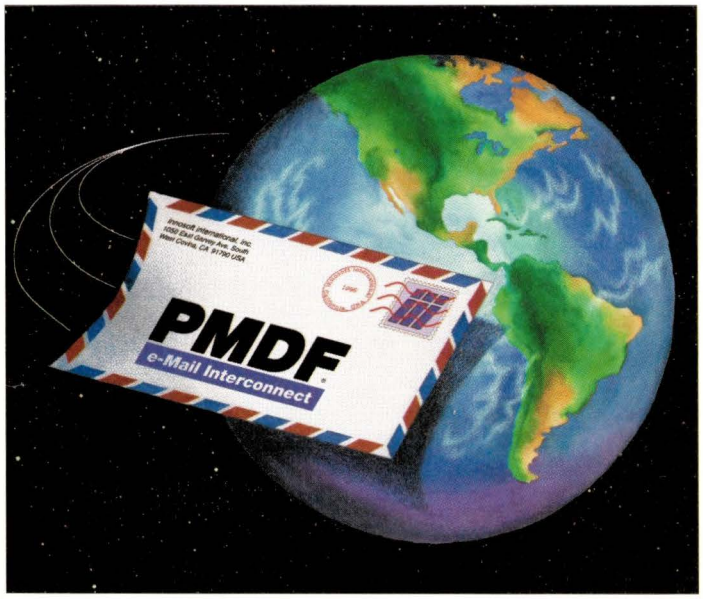

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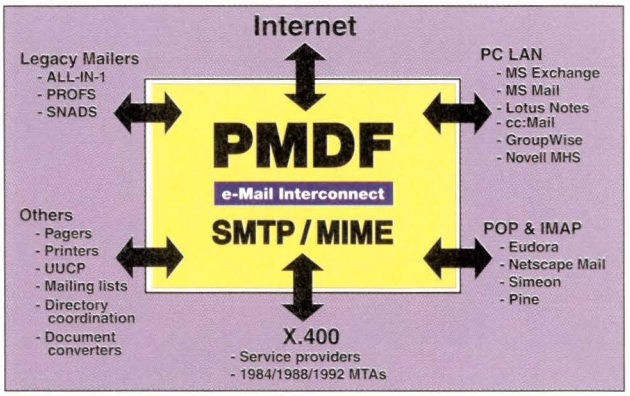

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four control-A characters.

Actually, the use of "From whomever" is an ad hoc format that was invented by the first authors of UNIX, long before UNIX was ever put on a network. In those days, this "From" line without a colon was the only header that mail messages had, giving the sender and the date the mail was sent. The date was both the sending date and the delivery date since the mail was sent and received on the same machine, effectively instantly. UUCP came later, and the Internet, later still.

In current usage, this form of the "From" line holds the so-called "envelope" information. Request for Comments 822 defines the format of a mail message, but it doesn't define how it should be delivered. That's handled by Simple Mail Transfer Protocol, SMTP.

Strictly speaking, it wouldn't be necessary for SMTP to state whom the mail is from. It could just connect, indicate who the mail was to be delivered to, deliver the mail, and get a return code indicating whether things worked or not. However, SMTP does specify a `FROM` command. There is no mechanism defined by which this information is ever used for anything, nor is there a mechanism for it to work its way into the RFC 822 header. In a process not blessed by any standard whatsoever, but in common usage, this SMTP `FROM` command information is stored via the "From" separator line in the Berkeley format.

This gives us a minimum of at least four separate header components indicating something about whom the message is from. We have "From-with-a-colon," "From-without-a-colon," "Sender:" and "Reply-to:". Which one actually gets used in formulating a reply?

The pecking order is pretty clear: use "Reply-to:" if it's present, otherwise use "From:" (with a colon). "Sender:" merely informs you that any reply may startle the originator of the message, since they didn't send it to you directly. "From-without-a-colon" is beyond the pale, and your mail user interface program can do anything it likes with the information.

The point is that "Reply-to:" is at the top of the heap. Replies should go there. Now, we begin to approach the nasty part of this month's business.

Replies go to the "Reply-to:" field, but delivery error messages do not. These are messages that are automatically returned to the sender when email can't be delivered. Delivery error messages aren't, in fact, supposed to use any part of the message header at all, according to the RFCs. They're supposed to go to the "From" address in the envelope information, that is, to the address given on the Berkeley-style "From" line, if present. Delivery error messages should be able to get this information directly from the mailer's memory of the original SMTP dialog, not from the actual transferred text. That is, the envelope information may appear in the Berkeley-style "From" line, but no automatic return error message should have to use that line.

This is important where mailing lists are concerned. Mailing list distribution programs deal in volumes of mail so huge they could be used as landfill. People disappear all the time, and delivery error messages are a frequent fact of

life. When a mailing list redistributes a message, it changes the envelope to point to an appropriate list-maintenance administrative mailbox, not to the originator of the message, and certainly not to the list address.

Serving Up Error Messages

Enter a player on the Internet stage. A really big player–CompuServe, in fact. CompuServe does not send delivery error notifications to the address in the envelope. It never has. It sends them to the "Reply-to:" address instead. And it says it won't change.

Many mailing lists set a "Reply-to:" address on every message they redistribute, pointing to the list. This is done so that replies to a list message go by default to the entire list. These lists are therefore peppered with error messages announcing that someone once on the list has quit paying their CompuServe bill and doesn't exist anymore. And there are a lot of these messages because CompuServe is big. In fact, there are many, many of these messages peppering mailing lists all over the place.

This is a complete swamp, with no obvious way out. DCA doesn't have anything to do with running the Internet any more, outside of its own small area. No one involved with the Internet has any enforcement powers outside their own sphere. So, there is no one, even theoretically, who has the power to slap CompuServe's wrist and tell it, "Bad provider! No donut!" If necessary, you can track down spammers in person and take care of the matter (Mr. Protocol wonders why no one ever seems to try this), but everyone knows where CompuServe lives, and it does no good at all.

CompuServe's attitude about this problem has always made perfect sense to CompuServe, though it looks twisted from the Internet perspective. CompuServe is older than the Internet. To CompuServe, Internet connectivity is on the fringes of the user's universe, a value-added service. The internal CompuServe forums are the centerpiece. Internet mailing lists just encourage junk mail and don't merit serious attention, though some of the more important ones are gatewayed to forums.

In fact, CompuServe used to refuse to forward mail that originated with a CompuServe user back out to an Internet mailing list, even when the subscriber was responding to a discussion that originated on that list. The list traffic was regarded as "value added," not something to be added for free by CompuServe. Subscriber threats and screaming, at least, ended this behavior.

There is little that anyone can do about this, other than isolation. Maintainers of large mailing lists are slowly moving in this direction. Some list maintainers refuse to add CompuServe addresses to the direct-delivery versions of their lists, automatically adding them to a digest version instead. Because replies to digests are thrown into a mailbox for the next digest, delivery error messages can be weeded out.

Other list maintainers, tired of this behavior, are preparing to announce that all CompuServe subscribers will be deleted from their lists after a one-

month grace period to permit subscribers to find other providers. Drastic as this action may seem, it will probably have little or no effect on CompuServe except from a public-relations perspective. From the viewpoint of most CompuServe users, Internet mailing lists *are* a fringe benefit, and in most cases probably not an important one.

Persistent negotiation over seven years has failed for at least one list maintainer. Still, it seems this is the only feasible action to take for now. CompuServe responds to public outcries, but this issue is sufficiently subtle in its cause, if annoying in its effects, that it seems unlikely that any great ground swell will appear spontaneously.

Reply to Whom?

And the issue is not lily-white on the Internet side, either. Remember how Mr. Protocol mentioned rather blithely above that mailing lists routinely set a "Reply-to:" header component to the list, to facilitate replies? This has burned some people's bacon. Their notion is that this actually raises all kinds of mischief. In their view, and Mr. Protocol believes that it is a defensible one, there should actually be two kinds of "reply" commands in every mail user interface program: one to reply to the author only, and one to the author and all other recipients. The second kind of reply command would handle the case of replying to a mailing list, because the list address appearing in the "To:" field would also be picked up.

Also, this handles the case where someone wants to reply to the author only. The mind-set one has after years of using the same mail program is firmly fixed: reply to the author to reply to the author. If messages are sent to a mailing list, though, the risk is high that a message will go out to the entire list consisting of something like, "Hi Jim Bob! Have you got that red paint off your dentures yet? Bet you weren't expecting Martha to throw you clear into the side of the barn like that, and in your skivvies too, ha ha." This probably won't be the final communication between these two people, but probabilities are high that it's close to it.

This begs the fundamental question: What can be done about large players on the Internet stage who refuse to behave? Small amounts of this behavior are already rampant: Companies like Netscape and RealAudio, rather than working through the standards process, figure to make a lot more money by taking existing standards, developing extensions of them, and hoping to make these extensions *de facto* additions to existing standards by making them popular in the marketplace...to a now-captive audience. However, when someone flat-out breaks the existing rules because they just don't care, the lack of any enforcement arm of the Internet becomes apparent.

This is not to say that there *should* be an enforcement arm of the Internet. In fact, Mr. Protocol rather hopes there won't be. This would act to stifle change and development more than it would help, and the consequent problems are, so far, relatively small. However, there *are* problems, and it looks like they're going to get bigger. Perhaps it's time to start worrying about how to deal with them. ⊸

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`.

Flipflap

As this issue went to press, Mr. Protocol received the following communication, written to some of the principals involved in the flap described above. This is extremely encouraging news, as it indicates that the Internet model of cooperative competition may yet survive for a while. This gives us a little breathing room in which to address the question of how to deal with large organizations that might prove less supportive than CompuServe proved to be in the end.

```
To:      Distribution
From:    Tom Haney - CompuServe

   On behalf of CompuServe, I would like to apologize
for the problems with mailing lists which you have
experienced. Engineers are currently working to change
the way in which errors are bounced to a list, follow-
ing standard conventions and RFCs. This update to the
"new" CompuServe Mail system should be incorporated
soon. There are still some mailboxes on the "old"
CompuServe Mail which, for technical reasons, will
continue to generate delivery reports as they always
have. Our goal for the next few months is to move most
all our mailboxes to the new CompuServe Mail system.
   A confused sysop stated that CompuServe discouraged
mailing lists. This is not true.
   Let me know if you have any questions. We are aware
of the inconvenience and we are working to put a change
in place quickly. Sorry for the delayed response.

Tom Haney
CompuServe Mail
```

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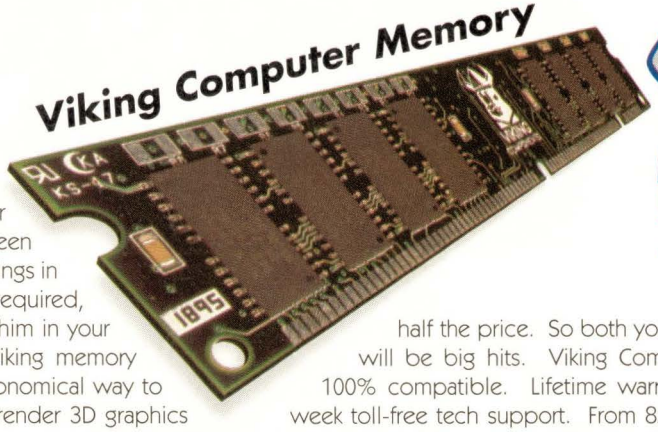

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by PETER COLLINSON, Hillside Systems

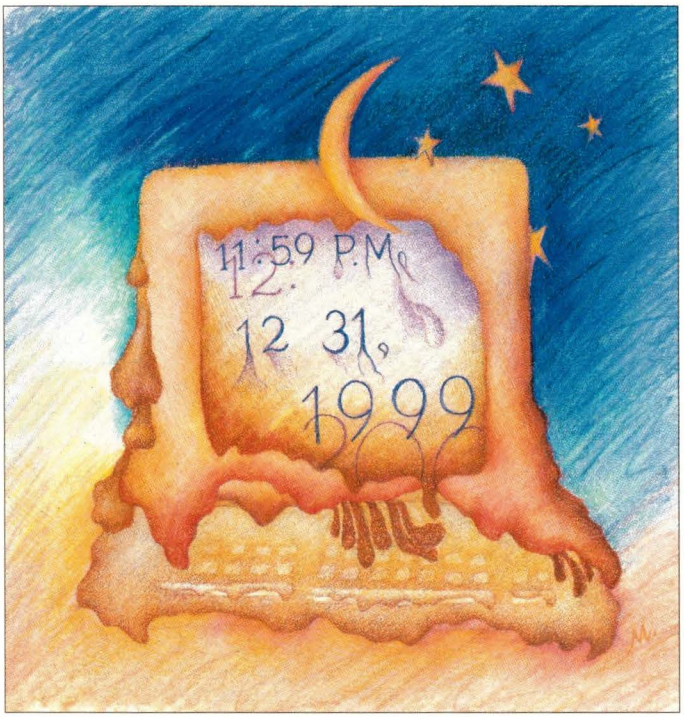
Tempus Fugit

We all take it for granted that our computer can tell us the time. You've probably got a little clock on your desktop ticking your working day away. Time is stored as the number of seconds from January 1, 1970. Using this particular starting point was a unilateral decision by Ken Thompson when he designed the system. It seems to have spread from UNIX to many other systems. With UNIX, the number is usually signed a 32-bit integer, so there are 31 bits of positive time that end on Tuesday, January 19, 2038 at 3:14:07 a.m. (Note: If you give Sun's time routines a negative number of seconds, they will print times before 1970.)

Recently, there has been great concern in the British Parliament that computer systems will not reflect that the last year of the millennium has arrived when clocks signal that it is January 1, 2000. Programs will continue to print dates with the preceding "19," and the year will be shown as 1900. Worse, many programs use only the last two digits of the year for time comparison. Suddenly, in the year 2000, a program that expects the two-digit year to be greater than the previous year's value will be sorely disappointed.

Undoubtedly the problem is a real one, but it may not be so for UNIX systems, whose time-decoding routines return the year from 1900. It depends on whether or not programs have been coded correctly. To be sure, the issues of the year 2000 need thinking about.

The notion of running out of bits to store the time on a system is likely to cause even more problems. Luckily, I will probably not be around in 2038 to witness the worry that will occur. The real problem will not be the live computer systems but all those timestamps on stored files that contain 31-bit times.



Still, I expect the solution will be to adopt an unsigned number for the time, giving an extra bit and another 68 years or so of untroubled running. Adding the extra bit will push the problem into the future, something that humans like to do.

The early UNIX systems running on PDP-11s maintained time using a clock that created a tick from the sine wave coming from the mains electricity supply. Obviously, the clock ticked in sympathy with the mains frequency, 60 times per second. Actually, in Europe, we had some problems with 60 being coded into some programs, because our mains frequency is 50 Hz.

The mains frequency is not particularly stable. I understand that in the UK, the power generation companies track the drift and adjust the frequency from time to time to ensure that mains-powered wall clocks remain accurate.

By the early '80s, computers were being supplied with their own crystal-controlled clocks, ticking at 1,000 Hz or faster.

The job of maintaining the time-of-day value is the same, whatever the source clock frequency. The kernel counts some number of internal clock ticks and increments an internal variable when a computed second has passed. The clock is simply a memory

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location in the kernel that stores a number. To set the clock, you simply load a value into the variable, and off it goes.

Time Zones

UNIX has always set its time-of-day clock to Greenwich Mean Time (GMT); this is now officially called Universal Coordinated Time (or UTC, a French acronym). The system then uses software routines to adjust from the stored value to a local time when a user wants to see a time in their time zone. It's not just the time zone that needs to be dealt with; programs have to cope with the annual start and finish of daylight saving time as well.

Of course, it's possible to avoid all this grief and simply run the machine with a local time value loaded into the kernel. This is what MS-DOS does. However, using a standard "canonical" time on all systems, wherever they are in the world, has proved to be sensible. As networks joined computers together, people could suddenly access more than one machine in one session, loading files from different systems in different time zones.

Each file bears a timestamp that means the same thing, the time starting from GMT. So across the globe, file times are comparable. There is no possibility that a file will be copied onto a machine and suddenly appear to have been created before the time shown by the clock on that machine. Running the clock on GMT also means that you don't need to reset the clock by hand twice a year as the earth orbits the sun and daylight saving time starts and stops.

It has taken some years to get the conversion from stored time value to local time to work well everywhere. The original UNIX systems retained two pieces of information about time in the kernel: They stored the local time zone details as an offset in hours from GMT; and they had a flag to say whether the machine should cope with daylight saving time. The time decoding routines used these two values to convert the time of day in seconds into a local time. The routines had an intimate knowledge of the names of the various time zones and also knew the algorithm used to switch daylight saving time on and off.

The distributed daylight saving algorithm didn't work well in the UK, where the dates of daylight saving time are decided by Parliament each year, and so sometimes the dates change. Even the people who print diaries have to second-guess Parliament and sometimes get it wrong. I guess that most Brits wait for the BBC to tell them when the clocks will change.

The rest of Europe also had problems with the original distributed code because they used different dates from the United States to start and stop daylight saving time. The general result of all these problems was that many sites on this side of the ocean ran their UNIX clocks on local time, changing them twice a year by hand.

Then, the first step on the road to

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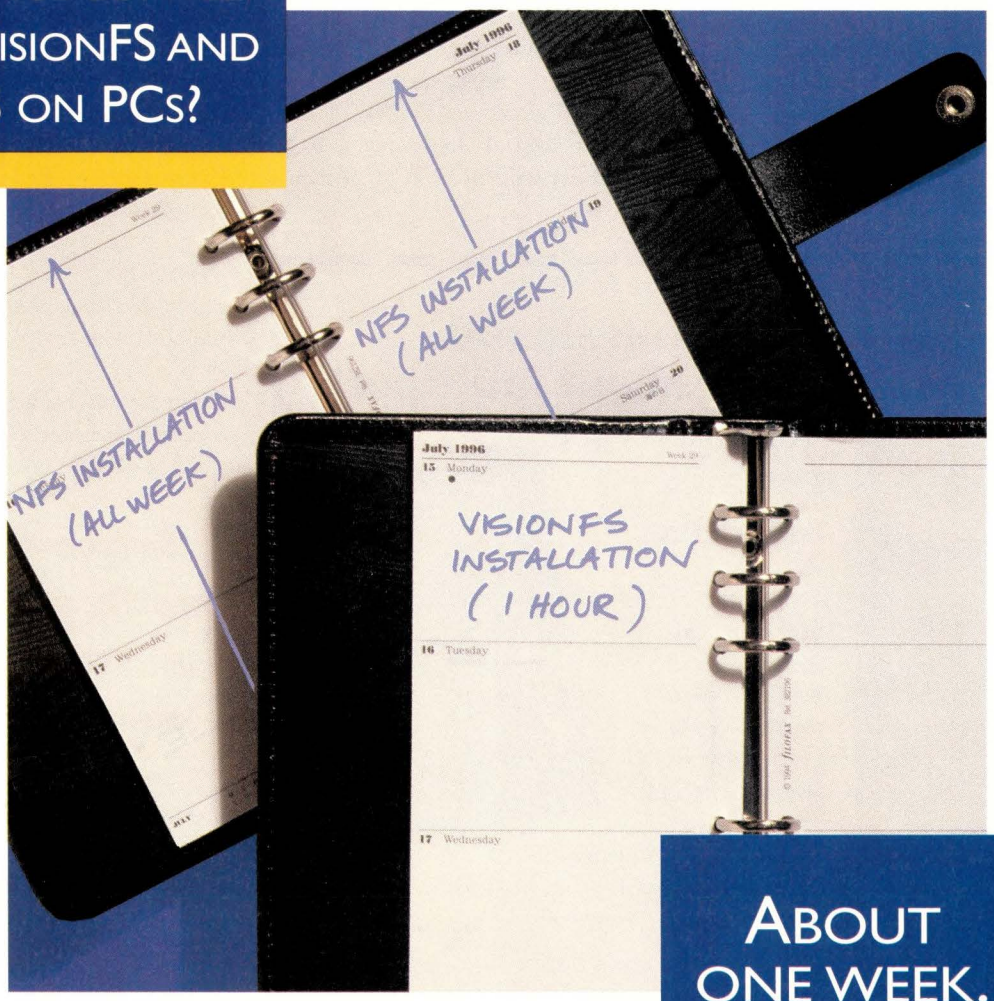

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getting the clock code to work everywhere arrived. Someone thought it would be a good idea for users to be able to see their own time when they used the emerging network to log into a machine that was several time zones away. The TZ environment variable was invented. You defined the variable to be an odd-looking string. For example, when using a system from the UK, I would say

```
TZ=GMT0BST
```

The string has three parts: The first is the name of your primary time zone; the second is the number of hours west of Greenwich; and the third is the name of your daylight saving zone. So my value says that my primary time zone is GMT. I am zero hours west of Greenwich, and my summer name is BST, for British Summer Time. Now when I call the `date` command or `ls` prints a date, the code looks for this string and adjusts the time accordingly.

The format of the TZ environment variable can still be used today, although the code that implements the time decoding is somewhat different. I use it to find out the local time in California when I call my friends. I have a script called `westdate` that reads as follows:

```
#!/bin/sh
TZ=PST8PDT export TZ
echo 'West:' 'date'
```

The TZ variable helps with time zones but does not resolve the problems with the daylight saving time compu-

Someone thought it would be a good idea for users to be able to see their own time when they used the emerging network to log into a machine that was several time zones away. The 'TZ' environment variable was invented.

tation, except that I can now change my TZ variable to lie about where I am in the world and, as a result, force daylight saving time on and off by supplying "incorrect" values for the digits in the middle of the string.

zoneinfo

Then came Richard Nixon. He decided to alter the U.S. algorithm that was used to change in and out of daylight saving time; he wanted more daylight on election day. The sudden U.S. need to get the system to show the correct time prompted several people around the world to cooperate and create a new mechanism for computing local time. The project

was masterminded by Arthur Olson of the National Cancer Institute in the United States, who broadcast the code to the Net. The code was adopted by Berkeley for the BSD releases, and Sun picked it up from there.

The basic idea is that the date routines read local configuration data from a known file, originally called `/etc/zoneinfo`. For execution efficiency, the file is precompiled into a binary form from a text specification. The file contains the name of the local time zone, the name of the local daylight saving time and the rules used to control when things change.

To select your time zone, you simply move the appropriate binary file into place, and bingo, all the commands that access the date routines pick up the correct value for your time zone and your daylight saving time change days. If you need to set a new rule, then you can edit a text file and run a special compiler called `zic` to create a new binary file.

The `zoneinfo` file contains the historical rules for your time zone, so it always generates the correct daylight saving time for dates in the past. The other benefit is that you have access to everyone else's rules so time requests for other time zones are correct, assuming that you have the correct files on your machine. I know that it was necessary to change most European ones last year, as the European Commission sought a compromise while encouraging each country to switch to and from daylight saving time on the same day.

In SunOS 4, the `/etc/zoneinfo` file migrated to the `/usr/share/lib/zoneinfo` directory. Your local time zone information is stored in a file called `localtime` in that directory. For Solaris, you are asked for your time zone name when you install the system, and the answer is loaded into the `TZ` variable for all users. The content of the `TZ` string is used to select a file from `/usr/share/lib/zoneinfo`. By supplying compiled files and naming them for the old `TZ` variable values, the `TZ` semantics were preserved.

In the `zoneinfo` directory on your Sun machine, you will find the text files that are compiled to make into binary files used by the system. They make fascinating reading and are stuffed full of comments on the history of time management across the world.

I said "Sun" machine specifically because many vendors only supply the binary files, and some vendors don't put the `zic` compiler on their distribution either. The omission means that you are no better off with the `zoneinfo` system than without it. You cannot change things on your machine. Of course, you can still find the original *zoneinfo* posting on archive sites like UUnet, so you can get the code and the original text control files.

Getting the Right Time

I would like to run all my machines with the correct time, and also I want all my machines to show the same time. In some ways, the desire for the machines to show the correct time is

less important than the need for them to all run with the same time. There can be undesirable effects when sharing files across several systems, where each is running with different values in their clocks.

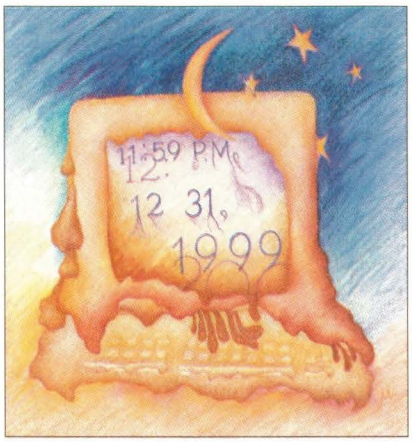
The problem of clocks on different machines not being synchronized affects all programs that get files across a network and use timestamps to determine whether or not a file has changed. If you saw my article last month on file caches, then you will perhaps remember that caches often use file timestamps to decide whether data has altered or not. A file will only be moved across a network into the cache if the remote version is newer than the cached copy. The underlying assumption is that time is a constant and the times on the two machines are the same. If the clocks are not in synchrony, there can easily be situations where the time comparison fails to operate correctly.

The first attempt at synchronizing clocks on machines was done at Berkeley. It used the simple strategy of having one machine ask another for the time and set its clock by the time that was sent. The command that does the work is called `rdate`, and you can still find it on SunOS or Solaris systems. The clock is generally set at bootstrap time to avoid the problems associated with changing the time on a live system. After setting, the clock runs free and hopefully both machines will maintain synchrony.

There are problems with using `rdate`, however. For example, what happens if you have a power failure, all the machines are rebooting and the reference machine is unavailable? Also, it turns out that clocks on systems drift and do not maintain the same time. There are several possible reasons for the drift.

First, the clock code computes seconds from a crystal clock that ticks very frequently, and if the crystal clock is slightly inaccurate then you multiply that inaccuracy. Second, counting seconds works by interrupting the processor and incrementing a counter in the interrupt routine. It's possible for the machine to be busy so that clock interrupts are missed, making the clock inaccurate. Finally, we tend to allow machines to remain running for long periods. We boot them infrequently, and slight inaccuracies are increased with elapsed time.

If we keep machines running for some time and want to resynchronize them, then we need to use `rdate` again. There are unpleasant consequences of setting the time on a machine that is live. The exact problems depend on the difference between the previous time that the



machine was using and the new value we are loading. If the clock was moved on, missing some time, then there's a possibility of creating confusion in commands that use the clock, such as the `cron` daemon. If the clock was set back so that time is repeated, then programs like `make` that depend on time advancing steadily will not function correctly.

Setting the clock with the `date` or `rdate` commands will generally introduce a discontinuity in the flow of time on the machine. The discontinuity is not a problem at bootstrap time when nothing is running, but on a live system it will break the assumption that time increases steadily and, consequently, will confuse programs. Anyway, if you are keeping machines in step, their clocks will not vary by much, perhaps a few seconds. What was needed was a way to adjust time without any discontinuity.

Someone invented the `adjtime` system call and it was incorporated into the Berkeley system in 1984. The idea is clever and simple. Time is maintained by counting, say, 1,000 ticks and then incrementing the central variable holding seconds. You can make time pass more quickly by only counting say 500 ticks, and more slowly by counting 1,500 ticks. This is an overexaggeration; you tend to steal or add ticks depending on a scaling factor. For example, the maximum change that SunOS will make is 100 msec in every second.

To adjust the time of day clock by some number of seconds, you tell the kernel the value via the `adjtime` call. The kernel can only add or subtract some fixed number of ticks for each second that it counts, so it can take some time for your change to take effect. For large changes, it's still necessary to set the clock to a new value.

Monitoring Time

The `adjtime` system call represented a breakthrough. Once a program was able to adjust the system time invisibly, it was possible to write time-monitoring programs that frequently reach out over the network, get a reference time and set the clock from it. The first time-monitoring program was `timed`.

The idea of `timed` is that one machine on your network is the master time server. Its job is to communicate with all other `timed` daemons. The master clock sends timestamps so that its client daemons can resynchronize their own clocks using `adjtime`. The update message from the `timed` server contains a time difference and not an absolute time, and so it is not subject to network delays.

The server derives its own time by requesting time from all the machines that it knows about and computing the average network time. To avoid a rogue machine throwing the entire calculation off, its time is only considered valid if the time that it sends is within some small difference from the current network time.

The `timed` system copes with the death of the master by implementing an election process so that all the remaining `timed` processes decide among themselves who the new master should be. This is controlled by a configuration file, and so is not entirely free and unbiased voting.

The `timed` system was designed

PRINCIPLES FOR
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#13

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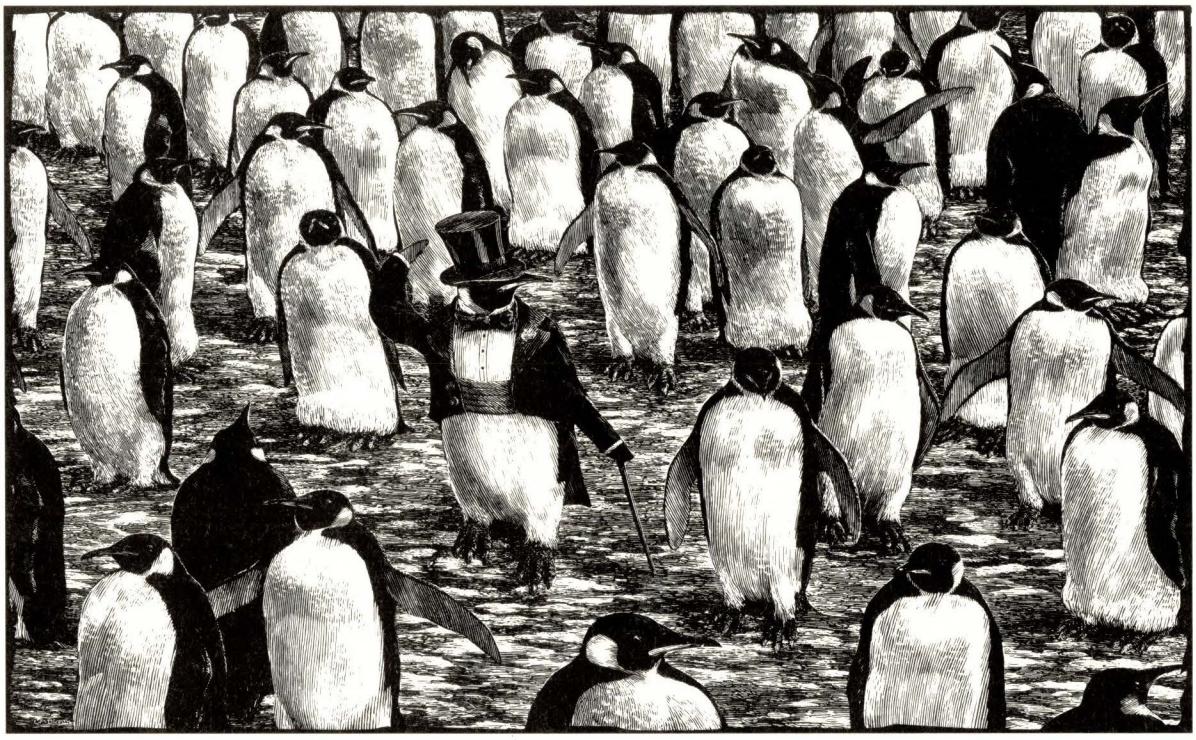

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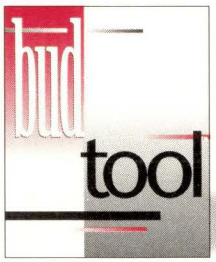

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and implemented at Berkeley. It was widely distributed with 4.3BSD and has found its way into many other systems. For example, I looked at the manual pages for SCO UNIX while writing this article.

The fundamental problem with `timed` is the use of average network time. Humans prefer accurate time and an averaging process doesn't deliver that. You need only one machine to have a pronounced drift that is within the change limits, and its inaccurate time can influence the whole network. This happened at the university where I used to work. Clocks on PCs are notoriously inaccurate, and a Sun386i machine had to be removed from the time control system because its clock was badly broken and ran slowly. Gradually, the bad clock made the time on the whole network drift away from reality.

Also, `timed` did not permit you to take advantage of a clock driven from some reliable external source. It was impossible to say "this clock is highly accurate, rely on it."

Network Time Protocol

Another system was needed, and Network Time Protocol (NTP) was born. The aim of NTP is different: It doesn't seek to synchronize clocks from some average network time but rather to inform hosts of the correct time so that they can monitor and set their own clocks. NTP works hard to eliminate network delays from timestamps, and there has been considerable research done into the best way of delivering accurate time packets to your system.

The aim of NTP is different: It doesn't seek to synchronize clocks from some average network time but rather to inform hosts of the correct time so that they can monitor and set their own clocks.

NTP assumes the existence of several systems running NTP servers that have access to accurate time standards. Devices that deliver highly accurate time have become more available. There are systems that have direct access to atomic clocks or can obtain the atomic clock signals that are broadcast by radio. The satellite-based Global Positioning System (GPS) transmits accurate time for navigational reasons, and inexpensive receivers with ASCII output are now available.

In the NTP system, these accurate reference systems are called level zero sources. They will be connected to a machine running at level one. The machine will act as a reference clock for other machines, which are running at level two. In turn, these will pass on the time to other machines, and in the end your local machine will be synchronized. There is, thus, a hierarchy of time servers, each one getting further from a primary source.

Time update is done by a client

sending a request message to an NTP server. The server changes some time fields in the message, recomputes the checksum and returns it to the client. The client has inserted a timestamp in the message before it was sent, and restamps it on its return. The complete collection of times is now enough to evaluate the local drift of the on-machine clock from real time. The network round-trip time can also be computed and the local clock adjusted accordingly.

The NTP program is provided with selection code to choose the "best" time sources from a range of possible sites. Your time management benefits from having many servers supplying time. You can point your NTP process at several clock sites, and it computes the best time from the data obtained from them. The rules for selection of the best source are complicated and I suggest you get the Internet RFC document if you are interested. The latest version of NTP, Version 3, is documented in RFC 1305.

The NTP program is a server as well as a client, and can provide its own time to others. It can do this by polling other servers to exchange times, or it can broadcast a time signal on your network, allowing other servers to pick up its time and use it.

The downside of NTP is that it demands that you are permanently connected to the Internet because the server sends regular packets out to its peers performing time synchronization. When my site was connected to the Net via ISDN, I needed to minimize connection time because ISDN connections are charged per minute like a regular telephone call. TCP/IP over ISDN would time out after some period of inactivity, but I didn't feel it was possible to use NTP because it would have kept the ISDN connection up for much of the day. Such frequent connection would be prohibitively expensive in the UK.

The alternative was to use a program that comes with the NTP package, `ntpdate`, to regularly poll various sources of time and set the clock on my machines. The `ntpdate` program can poll several time sources and derive the best time from all of them. After the poll was done, I let the clocks on the machines run free.

It was not possible to run my machines in synchrony because you cannot use the NTP server *and* `ntpdate` on the same machine. There seems to be no easy way of making a set of NTP synchronized have occasional injections of "good time." I now have a permanent Internet connection and run NTP.

Sadly, Sun doesn't distribute NTP. I found that the most recent version compiles and runs easily on Solaris 2.5. You can get the package using anonymous FTP to `louie.udel.edu` and looking in the directory `pub/ntp`. ⊸

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

by RICHARD MORIN, Technical Editor

Open Season on Operating Systems (Take 2)

Nearly three years ago ("Open Season on Operating Systems," November 1993, Page 38), I speculated about the future of operating systems:

"System software could become decoupled from the hardware vendors. This would free us to buy computers on the basis of performance, reliability and service.... Adventurous types could mix and match their system software. Pick up a microkernel here, a file system there and a user interface somewhere else."

Although my full prediction clearly has not been fulfilled, there are some definite motions in the described direction. There *are* add-in file systems and user interfaces. There are also gazillions of operating system options for Intel hardware and about a dozen for SPARC machines.

So, although Solaris is Sun's preferred operating system for the SPARC platform, it is quite possible to find reasonable alternatives. The most obvious contender, of course, is SunOS. SunOS is clearly the most popular environment for BSD-oriented Sun users.

Solaris and SunOS are not, however, the only games in town. There are several operating systems optimized for real-time applications, some freeware UNIX clones and one or two others. Let's take a look.

Chorus MiX

Chorus MiX is a commercial real-time operating system sold by Chorus Systems (`http://www.chorus.com`). It is an open, distributed, real-time operating system, which is binary-compatible with UNIX SVR4.0. Chorus does not sell binary versions of the system to end users. Instead, it licenses its source code to manufacturers, systems integrators and value-added resellers.

The operating system uses a communications-based technology that relies on a minimal nucleus (read: microkernel) and a set of independent servers. Extensions over traditional UNIX include a distributed file system, distribution of processes and signals over a network or bus, and real-time functions and responsiveness.

The GNU Hurd

The GNU system (aka the Hurd or the GNU Hurd) is a multiserver clone of UNIX, based on the Mach microkernel (see last month's column). At this writing, Version 0.0 of the system has been released. By press time, I would expect it to be up to Version 0.0.x, for some fairly small value of x. Thus, the current Hurd is only suitable for the really adventurous.

More to the point, it isn't even available, as yet, for the SPARC platform. So why am I bringing it up? Well, a couple of reasons.

First, the GNU Project (`ftp://prep.ai.mit.edu` or `http://www.gnu.ai.mit.edu`) has a very good history of getting its code to work on

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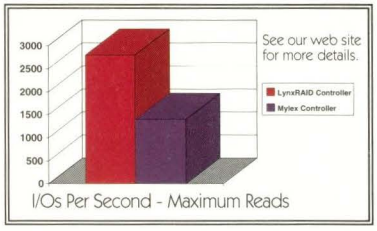

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multiple platforms, as well as maintaining and improving it over time. In addition, its code frequently has far fewer artificial limitations than commercial (or even other freeware) versions. So, I think the GNU Project has a good track record.

I also think that the portability of Mach, coupled with the modular design of the Hurd, may cause the GNU system to mature very rapidly. Thus, Version 1.0 may not be more than a year away. My *own* track record for predictions notwithstanding, I think the Hurd will be worth watching.

LynxOS

LynxOS is a commercial real-time operating system sold by Lynx Real-Time Systems (`http://www.lynx.com`). It is a POSIX-compliant, UNIX-compatible operating system designed for hard, real-time applications. It provides fast, deterministic response and allows the user to build configurations ranging from a small ROM-able kernel to a fully self-hosted development system. LynxOS also provides networking, windowing and industry-standard development tools.

NetBSD/sparc

SunOS is Sun's adaptation of BSD4.2, with some BSD4.3 extensions. Thus, it does not offer all the latest BSD-isms. Users who want to track the latest developments in the BSD series should look at NetBSD, which is derived from the (freeware) BSD4.4-Lite distribution.

NetBSD/sparc is a port of NetBSD, maintained by Paul Kranenburg. It works on a variety of platforms, including Sun4 (4/100, 4/200 and 4/300), Sun4c (SS1, SS1+, SS2, IPC, ELC, IPX and SLC) and Sun4m (Classic, LX, SS4, SS5, SS10 and SS20). Some Sun4c-compatible "clones" are rumored to work, as well.

For detailed information on NetBSD and NetBSD/sparc, see the NetBSD Web page at `http://www.netbsd.org`. This site is also the gateway to a large set of NetBSD mailing lists. By way of introduction, the server gives the following history and acknowledgments:

"NetBSD/sparc is based on work done at Lawrence Berkeley Laboratory (LBL) by the Computer Systems Engineering group under DARPA contract BG 91-66, which later appeared in the 4.4BSD-Lite distribution from the University of California at Berkeley. It was imported into the NetBSD source tree on October 2, 1993. Complete binary sets were made for the NetBSD 1.0 and NetBSD 1.1 releases. Special thanks are extended to the LBL Computer Systems Engineering group for their work. Without it, the port would not exist."

OpenBSD

OpenBSD is a spin-off from the NetBSD effort. It supports the Sun4 and Sun4c models, with Sun4m support promised soon. According to the OpenBSD Web site at `http://www.openbsd.org`:

"OpenBSD looks a lot like NetBSD (which it is derived from, following the 4.4BSD roots), but is now being devel-

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oped separately. Good changes from other free operating systems will be merged in (of course, depending on various factors like developer time, for example). OpenBSD tracks NetBSD changes very closely; say anywhere between two days to 10 days behind the state of NetBSD–current all the time. Hence you can truly say that OpenBSD is NetBSD plus more stuff."

PSX

PSX is a commercial real-time kernel sold by JMI Software Systems (`http://www.mcb.net/jmi`). PSX provides a 60% subset of the POSIX.1 system calls, supporting a single-user, single-group, multiprocess subset of POSIX. PSX facilitates the migration of applications from POSIX-compliant workstations to more than two-dozen embedded microprocessors.

PSX is designed for embedded systems where a small kernel is insufficient but a full POSIX system, with its hardware memory management requirements, memory size and consequent performance is too big and slow.

Sparc-Linux

While the University of California at Berkeley folks were busy fending off AT&T's lawyers, Linus Torvalds was busy building a whole new kernel. That kernel is the basis for the popular Linux operating system, but it is heavily supplemented by code from the BSD folks, the GNU Project, the X community and others. In short, Linux is a *very* eclectic offering.

Sparc-Linux is a part-time effort spearheaded by David Miller, a full-time student at Rutgers University. It currently supports the Sun4c (SPARC 1, 1+, 2, IPC, IPX, SLC, ELC) and Sun4m (SPARC Classic, LX, 5, 10, 20, including multiprocessor hyperSPARC configurations). Eventually, the Sparc-Linux kernel should support all Sun machines that use a SPARC processor.

The best resources for Sparc-Linux information are the Sparc-Linux mailing list, `sparclinux-request@vger.rutgers.edu`, and the Sparc-Linux Web page, `http://www.geog.ubc.ca/sparclinux.html`. The Web page describes the effort as follows:

"Sparc-Linux is a port of the Linux

operating system to the SPARC platform, specifically to Sun SPARCstations. This is not a "new" version of Linux; it is a port that is integrated into the normal distribution kernel tree. The user-level interface and most of the kernel will be the same. Only machine-dependent parts of the kernel will change."

VxWorks

VxWorks is a commercial real-time operating system sold by Wind River Systems (`http://www.wrs.com`). The company's Web site claims that:

"VxWorks is the premier development and execution environment for complex real-time and embedded applications on a wide variety of target processors. Three highly integrated components are included with VxWorks: a high-performance scalable real-time operating system that executes on a target processor; a set of powerful cross-development tools, which are used on a host development system; and a full range of communications software options such as Ethernet or serial line for the target connection to the host.

"On this foundation, Wind River has built an array of innovative features focused specifically on the requirements of real-time developers. VxWorks supports a wide range of industry standards, including POSIX 1003.1b Real-Time Extensions, ANSI C (including floating-point support) and TCP/IP networking.

"At the heart of the VxWorks run-time system is the highly efficient *wind* microkernel. This microkernel supports a full range of real-time features, including fast multitasking, interrupt support and both preemptive and round-robin scheduling. The microkernel design allows VxWorks to minimize system overhead and respond quickly to external events.

"Kernel operations are fast and deterministic–for example, context switching requires only 3.8 microseconds on a [Motorola] 68K processor (MV167C board). Interrupt latency is less than three microseconds. VxWorks also provides efficient intertask communication mechanisms, permitting independent tasks to coordinate their actions within a real-time system."

Primary Source

Aside from the World Wide Web, my primary source of information for this column was the *1996 Open Systems Products Directory*, published by UniForum (`http://www.uniforum.org`). This belongs on the bookshelf of any organization that uses UNIX. It is a clean, well-organized, heavily-indexed tome ($2\frac{1}{2}$ inches thick!), with major sections for horizontal software, vertical software, networking/communications software, application development tools, system hardware peripherals/devices, operating systems/system software, services/publications/user groups and indexes. ⊷

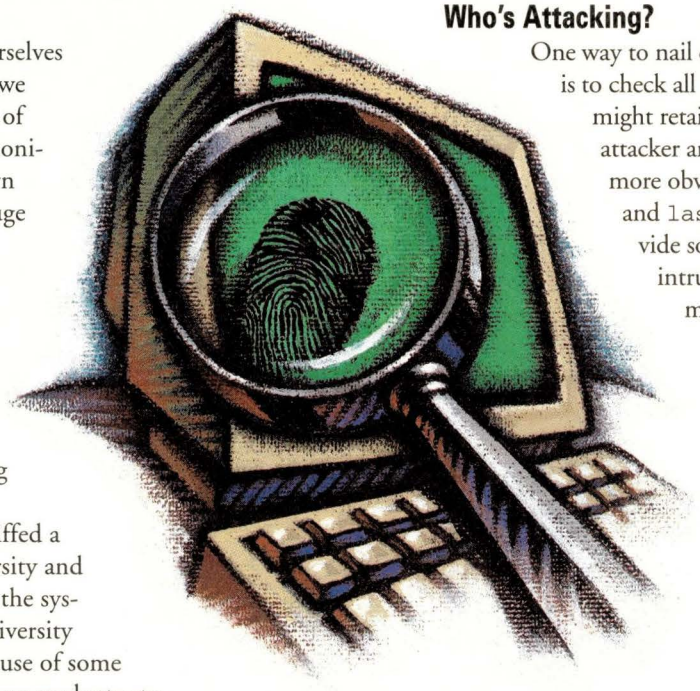
Richard Morin operates Prime Time Freeware (`ptf@cfcl.com`), which publishes mixed-media (book/CD-ROM) freeware collections. He also consults and writes on UNIX-related topics. He may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at `rdm@cfcl.com`.

by S. LEE HENRY

Intruder Detection

Would you know it if there was an intruder on your network? Would something have to "break" before you'd look for evidence of a break-in? Would a user have to complain that response had seriously degraded before you would examine what's running on his system? Would someone have to notice an unusual process running as `root` before you'd think about the ways that an intruder might be able to gain superuser access? And if you did notice an intrusion, would you know how to respond? Are you prepared to quickly get your system back in working condition?

Many of us never ask ourselves these questions. So maybe we should take a look at some of the things you can do to monitor for intrusions, nail down who broke in and how, gauge what damage might have been done, and limit the chance of a return visit.



ERIC PETERSON

The First Sign

Evidence of an intruder on your network often comes by way of something small and unusual. The Canadian teenager who sniffed a password at another university and set up shop on a couple of the systems at Johns Hopkins University came to our attention because of some very odd mail that one of our graduate students received, and a process that he then noticed running under his username. Had he not received the strange mail or simply deleted it and continued working, it is possible that we would never have noticed the intrusion. The benign intruder (i.e., he didn't do any direct damage to our systems) might have gathered a number of passwords to other sites and simply gone on his way.

On the one hand, the peripheral damage–the inconvenience to users who could not log in until they received a new password; the time that Fred Romelfanger and I spent figuring out what had happened, reporting the incident, and warning other sites; the trouble we took to ensure that all of our systems had been properly patched; and the loss of confidence that some of our users felt–might not have happened had we never noticed.

On the other hand, it's impossible to predict whether or not, in the long run, we would have suffered from more serious break-ins had we not had this unwelcome call to arms.

Who's Attacking?

One way to nail down the source of an intrusion is to check all the files and commands that might retain some information on the attacker and where he's coming from. The more obvious of these: the `w`, `who`, `last` and `lastcomm` commands could provide some clues to the identity of the intruder, if the files that these commands use have not been modified by the intruder–a fairly common practice. Briefly,

- `w` lists who is logged in and what they are doing, using `/var/adm/utmp`.
- `who` lists who is logged in, using `/var/adm/utmp` and `/var/adm/wtmp`.
- `last` displays user/terminal login and logout information, using the `/var/adm/wtmpx` file.
- `lastcomm` provides a reverse-order (most recent first) list of the last commands executed on the system, including who executed the command, when it was run and how long it took, using the `/var/adm/pacct` file.

Each of these commands can yield inaccurate information if the log file that it uses or the executable itself has been modified or replaced. There are a number of things that you can do to detect and guard against modifications to executables on your systems. Simply looking at the size

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and modification date of these files will not necessarily tell you what you want to know; the size may be irrelevant and the modification date can be forged (check out the `touch -t` command).

You can use the `ls -lac` command to check the actual modification time of files, in case `touch -t` was used, as shown in the sequence of commands in Listing 1.

If you compare a file using `diff` with one you know to be an original or use something like Tripwire to monitor system binaries, you can be fairly sure that your executables have not been compromised. It's much harder to tell whether or not log files have been altered because these files are constantly updated. Consider periodically copying these files to a more secure location. Log files maintained by syslog–defined in the `/etc/syslog.conf` file–can be maintained on whatever system you designate by assigning the name loghost in your `/etc/hosts` file.

Another way that you can attempt to track down where an intruder came from is to examine network statistics and router information for connections to unusual systems. For some sites (universities, for example) "unusual" might be hard to determine because it is quite common to have legitimate connections to other universities, research organizations and even government and commercial sites.

For many organizations, however, running a command like the one shown below might yield no external connections or only a few, potentially interesting, ones. For example,

```
chaos% netstat -p | grep -v mydept.myorg.com
Net to Media Table
Device    IP Address              Mask          Flags       Phys Addr
------------------------  ---------------  -------  ------------------
le0    sleazy.badguy.org   255.255.255.255             08:00:09:0c:1a:17
```

Listing 1

```
chaos% ls -l not_so_old
-rw-r--r--   1 slee   1295 Oct 4 12:35 not_so_old
chaos% /usr/bin/touch -t 9303030303 not_so_old
chaos% ls -l not_so_old
-rw-r--r--   1 slee   1295 Mar 3 1993 not_so_old
chaos% ls -lac not_so_old
-rw-r--r--   1 slee   1295 Sep 20 17:04 not_so_old
```

Listing 2

```
chaos% cat syslog | awk '{print $7}' | grep "to=" | sort | uniq
to=afriend@sri.lanka.net,
to=cooldude@earthlink.net,
to=mel@pha.jhu.edu,
to=slee@strange.cpg.com,
```

You might want to check `syslog` (or whatever file your `sendmail` records are logged to) for unusual email addresses. Although "unusual" is, once again, very site-specific, something might catch your eye. It is not unusual for intruders to send email while logged into a compromised system, probably "bragging" to their friends about their success. If your syslog files are nothing but sendmail records (like mine), the command shown in Listing 2 will list all destinations.

You might consider doing a finger of all of your users to determine where each of them most recently logged in. Using a simple loop, you can extract this information very easily from your system, as shown below using NIS.

```
chaos% foreach u ('ypcat passwd | awk -F: '{print $1}'')
? set LAST = 'finger $u | grep "Last login"'
? if ("$LAST" == "") then
? set LAST = 'finger $u | grep "On since" | head -1'
? endif
? echo $u":" $LAST ? end
slee: On since Oct 24 12:37:26 on console from :0
slug: Last login Tue Oct 9 14:49 on pts/5 from murky.water.com
```

You can also check history files in your users' accounts, if they exist. Keep in mind that the names of history files depend on the particular shell the user runs and usually start with a "." (e.g., `.history` and `.bash_history`).

Looking for Damage

If you check your executables manually, be sure to check `/bin/login`, all of the system start-up files (`/etc/rc*`, `/etc/init.d/*`), the Internet server files (`/usr/etc/in.*` or `/usr/sbin/in.*`), the `/lib/libc.so.*` files and anything else that is invoked through `inetd` (check the `/etc/inetd.conf` file). Make sure no new services have been added to the `/etc/services` file. Also, check `/usr/bin/su` and `/usr/bin/find` for any signs of intrusion.

Since it is possible that the very tools that you are attempting to use to uncover the break-in have themselves been compromised, or that Trojan horse replicas have been inserted elsewhere into your system, carefully check `netstat`, `ps`, `ifconfig`, `ls`, `who`, `w`, `last` and `lastcomm`, and make sure that "." is not in your path or at the tail end.

You might also want to use the `which` command to doublecheck the identity of an executable before using it.

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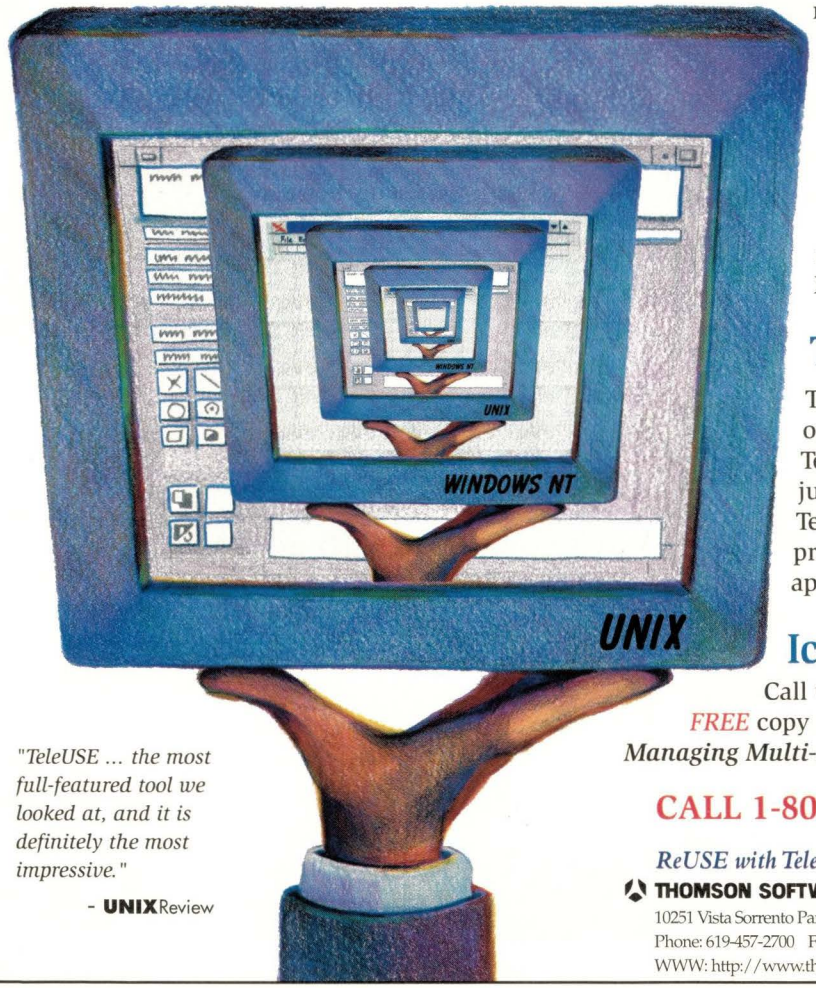

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Looking for Backdoors

Look for executables that have been given `setuid` or `setgid` access, since intruders will sometimes leave such files around to facilitate later access to your systems. The following `find` command will locate `setuid` and `setgid` files on the local system (i.e., not mounted directories) belonging to `root`:

```
chaos# find / -user root -perm -4000 -print -xdev
```

If you're going to check for `setuid` or `setgid` permissions, it's a good idea to know ahead of time which files in your system have these permissions under normal conditions so that you can determine which files have been changed.

You can also use the `ncheck` command with the `-s` option to check an entire partition for `setuid` permissions as shown here on a Solaris system.

```
# ncheck -s /dev/dsk/c0t2d0s7
/dev/dsk/c0t2d0s7:
1666    /slee/su
111490  /ftp/dev/zero
111495  /ftp/dev/tcp
111496  /ftp/dev/udp
111497  /ftp/dev/ticotsord
```

Examine all `~/.rhosts` files for suspicious entries and "+" signs. Remove any "+" or "+ +" entries immediately. Here's a `find` command that locates and prints the contents of each of these files in the `/home` partition:

```
# find /home -name .rhosts -ls -exec cat {}\;
 1952  1 -rw-r--r--   1 slee   nerds      2 Sep 20 17:32 /home/slee/.rhosts +
 1989  1 -rw-r--r--   1 wgates badguys    2 Aug 20 11:15/home/wgates/.rhostssneaky.ms.com billy
```

Check to make sure `.rhosts` files don't exist for any locked special accounts (e.g., `uucp`). You might issue a `find` command that locates and removes these files:

```
# find /usr -name .rhosts -ls -exec rm {} \;
```

Examine `/etc/hosts.equiv` if you have such a file, again removing any "+" entries you might find. Make sure `~/.rhosts`, `/etc/hosts.equiv` and `/etc/hosts.lpd` files do not contain any lines starting with "#". Although such lines are used to include comments in most UNIX files, they can be used to represent host names in these files, giving anyone who sets his host name to "#" access to your system without requiring a password.

While you're getting a workout using the `find` command, check also for any hidden files that may have been installed on your system. Intruders often call their programs things like "..." to make them harder to detect. In addition to checking for names like "...", you might also look for file names like "..", which might not catch your eye when listing files in a directory. Use a wildcard with `find` as shown here:

```
chaos% find . -name ".*" -ls
1952   7 -r-xr-xr-x   1 slee   111   6732 Aug 20 18:03 ./...
```

We can't cover everything in a single column, so let me throw a few more things at you before we run out of space. Check for new or modified entries in `cron` and `at` files, and make sure that you don't overlook user accounts that may have been added to the system.

Make sure that exported file systems have not become world-accessible, but are shared with a set of known hosts or a netgroup that you know is valid. Also, examine the setup of anonymous `ftp` accounts if you have any.

Securing the Network

Once you've collected the information you need to be sure that you understand how your network was compromised, you should take steps to limit the chance that the intruder will come back. Because you're unlikely to know if users' passwords may have been sniffed by a wayward superuser, you might consider installing a onetime password system like OPIE or simply adding an * to the password field of each of your users so that they are locked out of their account until a new password is assigned.

Carefully check the matrix of which hosts trust which other hosts and limit trust to what is necessary for your operations. Excessive interhost trust facilitates the spread of damage when an intruder gains superuser access to any system that is trusted by others.

Limiting `root` login to the consoles of systems is a good thing to do both because it can help keep an intruder out and because it means that superuser passwords will not be sent in clear text across your network.

One effective way to guard against break-ins is to use TCP Wrapper to restrict access to various network services through the use of an access control list. Logging information provided by TCP Wrapper can also be useful to examine following a break-in. Make sure that what is in the log files corresponds to the access restrictions you have established.

Plan your Defense

When you're not recovering from or fighting off an intrusion, spend a bit of time planning your defense. It's a good idea to get in the habit of examining log files routinely, preferably using scripts to reduce bulky data files to meaningful statistics. Collect and use a set of security tools to help monitor your network, gauge the security of a system and proactively search for weaknesses. Next month, we will take a look at a series of tools that no site should be without. ⊷

S. Lee Henry is on the board of directors of the Sun User Group and spends her weekdays in a dreary windowless office mistrusting everyone. You can send email to `slee@cpg.com`.

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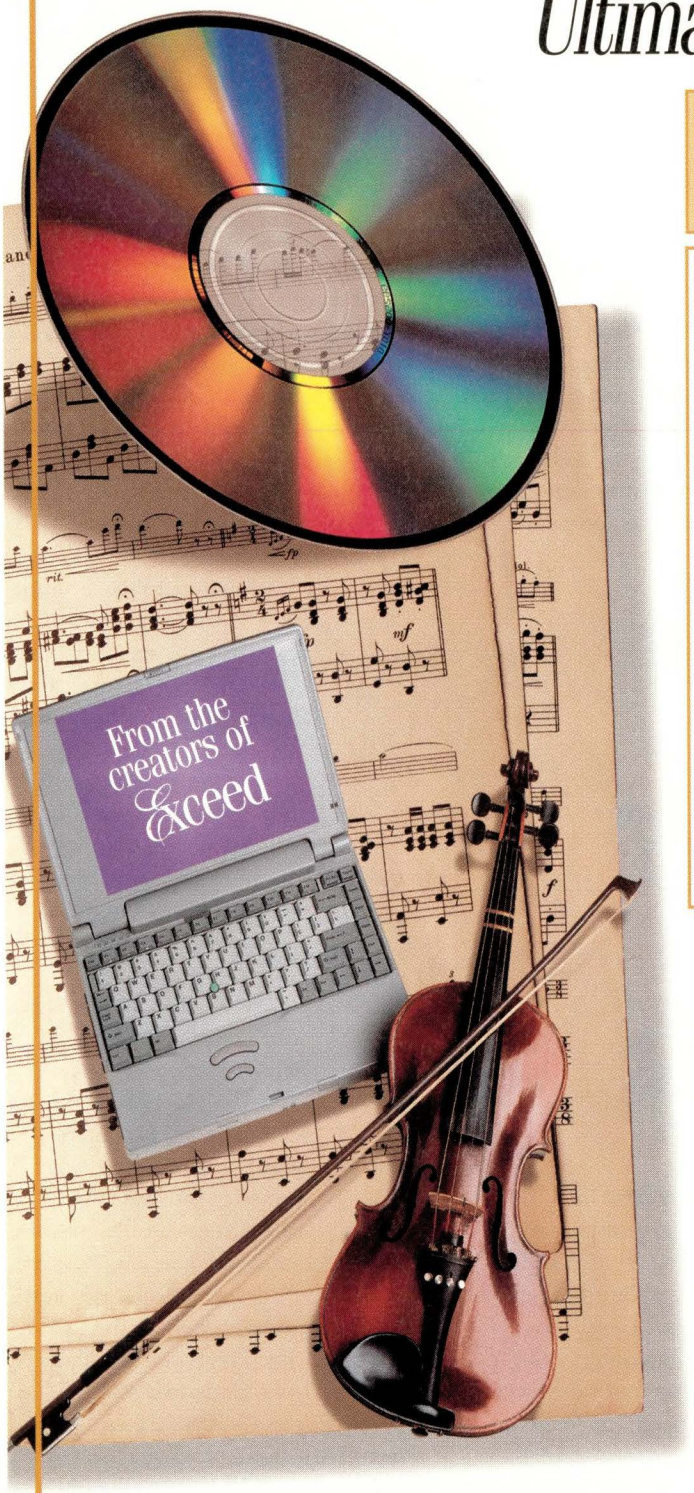

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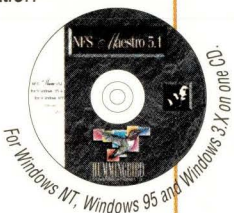

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by ALEX NEWMAN

News You Can Use

There's a lot of news from Sun User Group Headquarters these days, so let's get right to it.

Everyone got their calendars at the ready? Here's the official SUG schedule for the next 12 months. It highlights events all around the country, some big and some small. I've included detailed information about some of them, but, as ever, the best way to get more details about SUG happenings is to drop us a line to `office@sug.org`. Of course, the *best* way to stay on top of all the changes in the fast-paced world of SUG is to be a member, and we've got two great new benefits... but more on those later.

Here's the SUG calendar:

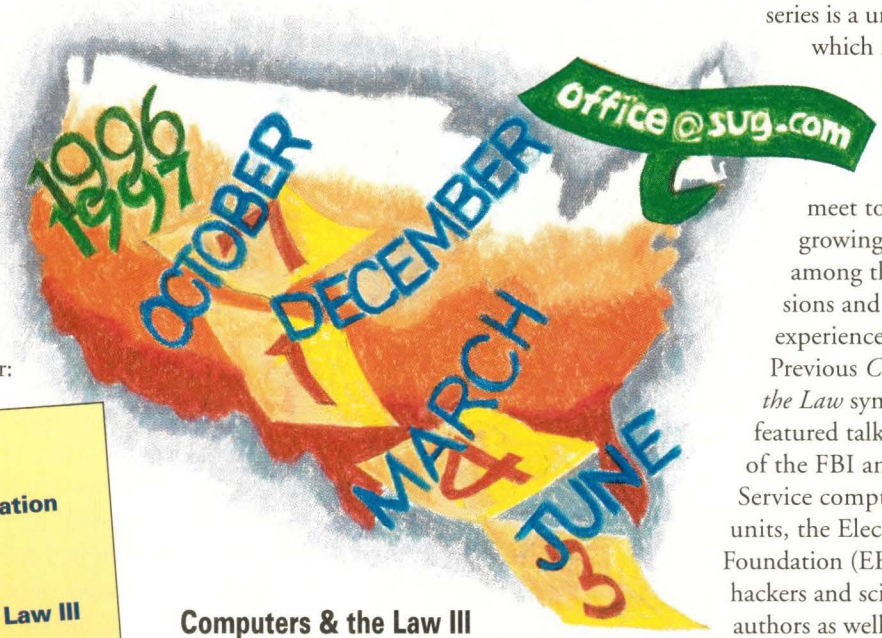
October 7
Advanced Solaris System Administration
Burlington, MA

December 1-4
Computers & the Law III
San Jose, CA

March 4-5, 1997
SUG West Coast Conference & Exhibition
San Francisco, CA

June 3-4, 1997
SUG East Coast Conference & Exhibition
Boston, MA

Throughout the year, the Sun User Group's Internet Academy presents classes on a variety of Sun- and Internet-related topics. The Academy is SUG's one-year-old training facility in Brookline, MA. The Internet Academy provides students with personalized instruction and hands-on experience using state-of-the-art equipment.



Computers & the Law III

San Jose, CA, will be the place to be December 1-4, 1996. The Red Lion Inn is the site of our third annual *Computers & the Law Conference*. As I've said so often, computers and the Internet are entering more and more corners of everyday life. As that happens, technology, security, legislation and law enforcement start to interact in new, untested ways. The *Computers & the Law Conference* series was initiated by the Sun User Group in 1993 to help members of these professions deal with a rapidly changing world. Last year's conference predicted the creation of the federal telecommunications bill, which shook up the industry, and the predictions for next year should be equally exciting as the speakers tackle the theme of "Assessing the Internet Threat."

The *Computers & the Law Conference* series is a unique forum in which members of the computer, legal and law enforcement fields can meet to address the growing connections among their professions and share their experiences and ideas. Previous *Computers & the Law* symposia have featured talks by members of the FBI and Secret Service computer crimes units, the Electronic Frontier Foundation (EFF), notable hackers and science fiction authors as well as many leaders from throughout the high-tech industry. These conferences were critically acclaimed, and this year's is expected to be even more successful with more than 20 invited speakers, including Mike Godwin of the EFF, and futurist and VRML expert Mark Pesce. We'll also be having a few talks on Java vulnerabilities as well as the real deal on Java security.

This year's conference will also be

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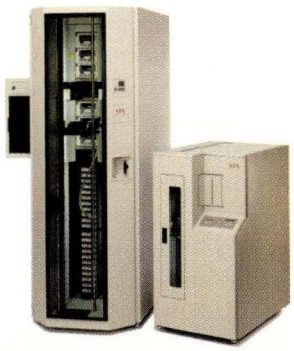

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the first to feature a tradeshow. The exhibit is specifically oriented to showcase security products and other technology affecting the legal ramifications of computers. It's free and will spotlight products that help keep computers safe from intrusion and protected under current legal guidelines. Featured products include firewalls, system monitors, contract software, law enforcement software and parental control products.

Included in this program are panels on the future of computer crime and the jurisdiction of cyberspace; tutorials on prosecuting computer intrusions, basic and advanced computer security and the liability of system administrators; and talks on censorship, cryptography, copyright law, privacy, firewalls, cyberporn, on-line commerce and legislation and Internet fraud. A wide variety of other topics, key to maintaining a networked, corporate or private computer system in today's security-conscious and litigious environment, will also be discussed.

"The explosive growth of cyberspace is straining the law's ability to keep up. Issues such as privacy, copyright and jurisdiction are currently being played out in the courtroom in uncharted territory," says Edward A. Cavazos, attorney with Andrews & Kurth and chair of the *Computers & the Law* legal track.

Other track heads include John C. Smith, investigator with the Computer Crime Unit of the Santa Clara County District Attorney's office and head of the Conference's law enforcement track; and Tom Courtney, security consultant with the Sun User Group and head of the technical track.

Computers & the Law III features two days of talks and panels and two days of workshops and tutorials in addition to the free computer security tradeshow. The tutorials will be held on Sunday, December 1 and Wednesday, December 4; the talks and other featured events will take place on Monday and Tuesday, December 2 and 3; the tradeshow will be open on Monday, December 2 and Tuesday, December 3.

Help Wanted

So, you're reading all this and saying to yourself, "Hey, those Sun User Group guys are doing some pretty exciting stuff. I wish I could get involved." Well friends, you're in luck. You see, all of these conferences require a lot of hard-working people. We need track chairs, conference chairs, people to set up email stations, people to review papers and people to write them. You could be one of those people.

Want to get involved? Drop me a line at `troll@sug.org`. Volunteers meet interesting people, get free admission to SUG conferences and get cool T-shirts, besides winning the admiration of their peers, colleagues and friends. You don't even need to be a SUG member to help out...and most of the time one of the perks of volunteering is free SUG membership.

Speaking of Perks...

As promised, we've got two new SUG membership benefits for you. Remember folks, these are for SUG members only, and the vendors who are providing these discounts are going to ask you for a current SUG ID number and its expiration date. They check this stuff, so don't think you can pass off your old Captain Midnight Secret Society badge number as a SUG membership number. The two organizations are similar, but not identical.

One of the most common questions we hear at the office is, "Where can I buy (or sell) my used Sun equipment?" Until now, we pointed people toward our electronic mailing list and our newsgroup, `comp.org.sug`. Now, thanks to the good folks at Affiliated ReMarketing Web, we've found a better way.

Affiliated ReMarketing Web came pretty highly recommended. *Internet Life* magazine picked it as "The Best" used computer site on the Internet, and the company has also won awards from NetValue and Top Shopping.

For a small fee ($14.95 for SUG members), users can advertise their used equipment to more than 130 dealers at once, and anyone can browse the thousands of listings of used equipment for free. Despite the fact that there are 18 companies that deal with Sun equipment listed, there doesn't seem to be a lot of Sun equipment for sale. You know there's a demand for it; here's your chance to move that old SPARC 1+.

Of course, if you don't want to sell your old Sun machines, you can always upgrade them. Through an arrangement with Open Access, SUG members are able to buy Cycle Computer and Ross Technology upgrades at greatly reduced prices–in some cases thousands of dollars. For example, the list price for a Cycle 5 110-MHz motherboard is $3,825, but if you are a SUG member you can buy one for $2,493, a saving of more than $1,000.

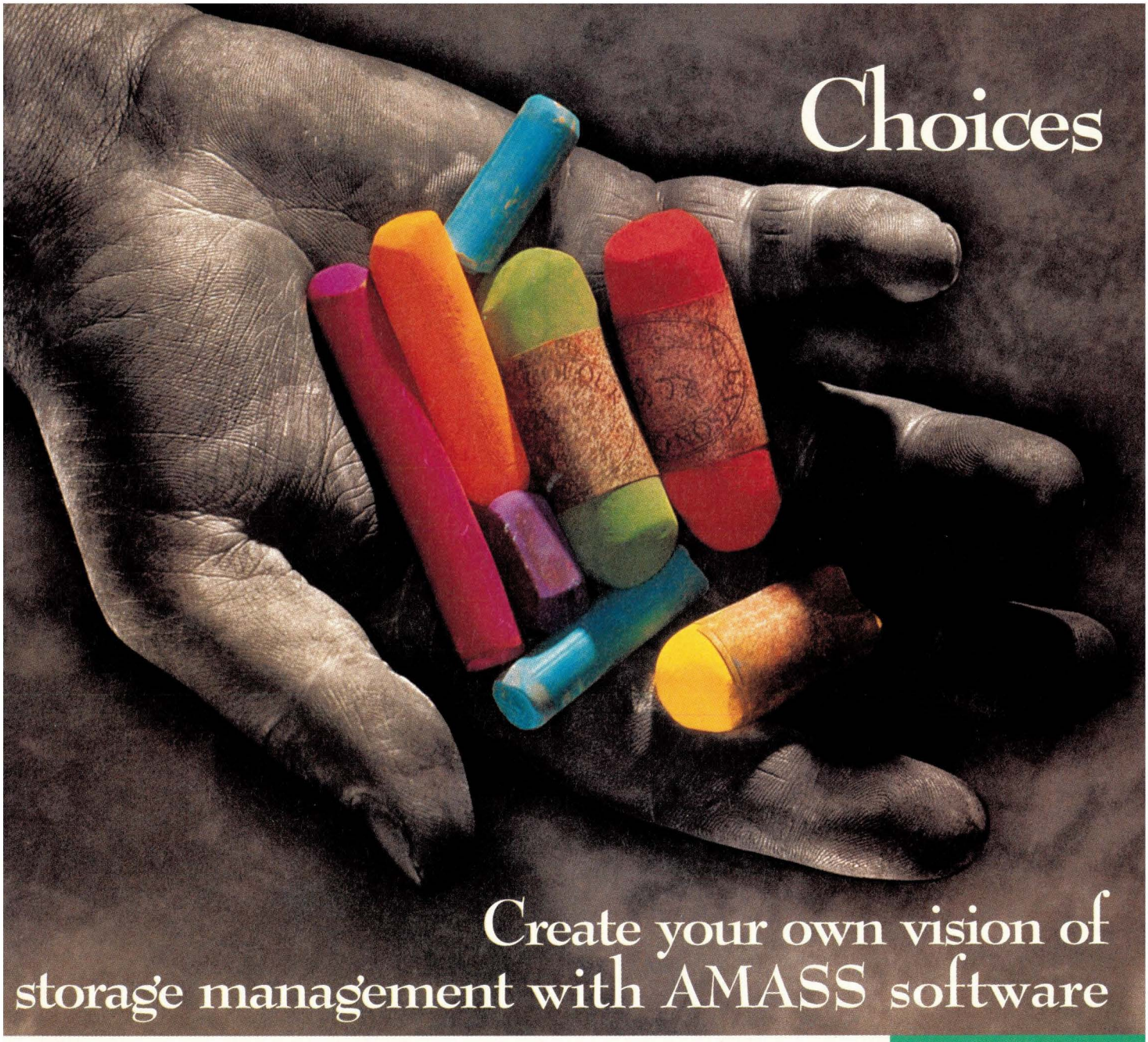
These aren't just CPU upgrades, they're system-level upgrades that increase all aspects of performance, including CPU, disk I/O and networking. We've got a couple here in the office and we have been very happy with them. One of the great things about these upgrades is that SunService provides worldwide support for them. Contact your local SunService office for details.

These benefits are added to the ever-growing roster of great deals offered to SUG members. For more details, drop a line to `office@sug.org`.

News from the Board

I reported in my last column that our president had stepped down. At a recent meeting, the Sun User Group board of directors made three important decisions (four, if you count them renewing my contract). First, John McLaughlin, our vice president, was kicked upstairs into the president's seat, and Evan Marks was elected to the vice presidential position. Last, as it looks more and more like the annual conferences will take place in June, rather than December, the board voted to extend the terms of all board members that were due to expire in December 1996 to June 1997, and move the annual elections to June from this time forward. ⊸

Alex Newman (`troll@sug.org`) is the executive director of the Sun User Group and Java-SIG. He is also the author of *Special Edition: Using Java,* published by Que Publishing, and an upcoming book on the history of computer crime.



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BUILD YOUR OWN WAREHOUSE

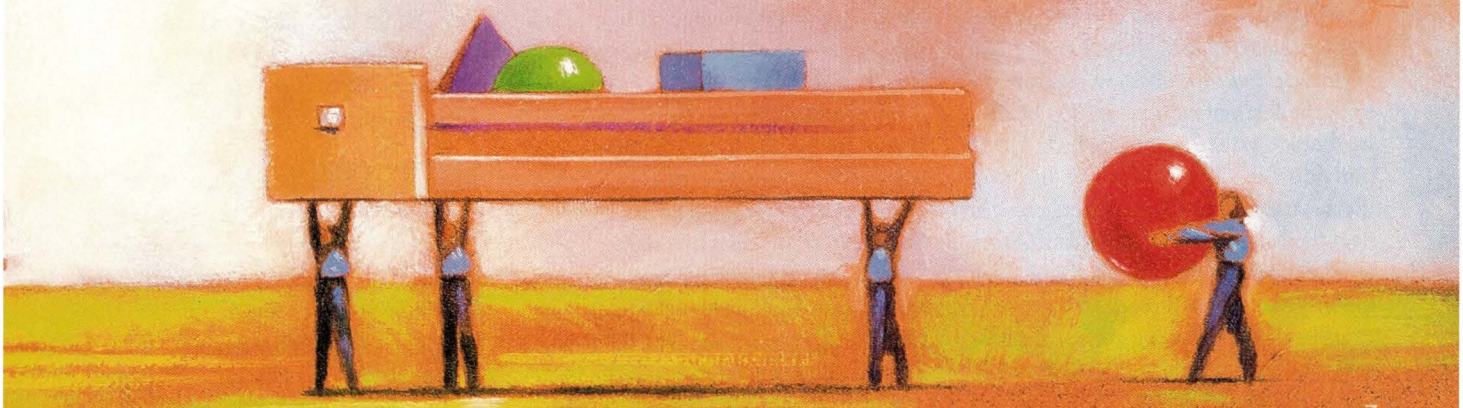
by KAREN WATTERSON

CHANCES ARE THERE'S A DATA WAREHOUSE IN YOUR FUTURE, AND YOU DON'T NEED TO WAIT FOR METADATA STANDARDS TO BE IN PLACE TO START GETTING READY.

It used to be that data warehouses were limited to Fortune 500-type firms with deep pockets and big iron.

Now, however, you don't have to be a billion-dollar company to build your own warehouse. And you don't need big iron, either. Today, organizations are building gigabyte, even terabyte, warehouses under Solaris. You'll even find inexpensive "starter kits" for a variety of UNIX platforms–even NT. But whether you've got terabytes, gigabytes or merely megabytes of raw data, building a warehouse requires making tough design decisions about what data to consolidate, summarize and otherwise "predigest." No matter whose tool you use, building a data warehouse is just plain hard work.

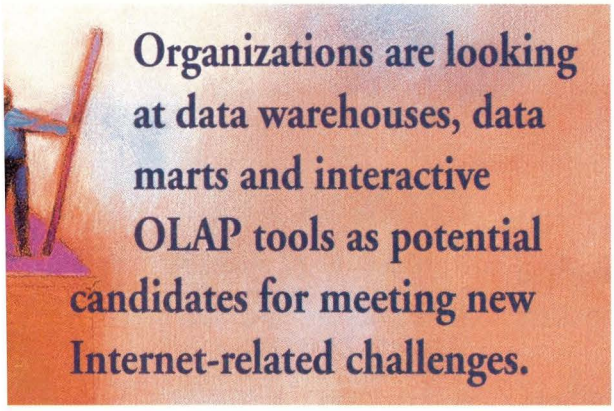
There's no single simple definition of a data warehouse, but most people agree that it's an enterprise-scale (as opposed to divisional or



PAUL ANDERSON

departmental) read-only database derived from one or more data sources and intended for decision support. You can categorize data warehouses as follows:

- Traditional relational database management system (RDBMS) with various enhancements, including relational on-line analytical processing (ROLAP) engines that add multidimensionality to data residing in RDBMSs.



- Any of a range of so-called on-line analytical processing (OLAP) or multidimensional "hypercube" servers.
- Metadata repositories or indexing schemes that define virtual warehouses.

Big terabyte warehouses may get the limelight, but for every one of those behemoths, you'll find hundreds of smaller data marts and multidimensional databases. Some are even being Web-enabled to allow Internet access, and many are being built to support OLAP. Even data mining and data discovery operations are entering the mainstream.

THE BUSINESS MOTIVE

During the '80s MIS perfected the art of capturing, storing and safeguarding data–getting it *in*. Initial attempts at getting it *out* for decision support took the form of expensive EIS "briefing book" systems that were built for individual executives. Then, in the '90s, users started demanding better access to data, and a combination of client/server technology, reengineering and downsizing impelled IT to provide it.

Users didn't just want raw data gathered from the production OLTP systems, though. (Nor was IT likely to give them access to operational data.) No, chances are users wanted *aggregate* or derived data, along with the ability to manipulate the data-slicing and dicing, and so on–in multiple dimensions. They wanted to be able to find out, say, net sales, in both dollars and units, of every product (or service), at every store (or office), by week, for the last five years, compared with budgeted sales. They wanted to look at trends to help them analyze customer or product profitability and do promotion planning. People were beginning to understand what Nicholas Negroponte, director of the Massachusetts Institute of Technology's Media Lab, observed so succinctly in one of his 1994 columns in *Wired*–that the "value of information *about* information is often greater than the value of the information itself."

The result of users' demands for better data access was the creation of thousands of custom client/server applications, and it didn't take IT long to realize the appeal of more general-purpose data warehouses. Unfortunately, warehouses required a big investment in both time and money, so the status quo–building more client/server applications–tended to prevail.

Today, however, it's not just your own users who expect access to corporate data. It's likely your customers and partners are beginning to clamor for access to relevant data over the Internet. Organizations are looking at data warehouses, data marts and interactive OLAP tools as potential candidates for meeting new Internet-related challenges. If you haven't created a data warehouse yet, chances are it won't be long before you do.

The business motive is survival. In today's competitive environment, characterized by shortened product cycles, more volatile markets and an overall decline in traditional hierarchical "command and control" organizations, businesses simply have to be more nimble. Managers have to make decisions faster and be able to shift rapidly from one plan to another. Customers who can't get fast answers to their questions simply go elsewhere.

Unfortunately, as we said earlier, building a data warehouse isn't cheap, and it's hard to cost-justify. How do you assign a dollar value to customer satisfaction, or estimate the opportunity costs associated with reacting too slowly? (Evidently, some organizations have figured out how. A 1996 study by Framingham, MA-based market research firm International Data Corp. based on 62 data warehouse installations reported an average return on investment of 401% and a 2.3-year payback.)

Fortunately, you'll find a myriad of vendors jockeying for your attention. After all, they smell dollars. IDC estimates that the overall warehousing market will explode from $1.46 million in 1995 to $5.6 million by 2000. Some will be old familiar hardware and RDBMS vendors with symmetrical multiprocessing (SMP) and massively parallel processing (MPP) systems, support for special indexing, and/or OLAP tools, but you'll also find that vendors of the high-end financial and statistical analysis packages have adjusted their product lines to cater to would-be warehousers.

Middleware and utility vendors will also be lining up to offer you extraction and transformation tools that will help you populate and refresh your warehouse. Other vendors will try to sell you their "multidimensional" databases, their OLAP engines, their data mining tools. To top it all, you'll have the so-called "fat client" client/server and reporting vendors trying to show you how using *their* products will empower your users–whether they're accessing warehouse, mart, relational or multidimensional data.

Figuring out which product or combination of products is best for you is almost as difficult as building the warehouse itself.

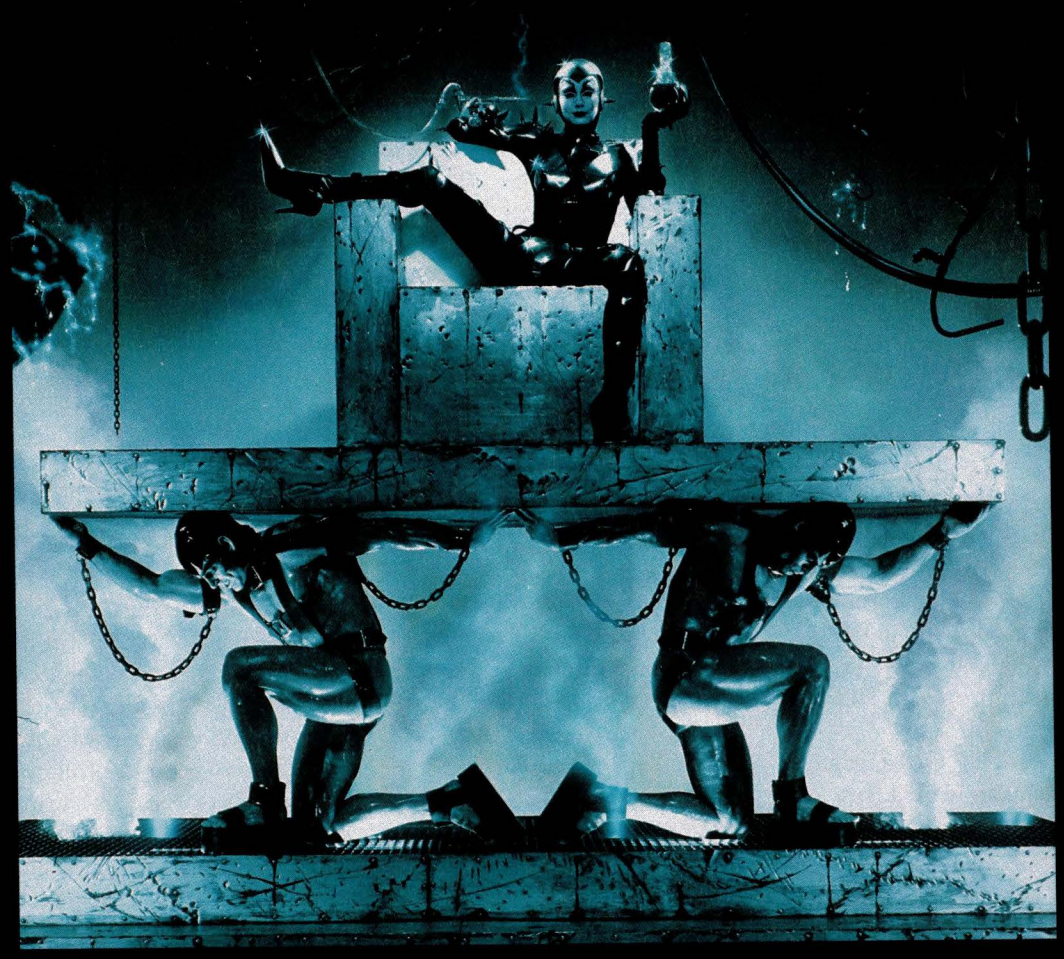
ARCHITECTURAL ALTERNATIVES

Most of you are familiar with the traditional RDBMS systems like Oracle Corp.'s Oracle, IBM's DB2 and Informix Software Inc.'s Informix, that store data in two-dimensional tables. Although they're great for OLTP operations, they're not particularly well-suited for easy querying or interactive data manipulation. Also, data isn't organized in what most users would

UNIX users can

now add Windows to their list of conquests.

(Consider all ties with humility severed.)



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consider an intuitive fashion that makes it easy for them to analyze it by common business dimensions like time, geography or business group. End users expect interactivity: drill-down, roll-up, pivoting, spreadsheet interface and graphing–and they don't want to have to learn new tools.

Ironically, E.F. Codd, the "father" of relational database technology, may have fired the first volley in what has become a raging battle of ideologies in the warehouse architecture war when, along with associate Chris Date, he published a white paper that included 12 OLAP product evaluation rules. The message was that multidimensional database products can provide better performance than relational databases that use two-dimensional tables for complex data analysis.

Nevertheless, RDBMS and third-party vendors have responded with methods of making RDBMSs suitable for data warehousing operations. For example, Sybase Inc. has both Sybase MPP for building terabyte-scale enterprise warehouses, and a stand-alone product, Sybase IQ, that actually stores data as bit arrays and relies on special indexing (see "Why Bit-Mapped Indexes?") and compression to create high-performance data marts. Sybase IQ, therefore, really has nothing to do with SQL Server, although data from SQL Server or Sybase MPP databases can be loaded into it. Oracle also provides gateways to non-Oracle data sources, a parallel option for its Oracle 7.x servers, and a series of Oracle Express (formerly IRI Express) OLAP tools.

Informix, which like Oracle acquired its OLAP technology, should have released MetaCube 3.0 as a stand-alone OLAP product by the time you read this. Informix has promised to deliver MetaCube as a DataBlade module for the Informix Universal Server in mid-1997. (DataBlade modules basically let you extend the Informix Illustra architecture to support new data types.)

Computer Associates International Inc. doesn't have a warehouse product, per se, but promotes a combination of its enterprise server and middleware tools as what users need. Software AG of North America Inc. has put together a "tire-kicking" data mart package that includes consulting and training designed to let you have a data mart based on Adabas D up and running within 10 days. Red Brick Systems positions itself as the only "new" RDBMS company that has been architected specifically for data warehousing. It helped popularize the "star schema" discussed below and also relies on bit-map indexing (see "Why Bit-Mapped Indexes?").

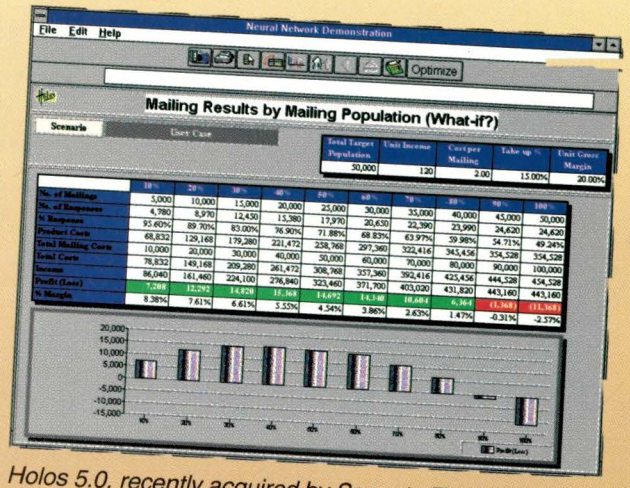
A handful of so-called "relational OLAP" vendors, notably MicroStrategy Inc. (DSS), Platinum Technology Inc. (InfoBeacon) and Information Advantage Inc. (Decision Suite), have also entered the fray. The difference between ROLAP and the 30+ OLAP vendors is basically that ROLAP relies on traditional RDBMSs for data storage and retrieval, while OLAP products either use their own proprietary multidimensional databases (MDDs) or build repositories with predefined data access paths and joins.

MDDs use multidimensional array structures, sometimes called cubes or hypercubes, which let you organize data hierarchically in multiple (predetermined) dimensions. Here are some examples of common hierarchies:

- Region–Distributor–Retailer
- Region–Market–Store
- Manufacturer–Brand–Product
- Year–Quarter–Month–Date
- State–City–Zip Code–Customer
- Promotion Period–Date
- Property Country–Property City–Property Zip Code–Property Policy.

MDDs rely on a variety of array processing techniques to retrieve data in logical (multidimensional) "chunks" that let users manipulate data using drill-down and roll-up techniques, for example. The idea is to load up a multidimensional server with data that is likely to be combined. Imagine all the possible ways to analyze clothing sales: by brand name, size, color, display location, advertising and so on. If you fill a multidimensional hypercube with this data, viewing it from any perspective (hypercubes have n*(n-1) sides, or views) will be fast and easy, and that's the appeal of OLAP vendors like Arbor Software Corp.'s Essbase, Dun & Bradstreet Software Services Inc.'s Pilot Lightship Server, Comshare Inc.'s Commander Decision, TM1 Software's (formerly Sinper) TM1, Seagate Technology's Holos (formerly Holistic Systems) and SAS Institute Inc.'s new

FIGURE 1

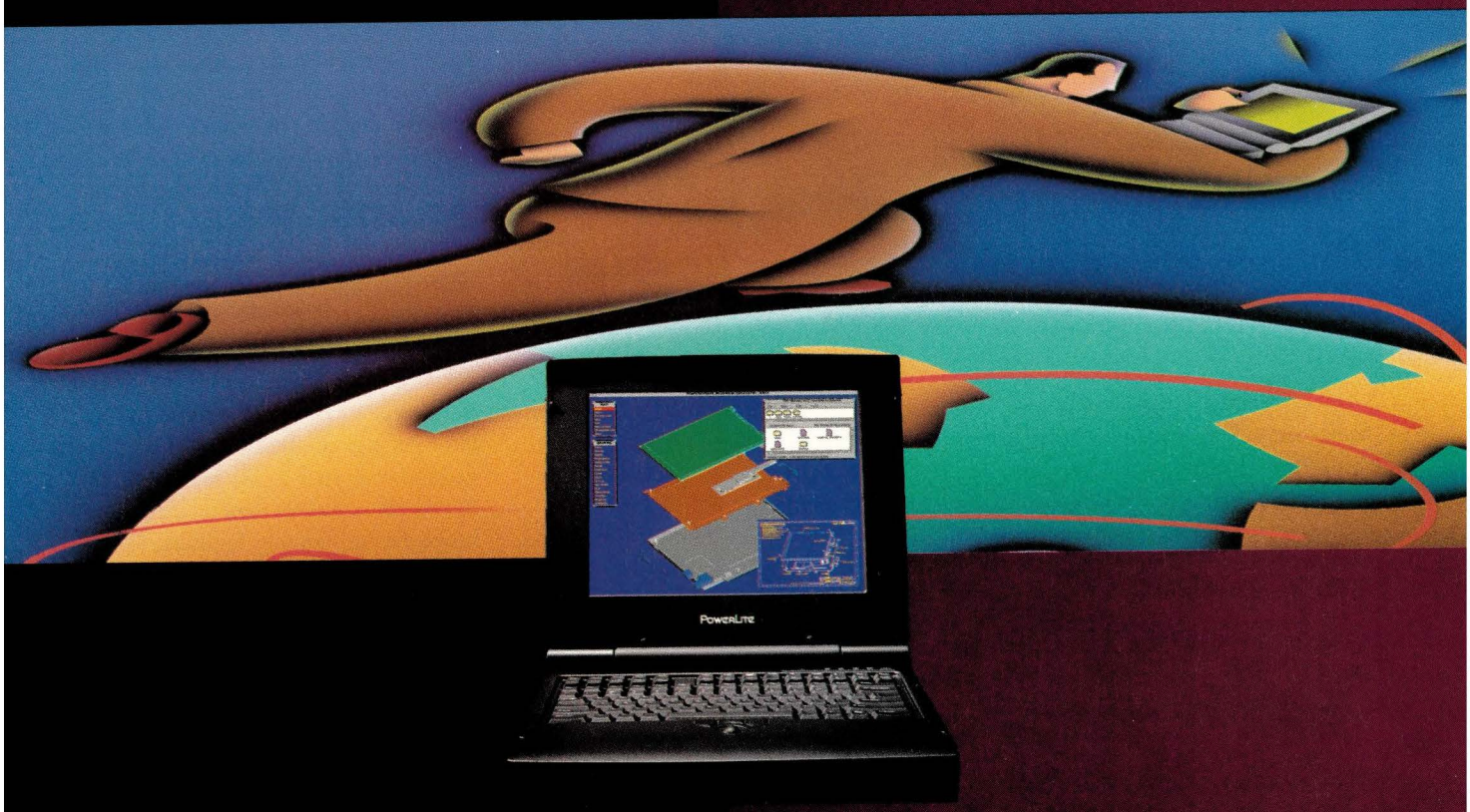


Holos 5.0, recently acquired by Seagate Technology, adds neural networking-enabled data mining to its OLAP engine.

One common way to bridge the gap between relational and MDDs is to use star schemas that require creating fact and multidimension tables. Facts are arranged in a single large table, indexed by a multipart key composed of the individual keys of each dimension. There are many variations on the star schema theme, all sharing the basic concept of fact tables and dimension tables.

In many cases, not all facts share the same dimensionality, and multiple fact tables may be used. An example is selling price, which may not vary between markets or customers or state or federal tax rates. When dimensions are large (high cardinality), it makes sense to use the snowflake schema, which splits dimension tables at the level of the attributes, storing hierarchical data in the dimension tables themselves.

{ LET'S TALK SPEED. }



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MDDB. Because the market is so crowded, vendors are competing on value-add features such as built-in data mining (see Figure 1) or Web access.

OLAP servers are great for time series analyses, for recursive calculations (how to allocate overhead as a percent of revenue contribution by product line), and for data with up to 15 dimensions. Beyond that, most multidimensional servers fail under the sheer weight of their own indexes and 50 GB is typically cited as the upper limit.

RDBMS and OLAP/MDD products aren't the only warehouse construction tools. You'll also find a half-dozen or so vendors offering "virtual warehouse" construction kits, which rely either on specialized indexing (Dynamic Information Systems Corp.'s Omnidex), extraction toolsets (Evolutionary Technologies Inc.'s ETI Extract) or on repositories (Informatica Corp.'s PowerMart Suite, Prism Solutions Inc.'s Warehouse Manager or Hewlett-Packard Co.'s OpenWarehouse.) One vendor with an radically innovative approach is Cross/Z International Inc. Its Fractal Database Mining System (F-DBMS) uses fractal geometry to store warehouse data.

BUILDING A WAREHOUSE

It's no secret that consolidating years of data from heterogeneous sources is hard work. Some of the real challenges facing warehouse designers and implementers are incompatible keys, data that has changed over time (ZIP codes, telephone numbers, product names and IDs), embedded keys, aggregates, currency conversions, sparse and missing data and geographical data. The process of extracting and transforming–and often aggregating–data is often referred to as "data cleansing."

So how long does it take to build a data warehouse? Although the answer depends on factors like the number of discrete data sources and the complexity of the new data structure, two to three months seems to be a good average.

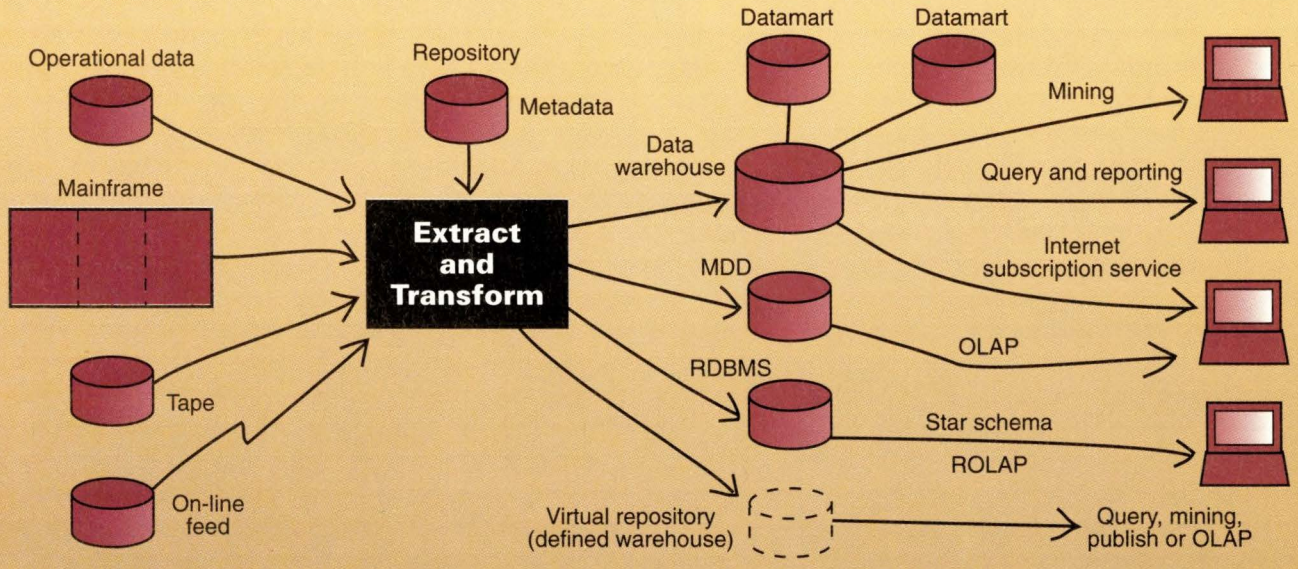
Database marketing and list management firms invented many of the merge/purge techniques that need to be part of the data extraction process, but there are dozens of vendors with products to help you extract, transform and refresh your warehouse (see Figure 2).

So how long does it take to build a data warehouse? Although the answer depends on factors like the number of discrete data sources and the complexity of the new data structure (relational or multidimensional), two to three months seems to be a good average.

Pete Asick, assistant director of data access for the University of Illinois, says that building the 5-GB student warehouse for the Urbana campus was about a six-month project, two of which were spent on design. The project involved combining data from 55 DB2 tables into a "temporary" DB2 warehouse that will eventually be moved into a Sybase MPP warehouse running on a four-processor Sun Microsystems Computer Co. SPARC 1000E with 512 MB of RAM and 80-GB storage arrays.

Campus employees use both mainframe-type tools from statistics vendors like SAS Institute Inc. and PC-based desktop tools such as Microsoft Corp.'s Access 95 to retrieve the student warehouse data to find out, for example, all the students who attended a particular high school from a given ZIP code.

FIGURE 2. BUILDING A DATA WAREHOUSE INVOLVES A DIVERSE TOOLSET



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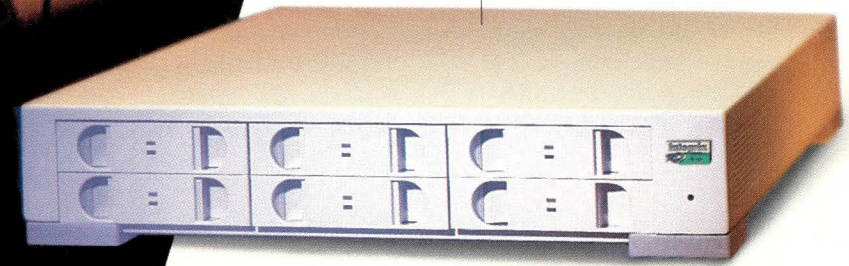

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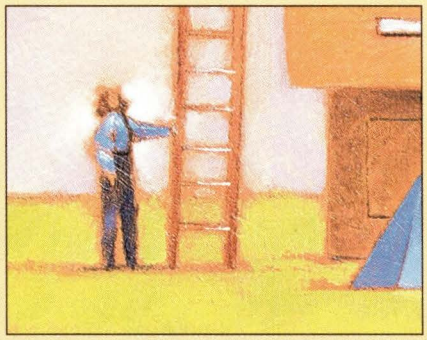
WHY BIT-MAPPED INDEXES?

Traditional RDBMSs have been designed for the on-line transaction processing market, and their engines and optimizers have been tuned to accommodate fast data entry of transactions. Data warehouses, on the other hand, need to be tuned for data retrieval and aggregation operations.

Bit-map indexes, which offer improved response time over traditional indexing methods by reducing the number of read operations to the data, are often part of a warehouse solution. Sybase Inc., Oracle Corp. and Red Brick Systems have each incorporated bit-map indexes into their warehouse products. Sybase's IQ, for example, incorporates five different kinds of indexes based on various combinations of bit-map, bit-array, compression and B-tree technologies.

B-TREES

Well-designed relational database tables have a "primary key" field along with an index based on that key, and you can generally define as many other indexes as you like. For example, a product table would probably be indexed both on the product ID (the primary key) and the manufacturer ID (a foreign key relating data about a specific product to its manufacturer). An index is basically a lookup table that contains actual key values (the product IDs, for example) along with pointers to the complete record.



All RDBMSs support both sequential and indexed access to records. Sequential access doesn't use an index; it simply reads the data sequentially until the desired row or rows are found. This brute force approach works fine for small tables where all of the rows are physically clustered together or in applications that need to perform some action on every row.

Most RDBMSs use B-trees–or some variation thereof–as their primary indexing method. B-trees store index data in a hierarchy (or tree) of pages with each index page typically containing many index entries along with pointers to the next page of index entries. The advantage of B-tree indexes over sequential access is that, instead of scanning pages that contain raw data, the RDBMS needs only look at a few index pages until it finds pointers to the requested rows.

HASHING

Hashing avoids having to create and maintain indexes, instead relying on a mathematical formula to directly calculate the page on which a data row is stored. Ideally, the hash function will distribute the records fairly evenly across the pages of the database (which happens when the hash values are fairly unique) and requires only a single read operation to retrieve the requested row.

Hashed and B-tree indexes work well in OLTP systems that generally involve only a few rows at a time, but not in complex decision support systems that involve complex SELECTs or joins across multiple tables. Cost-based SQL query optimizers are part of all RDBMSs and they all have complex rules for index selection, but basically optimizers in OLTP systems have been optimized for INSERT and UPDATE operations–not SELECTs. Hence, the need for alternate indexing methods.

BIT-MAP INDEXING

The basic idea behind a bit-map index is to use a single bit to indicate that a specific value of an attribute is associated with a row. Each distinct value in this row would have its own bit-map index consisting of 5 million bits–one for each record in the database. When a bit is on (1), the value occurs in the record. When the bit is off (0), the value doesn't occur in the record.

Because records can be identified through their position in the bit map, bit maps don't need pointers. Imagine a telephone white pages listing with 250,000 names. Each unique last name (Anderson, for example) has its own bit-map index with 1s corresponding only to those entries where the last name is Anderson.

Bit-map indexes offer several advantages, including reduced storage overhead (replacing lots of bytes required for multiple entries of 8-byte Anderson, for example, with single bits) and the possibility of doing low-level Boolean logic operations or compression operations on the indexes.

Bit-map indexes are obviously best for data where you don't have a lot of unique values. (Having a lot of different values is called high cardinality, the most extreme case of which would be columns like product ID where each record had a unique value.) Bit-map indexes are also best on nonvolatile data. As you can probably imagine, modifying bit-map indexes can impose a tremendous amount of overhead. That's one reason why some vendors' warehouse indexes only work with read-only operations.

BEYOND BIT-MAP INDEXES

Today, most RDBMS vendors' warehouse options use a combination of technologies based on B-trees, bit maps, internal row IDs and compression, and give you the option of building different indexes depending on the cardinality of your data. They also parallelize many operations such as index building, data loading, processing bit maps and performing sorts.–*kw*

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Asick also built a warehouse with university human resources data and plans to create another one with financial data that will involve bringing IMS data into the warehouse using Platinum Technology Inc.'s InfoRefiner. Asick also inherited a student warehouse for the Chicago campus. It's another DB2 warehouse that is populated with data from an Adabas database. So far, he has primarily used Platinum's InfoRefiner and InfoTransport–Platinum has an impressive lineup of utilities in the warehouse building and management space–for the data cleaning and consolidation steps, but he also uses SyncSort Inc.'s SyncSort and various custom programs written in Natural, Software AG's 4GL language, for the Urbana student warehouse.

The Internet and Java have created a minor revolution in the warehouse access tools marketplace, one that is just unfolding.

Asick currently updates the warehouses weekly but hopes to refresh them daily, perhaps using tools like Micro Focus Inc.'s COBOL or Visual Object COBOL and some of Sybase's replication services, in addition to InfoRefiner, InfoTransport and SyncSort.

Because its warehouse effort was part of a larger reengineering effort, it took Merrill Lynch & Co. considerably longer. Two and a half years ago, when Merrill Lynch's corporate Marketing Systems Group, Trenton, NJ, wanted to analyze customer service data for any of its clients, there wasn't a central location that contained client data. Instead, data for its almost five million clients was spread out over 17 different data sources–including seven different DBMSs–on six different platforms. The notion of information at their fingertips must have seemed like a cruel joke. Today's 270-GB data warehouse is just one of the results of the company's ongoing reengineering project.

After performing in-house benchmarks with both Sybase and Microsoft's SQL Server and Informix's Illustra, Merrill Lynch opted for SAS Institute's warehouse solution and built a warehouse on a six-processor Sun SPARC 1000 equipped with 1,024 MB of RAM and 270 GB of disk storage. Surprisingly, the company didn't require any third-party tools for the cleansing and extract processes, relying instead on SAS tools and some batch COBOL to access DB2 data.

Today, only about 50 corporate staffers access the warehouse's data sets, which contain information about accounts by client or household–including service requests and complaints, not details about individual transactions–but by early 1997, Merrill Lynch hopes to roll out access to branch offices.

The office hierarchy is another facet of the Marketing Systems Group's warehouse. Front-end access is available from Andyne Computing Ltd.'s GQL and SAS for ad hoc queries and analysis and from various prebuilt Visual Basic and PowerBuilder applications. Refreshes are

FOR YOUR INFORMATION

WATTERSON'S PICKS ON THE INTERNET

- **OLAP Council site**–*http://www.olapcouncil.org.* Excellent links. Includes glossary, mission and white paper.
- **Seth Grime's data warehousing and mining site**–*http://www.access.digex.net/~grimes/olap.* Best links I found.
- **UK data mining site**–*http://www.cs.bham.ac.uk/~anp/TheDataMine.html.* Excellent resource on data mining.
- **Neil Raden's star schema 101**–*http://www.members.aol.com/nraden/str101.htm.* Includes 18-screen graphic explanation.
- **Usenet newsgroup**–*comp.databases.olap.* Quite active.
- **Academic papers**–*http://www-db.stanford.edu/warehousing/publications.html.* Mainly theoretical.
- **Kurt Thearling's data mining and database marketing site**–*http://www.santafe.edu/~kurt.* Kurt works for Pilot Software Inc. (a division of Dun & Bradstreet Corp.).
- **IBM white papers**–*http://www.software.ibm.com/data/dbtools/dbsmwp.html.* Great stuff from the Santa Teresa Labs.
- **MicroStrategy Inc.'s data warehousing forum**–*http://www.strategy.com/msi_dwf1.htm.* Good links. Includes white paper and articles.

AT THE BOOKSTORES

- Michael Brackett's ***Data Warehouse Challenge: Taming Data Chaos*** (Wiley, ISBN 0-471-12744-2, 1996, 579 pages, $44.95). Excellent book focusing on data modeling, analyzing data and its structure with a host of practical examples.
- Ralph Kimball's ***Data Warehouse Toolkit*** (Wiley, ISBN 0-471-15337-0, 1996, 338 pages, $44.95 with CD-ROM). Written by the founder and CEO of Red Brick Systems, this book focuses on multidimensional data warehouses and ships with a Windows program, Star Tracker, for querying databases multidimensionally via ODBC links.
- Vidette Poe and Laura Reeves' ***Building a Data Warehouse for Decision Support*** (Prentice Hall PTR, ISBN 0-13-371121-8, 1996, 210 pages, $49). Lightweight overview for nontechnical managers.

performed on a weekly, monthly or quarterly basis as appropriate.

Both Asick and Merrill Lynch's John Crawford emphasize the difficulty of the data mapping/extraction and transformation phase and the importance of an incremental approach. In other words, don't try to build the perfect warehouse right off the bat. Even aiming to satisfy 80% of users' requests may be too optimistic in round one.

USING WAREHOUSES AND MDDS

This article has focused on tools you can use to build a data warehouse, data mart, multidimensional database or "virtual" warehouse, but users require different tools. Almost all of the warehouse vendors are smart enough to have built "open" products that allow users to plug in their favorite front-end tool, but there are literally dozens of stand-alone front-end querying and mining tools that create their own "virtual" warehouses.

Popular examples of end-user reporting and querying tools include Cognos Corp.'s Impromptu, SAS' SAS System, Andyne Computing's GQL, IQ Software Corp.'s IQ/Objects, Powersoft Corp.'s InfoMaker, and Business Objects Inc.'s Business Objects, but there are many more. Generally, you should look for tools that have good support for time dimension and multidimensionality,

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Indeed, the Internet and Java have created a minor revolution in the warehouse access tools marketplace, one that is just unfolding. Despite the well-known security and bandwidth issues associated with the Internet, there are strong incentives to deliver interactive "thin client" Web-based decision support and/or multidimensional analysis. Because the market is so new, we're limited to advising you to "watch this space."

Another emerging market is the one associated with data mining and knowledge discovery. When you conceptualize a query or explore certain combinations of business "dimensions," you're either looking for specific answers or have an hypothesis in mind. Data mining and knowledge discovery, on the other hand, help you discover "new" relationships. Most use some sort of proprietary pattern-searching algorithms to search through large amounts, but others rely on neural network technology or offer sophisticated data visualization. Vendors in this arena include Information Discovery Inc., Angoss Software International Ltd., Reduct Systems Inc., Inductive Solutions Inc., IBM, DataMind Corp. and Pilot Software Inc.

STANDARDS AND TRENDS

Many trends have conspired to move data warehousing and OLAP into the mainstream, and you can expect to see more organizations experimenting with data mining and knowledge discovery tools in the hopes of gaining that elusive "competitive advantage."

Vendors of proprietary MDDs and OLAP tools are under pressure to offer interoperability, and there are several organizations that will help move the industry in this direction, notably the Metadata Council (spearheaded by the META Group to devise a method of sharing metadata and repository information) and the OLAP Council.

But don't wait for standards to emerge. If you're like most organizations, you probably need a data warehouse or OLAP product today. The good news is you've got lots of options. The bad news is you may need a combination of tools to get the job done. The purpose of this article has been to help you target your focus. In the end, you may well need more than a single data mining or warehousing tool. ⊸

Karen Watterson is an independent San Diego, CA-based writer and consultant specializing in client/server and database design issues. She writes a monthly column for *Data Management Review*, is editor of Pinnacle Publishing's *Visual Basic Developer* and *SQL Server Professional* newsletters, and has written two books for Addison-Wesley: *Visual Basic Database Programming* and *Client/Server Technology for Managers*.

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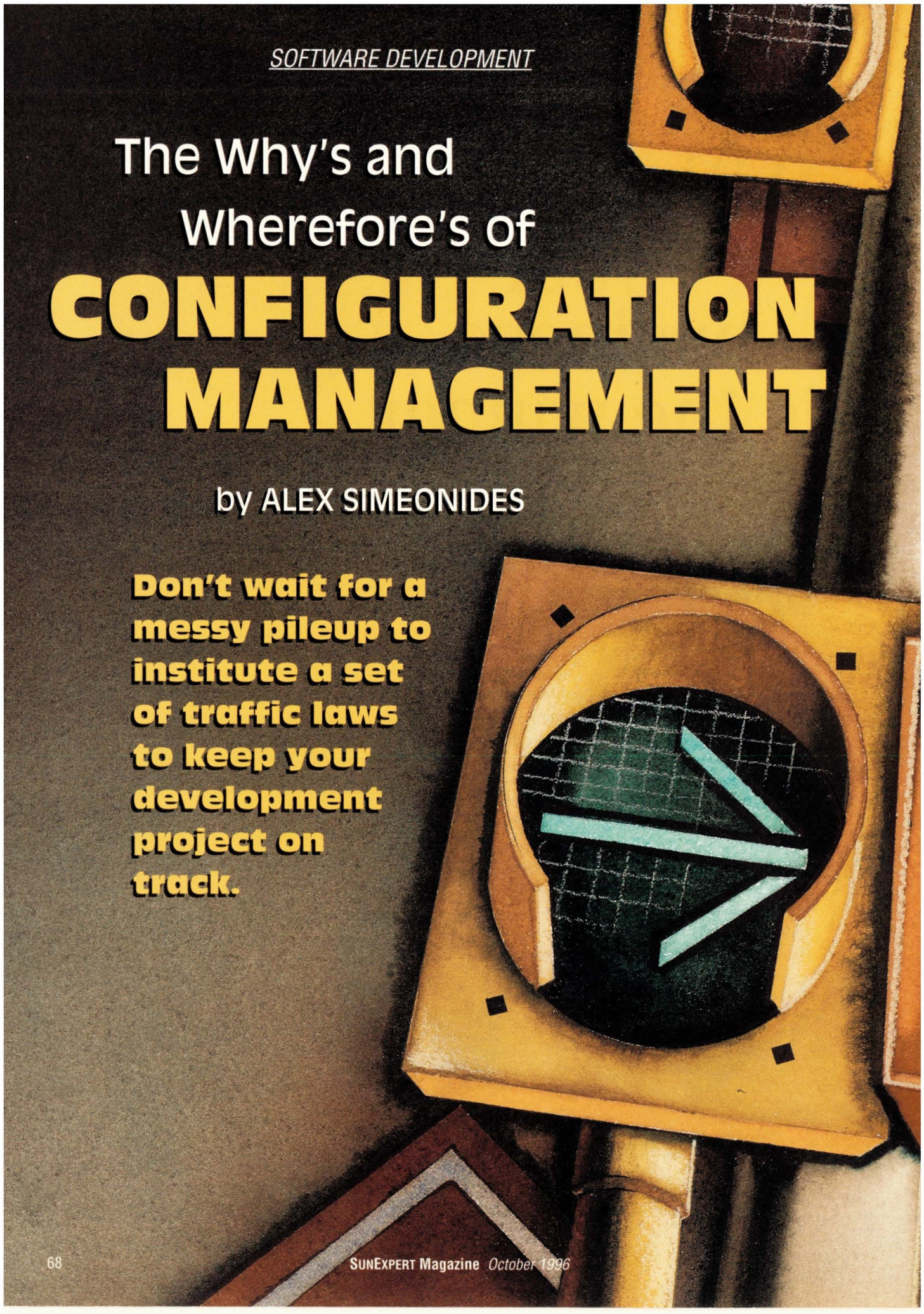
The Why's and Wherefore's of CONFIGURATION MANAGEMENT

by ALEX SIMEONIDES

Don't wait for a messy pileup to institute a set of traffic laws to keep your development project on track.



REBECCA RUEGGER

Early in this century, there was a rich man who owned the first automobile in a remote Western state. He was quite a reckless driver, thinking he could do no harm, until one day he drove head-on into the state's second automobile. If you're a software developer and you're not using any form of configuration management, you should consider the moral of this tale.

Configuration management (CM) is like a set of traffic laws regulating a development project, helping your team keep control over the project and avoid the big disaster. Development projects vary in complexity, as do budgets, available tools and the temperaments of the people on the team. A lightly staffed development team working on a straightforward project probably only needs a few safety guidelines, in the form of a basic version control system. Larger projects often require a more comprehensive CM framework, a map of sorts. This type of CM package is commonly known as a process control system, and depending on the features it supports, can help you determine where you're going, how to get there, and how to report and track any problems you might encounter along the way.

Simple Version Control

The responsibilities of a development team are unfortunately not limited to writing good code. Once you've written the code, the question remains of how to properly integrate and maintain the code into a working, efficient system. To this end, most development teams insist on having in place a version control system that does two basic things: keeps a backup of the

original files; and documents the modifications (changes, deletions and additions) that were made to the file, usually in a history file.

Some teams manage to enforce version control via informal, homegrown systems. Some of the basic disciplines of version control are, for example, adding comments with dates to code so that other developers can read it, instituting a safe release area for source, and making copies of the files you want to edit in a separate working directory. Others will write shell and perl scripts to help automate the process.

Most teams, though, ramp up the sophistication level and opt for an official version control system. The lowest priced and most widespread version control systems to implement, on the UNIX side, are the SCCS and RCS utilities. SCCS, or source code control system, is usually bundled with commercial UNIX operating systems. RCS, or revision control system, is copy-lefted by GNU and thus available for free, see `ftp://prep.ai.mit.edu/pub/gnu/rcs-5.7.tar.gz`.

Both SCCS and RCS make use of the lock-modify-unlock methodology. This means that, in order to make changes to a file, you must first acquire a "lock" on it, also referred to as "check out" (as in checking a book out of the library). This copies a version of the file into a working area and makes the original file read-only.

You can only check out a file if someone else hasn't already done so. This prevents "concurrent edits," ensuring that only one person can edit a file at a time. Once you have a lock on a file, you can go ahead and edit it. Finally, you "check in" the edited file, after having examined it and ascertained that you are ready to commit it to the central database.

Putting a file under the control of SCCS or RCS automatically generates a history file. If you examine the contents of an SCCS history file, you will find a log of the edits you made to the file. SCCS refers to these edits as "deltas" and "branches." Examining the history file is, in effect, one of the only tools that a developer can use to check whether or not an edited file is ready to be checked in.

Assuming that all you need is a safeguard against two users editing the same file at the same time and some change logging, then these simple utilities are obvious choices, mainly because they *are* simple and relatively unobtrusive. For these reasons, not only do programmers place crucial system files under SCCS or RCS control, but good systems administrators do too–see Hal Stern's article on using SCCS for systems administration, `http://www.sun.com:80/sunworld online/swol-07-1995/swol-07-sysadmin.html`.

RCS and SCCS, while relatively simple, can also tick developers off. The policy of file locking–which effectively allows only one developer to make changes to a file at a

A Homegrown CM System

```
To:             comp.software.config-mgmt
From:           Giles Davidson, configuration controller
Organization:   Speedwing International, UK

    On the project I am currently working on, the plan had been
to have a big bang release of software every three months or
so, making a baseline on each occasion. Needless to say, this
didn't work.
    I tore this up and introduced a system whereby the developers
work within a well-defined source tree, with a source, include and
output directory for each module. The developers have a common
area where (more or less) stable code goes, and their own work
areas for work in progress. Whenever code is moved into their
common area, it is baselined by generating a release file, which
is essentially a file version list. This lists all source and the
makefile currently in the module.
    Whenever they release to the systems integrators (my team),
they simply inform me of the release number. In the case of com-
pound deliverables–executables, DLLs, shared libraries–they also
list the releases of the components in their baseline at the
moment of release.
    On receipt of the release note I can simply check out the files
specified in the file version list for each module (using a script).
    Thus, I can regenerate any previous release by checking out
all the corresponding component releases, hence the importance
of including the makefiles in the release.
    Working this way I am not interested in individual files, as
these are handled by the version file. When I started this proj-
ect, I had to track the files in the release notes for each
module and update the makefiles–a virtually impossible task with
around 150 modules, 1,500 header files and even more source files.
    With this system, only the occasional file gets out of line and
is easily found. My colleagues and I have written generic makefiles
where the programmers have to do little more than change the list
of source files, and their directory structure closely matches
that of the Integration team. Thus, both teams can use the same
makefiles–again reducing the need for manual intervention.
    Finally, when running in the Integration structure, the make-
files run a script to automatically generate a build file for any
compound deliverable that consists of the version of the current
subcomponents, database release and so on.

- Giles Davidson
```

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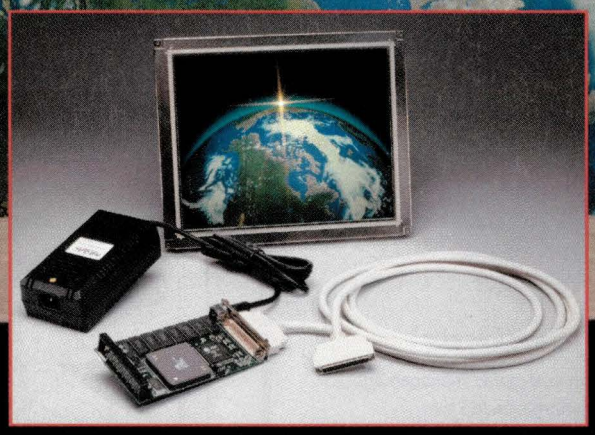

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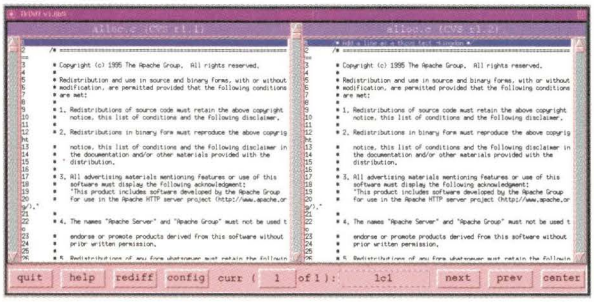
time–is incompatible with the everyday reality of software design.

Jim Blandy, co-founder of Cyclic Software, Bloomington, IN, which provides support for Concurrent Versioning System (CVS) and the GUI-based tkCVS, used RCS while working on the Emacs project at the Free Software Foundation. "While at the FSF, I found I had to mail the other Emacs developers frequently, asking them to release locks on files. Usually, they had finished their work and forgotten to release the lock, or were working on a separate region of the file, so I could have made my change safely without their involvement," he says.



A diff screen from Cyclic Software's tkCVS GUI-based versioning system.

Copy-Modify-Merge

Developers who think that locking is more trouble than it's worth but still require a low-cost system with low overhead may want to try CVS instead. CVS employs the copy-modify-merge methodology. Simply put, every developer has a complete set of files to work from. Two separate commands allow you to incorporate changes from other developers to your files, and add your changes to theirs.

The problem with CVS though, according to some developers, is that because there is no file locking, there is always the possibility that a conflict could occur. However, according to Blandy, "conflicts occur rarely." He says, "During the period Karl [Fogel, a partner at Cyclic Software] and I used CVS to manage the gene editor sources [a project they worked on together at the University of Illinois at Urbana-Champaign], we found one conflict roughly every two months. All our conflicts were straightforward to resolve."

Blandy's unofficial position is that conflicts are not the fault of problems in the CM system. Instead, he says that "conflict frequency depends partially on how cleanly the team has divided the project." Specifically, he points to poor planning and communication. "The rarity of serious conflicts may be surprising, until one realizes that they occur only when two developers disagree on the proper design for a given section of code. Such a disagreement suggests that the team has not been communicating properly in the first place," Blandy says.

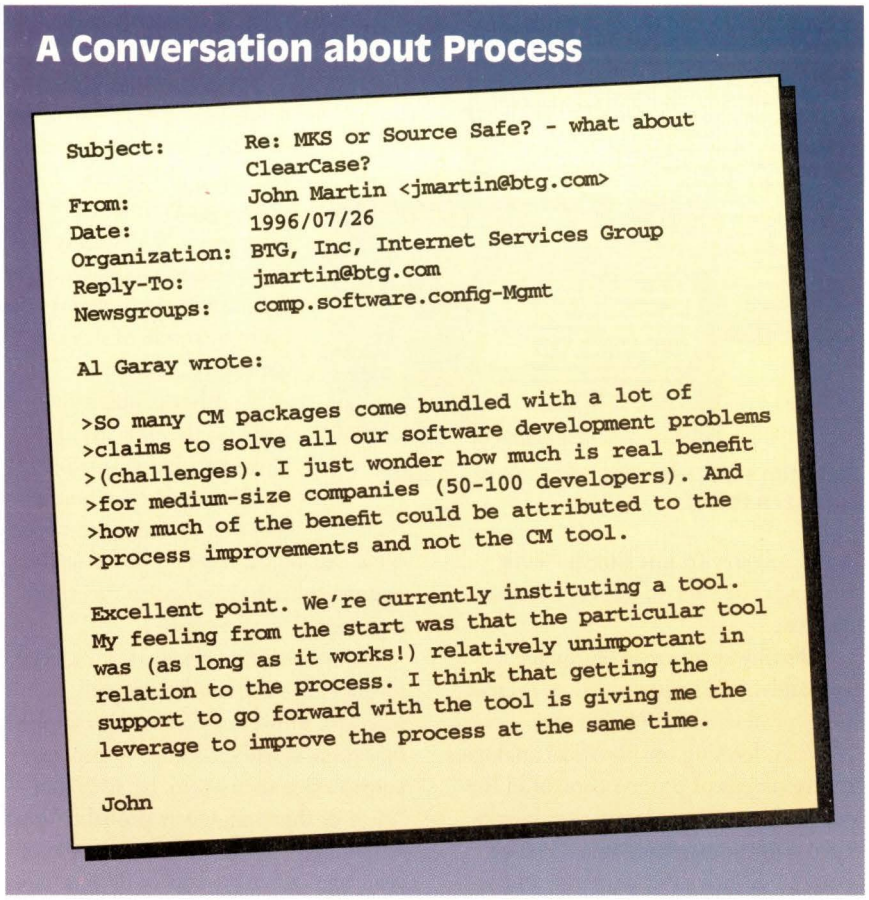
Note, however, that the CVS users that Cyclic supports aren't so enthusiastic about CVS's lack of locking features. So much so, that under customer pressure, Cyclic has officially reversed its policy, stating that CVS's "lack of locking is a bug, not a feature."

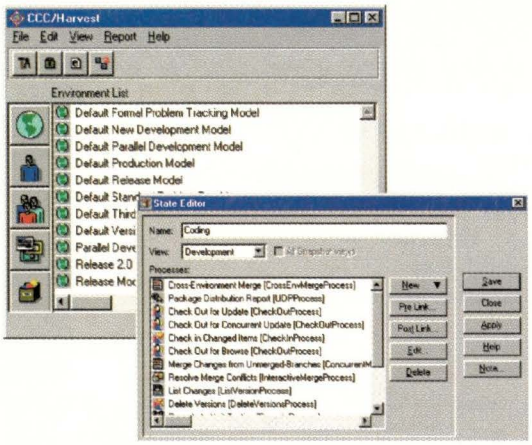
No Longer Arts and Crafts

Nobody argues with the wisdom of writing down telephone numbers on a piece of paper, but some of us put up an awful lot of resistance to the idea of getting a full-fledged filofax. It might be more of a concession to organization than we're willing to accept. Or perhaps we argue that the thing is too heavy to carry around, and that the time you spend entering all the details of your life outweighs the time you spend scrambling for that little piece of paper.

Likewise, process control-oriented tools are often perceived as obtrusive and cumbersome, time-consuming, and in the end, overkill. To make matters worse, they carry the stigma of being management tools with which–if you're particularly down on managers–micromanagers can better pester programmers.

This isn't to say that a lot of companies–large and not-so-large–aren't implementing process control. Tani Haque, chief executive officer of SQL Software, the Vienna, VA-based vendor of PCMS software, says that this is related to the increased pressure on the soft-





Platinum's CCC/Harvest takes an integrated approach to CM.

ware industry to not simply "write lines of code, but to deliver product on time."

"Writing software is no longer an arts-and-crafts industry, but is increasingly professional," Haque says.

When looking for historical analogies to the advent of process control in the software industry, Haque cites Henry Ford and the assembly line. "Henry Ford could not meet demand, and so he had to ask himself how he could gain more time. The solution was to divide up car manufacturing and assembly into processes," says Haque.

"The result was that engineers were left with more time to produce better and more sophisticated cars." Likewise, Haque believes that all software development teams, large and small, can benefit from judiciously implementing process control.

Process Control: 'A Maturity Issue'

All the philosophy in the world, however, probably won't get engineers excited by the prospect of a process control system. It's "a maturity issue," according to James Carver, staff specialist on the F16 project for Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX, and a user of PCMS.

Carver says that, "as a rule, most engineers would rather have no CM system at all," than be burdened with the check-ins, check-outs, problem-tracking reports and to-do lists inherent in a process management tool. The reason for the resistance? "A CM system is probably going to get in the way of an engineer's productivity," he says. "It's management that really benefits from it."

But even when you consider the overhead involved in using the tool, Carver says that, ultimately, "it's been a great timesaver" for his group. "We used to have paper-based change request forms, and those could take up to a couple of days to get signed," he says.

"Another problem we had was that we could never get the people on the change review board together at the same time. Now our board meets electronically, and we don't have to go to meetings any more," Carver says.

Any system that eliminates the need for meetings is bound to be well received. However, Carver does admit that there is still resistance to process control. But then again, he adds that "most of those engineers probably don't remember what it was like a couple of years ago, when we had to fill out paper forms."

Components of a CM Package

Most CM packages have some combination of basic version control features. But beyond that, there are few other features that a CM package must have in order to remain a CM package. The following section will talk about the various features that users look for in a CM package. Note: The `comp.software.config-mgmt` newsgroup FAQ lists more than 45 commercial off-the-shelf CM packages, and several free or shareware offerings.

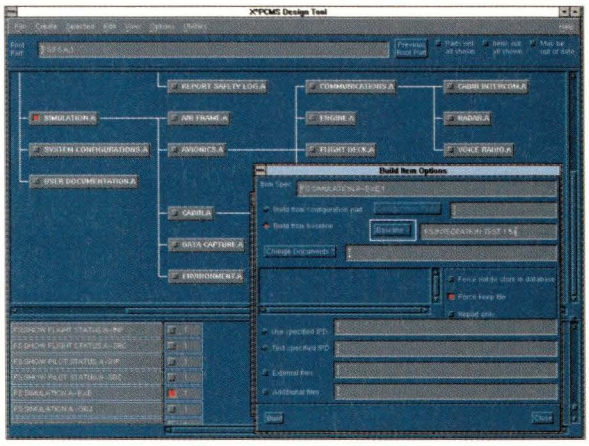
Some vendors take an integrated approach to the subject, with one large application performing many functions aimed at different kinds of users. One example of this kind of system is Platinum Technology Inc.'s CCC/Harvest product. Other vendors supply individual components, or modules, that can be integrated with one another, or with components from other vendors. PCMS Dimensions, from SQL Software Inc., for example, is a suite of CM modules, all written with each other in mind.

On the other hand, Atria Software Inc. does not supply an obvious problem-tracking or process-managing companion to its ClearCase product, and so a lot of teams have coupled it with Scopus Technology Inc.'s ProTEAM or Pure Software Inc.'s PureDDTS. A CM system can often be a mix-and-match collection of so-called point products. In fact, many users do this, and to better address such users' needs, Pure Software and Atria Software are merging to become a single company called Pure Atria Corp.

Configuration Control

RCS and SCCS history files do an adequate job of noting which changes occurred and when. But they assume that all changes are for the better, and that a development cycle moves in one direction: forward. Developers know, however, that edits to a file might be experimental, and that the officially released build reflects files that are perhaps several versions younger than those currently being worked on.

A CM system that knows which versions of which files are associated with a given build is one of the main things that users look for above and beyond simple version control. Suzanne Reid, CM administrator for the Germantown, MD-based Hughes Network Systems, says, "Not including versioning, the most important thing to us is how easy and fast you can reproduce a past build."



SQL Software's PCMS is a suite of CM modules.

Commercial CM Products and Vendors

CMZ	CodeME s.a.r.l.	14, Rue de l'Eglise F-01630 St. Genis-Pouilly France	(distributed via CERN: *codeme@cernvm.cern.ch* *http://asdwww.cern.ch/cmz/)*	Circle 183
CONTROL-CS	Network Concepts Inc.	201 Littleton Road Morris Plains, NJ 07950	*nci@netwkconcept.com* *http://www.netwkconcept.com/*	Circle 184
CORPORATE RCS	Thompson Automation Software	5616 SW Jefferson Portland, OR 97221	*http://www.tasoft.com/~thompson/rcs.html*	Circle 185
CVS	Cyclic Software	P.O. Box 804 Bloomington, IN 47402	*info@cyclic.com* *http://www.cyclic.com/*	Circle 186
DEVMAN	VNP Software	180 Franklin St. Cambridge, MA 02139	*http://www.vnp.com/DevMan*	Circle 187
DRCS	Software Services and Solutions Inc.	94 Murray St. Meriden, CT 06450	*sss@sss.com* *http://www.opensource.com/Software/Development/DRCS.html*	Circle 188
DRTS	ILSI	6235 E. Monte Carlo Ave. Scottsdale, AZ 85254	*ilsi@enet.net*	Circle 189
ENDEVOR/WSX	Computer Associates International Inc.	1 Computer Associates Plaza Islandia, NY 11788	*http://www.cai.com*	Circle 190
EXCOCONF	Excosoft AB	Electrum 420 164 40 Kista, Sweden	*info@excosoft.se*	Circle 191
HUMAN-ORIENTED PROGRAMMING ENVIRONMENT (HOPE)	Aladdin Knowledge Systems Inc.	The Empire State Building 350 Fifth Ave., Ste. 6614 New York, NY 10118	*hope.sales@us.aks.com* *http://www.aks.com*	Circle 192
MKS SOURCE INTEGRITY	MKS Inc.	185 Columbia St. W. Waterloo, Ontario Canada N2L 5Z5	*inquiry@mks.com* *http://www.mks.com*	Circle 193
P3	P3 Software	915 Delmar Ave. Alameda, CA 94501	*p3@p3.com* *http://www.p3.com*	Circle 194
PROCESS CONFIGURATION MANAGEMENT SYSTEM (PCMS)	SQL Software Inc.	8500 Leesburg Pike, Ste. 405 Vienna, VA 22182	*http://www.sql.com/pcms.html*	Circle 195
PVCS	Intersolv Inc.	1700 NW 167th Place Beaverton, OR 97006	*pvcsinfo@intersolve.com* *http://www.intersolv.com*	Circle 196
AIDE-DE-CAMP (ADC)	True Software Inc.	200 Baker Ave., Ste. 300 Concord, MA 01742	*info@truesoft.com* *http://www.truesoft.com*	Circle 197
ALLCHANGE	Intasoft Ltd.	Tresco House, 153 Sweetbrier Lane Exeter EX1 3DG, UK	*intasoft@cix.compulink.co.uk*	Circle 198
ANDROMEDE	Eslog	2 bis, BUROSPACE 91571 Bievres CEDEX, France		Circle 199
CONTINUUS/CM	Continuus Software Corp.	108 Pacifica, 2nd floor Irvine, CA 92718-3332	*info@continuus.com* *http://www.continuus.com/*	Circle 200
CHANGE AND CONFIGURATION CONTROL (CCC/HARVEST)	Platinum Technology Inc.	340 S. Kellogg Ave. Goleta, CA 93117	*http://www.platinum.com/*	Circle 201
CHANGE MAN	Serena International	500 Airport Blvd. Burlingame, CA 94010		Circle 202
CLEARCASE	Atria Software Inc.	20 Maguire Road Lexington, MA 02173-3104	*info@atria.com* *http://www.atria.com/*	Circle 203
CMSTAT	CMstat Corp.	10241 Wateridge Plaza San Diego, CA 92121	*info@cmstat.com* *http://www.cmstat.com*	Circle 204
CMVISION AND CONFIGURATION MANAGEMENT FACILITY (CMF)	Expertware Inc.	12901 Alcosta Blvd., Ste. 2A P.O. Box 1847, San Ramon, CA 94583		Circle 205
CMWIN	Expertware Inc.	130 Ryan Industrial Court, Ste. 210 P.O. Box 1847, San Ramon, CA 94583		Circle 206
CONFIGURATION MANAGEMENT VERSION CONTROL (CMVC)	IBM	Contact local sales office	*http://fnctsrv0.chips.ibm.com/products/ppc/Developers/ppctools-62.html*	Circle 207

Commercial CM Products and Vendors (Continued)

PureDDTS and PureDDTS WebTracker	Pure Software Inc.	1309 S. Mary Ave. Sunnyvale, CA 94087	http://www.pure.com	Circle 208
Razor	Tower Concepts Inc.	103 Sylvan Way New Hartford, NY 13413	razor-info@tower.com http://www.tower.com	Circle 209
Revision Control Engine (RCE)	Xcc Software Technology Transfer GmbH	Durlacher Allee 53 D-76131 Karlsruhe, Germany	rce@xcc-ka.de http://www.xcc-ka.de	Circle 210
Revision Management System (RMS)	Data Design Systems Inc.	5915 Airport Blvd., Ste. 625 Mississauga, Ontario, Canada L4V 1T1	sales@datadesign.com	Circle 211
SABLIME	AT&T Software Solutions Group	10 Independence Blvd., Room 3A-32 Warren, NJ 07059	http://www.att.com/stc/sablime/SABLIME.html	Circle 212
SoftBench CM	Hewlett-Packard Co.	3404 E. Harmony Road Fort Collins, CO 80525	http://hpcc998.external.hp.com:80/sesd/products/softcm/main.html	Circle 213
Software Management System (SMS)	Intasoft Ltd.	Tresco House, 153 Sweetbrier Lane Exeter EX1 3DG, UK		Circle 214
Source Code Manager	UniPress Software Inc.	2025 Lincoln Hwy. Edison, NJ 08817	scm@unipress.com http://www.unipress.com/cat/scm.html	Circle 215
SPARCworks/TeamWare, ProWorks/TeamWare	SunSoft Inc.	2550 Garcia Ave. Mountain View, CA 94043	sunpro-info@sun.com	Circle 216
TreeSoft/CM	+1 Software Engineering	2510-G Las Posas Road, Ste. 438 P.O. Box 6041, Camarillo, CA 93011		Circle 217
VCS-UX	Diamond Optimum Systems Inc.	22801 Ventura Blvd., Ste. 105 Woodland Hills, CA 91364	DiamondOS@aol.com	Circle 218
Visual SourceSafe	Mainsoft Corp.	1270 Oakmead Pkwy., Ste. 310 Sunnyvale, CA 94086	http://www.mainsoft.com	Circle 219

This functionality is sometimes also called software release management.

An integral part of maintaining records of previous builds is managing the `make` files that go along with them. Case in point: Discussions of different `make` utilities are a frequent topic in CM-related newsgroups. For example, some recent discussions have centered around GNU `automake`, and, for developers performing multiplatform builds, Opus make, from Opus Software.

Not surprisingly, providing build management facilities is another feature that CM vendors rush to offer, usually with the help of a proprietary build utility and support for preexisting `make` files.

Problem Tracking

If you have already implemented a successful CM policy, the next thing you will probably want to do is integrate some sort of problem-tracking system. Problem tracking, sometimes referred to as change management or defect tracking, can help you do two things: reliably capture and store information about bugs, enhancement requests and client preferences; and assign responsibility for the changes to a member of the development team.

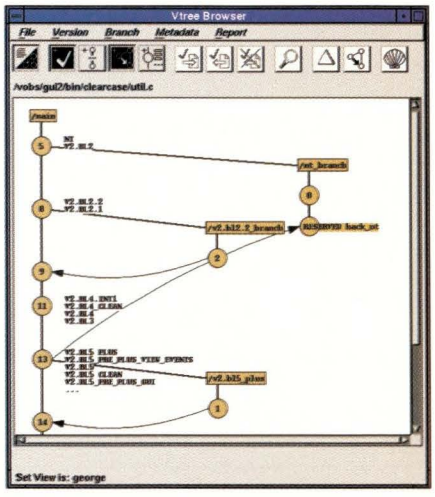
At the very least, a problem tracker should provide a series of (user-defined) forms that assist in gathering pertinent information about a bug or problem. On a more advanced level, some problem-tracking solutions attempt to identify potential files that need to be edited, and assign ownership of the problem automatically–assigning due dates, notifying appropriate authorities, automatically adding the item to a developer's to-do list and so on.

Heterogeneous Environments

A primary challenge facing development teams hoping to implement a CM package is how to deal with heterogeneous environments. This becomes especially true for software development teams that frequently do their development on UNIX, but have support groups on Windows or Macintoshes.

It's not surprising that the solution to effective networking on a multiplatform environment is emerging from the Web. Pure Software, which makes the PureDDTS problem-tracking system, recently released a Web-based version of the product, called PureDDTS WebTracker. The product uses standard CGI forms and lets users set preferences, query the database, submit new defects and generate reports, all from a common Web-based interface. In addition, users have found that the software integrates well with Atria's ClearCase, which fills basic CM needs such as version control and build management.

Another challenge facing software



A version tree in Pure Atria's ClearCase CM product

development teams is the reality of remote development sites. Engineers collaborating on the same project are not necessarily in the same office these days, much less in the same time zone. Keeping staff up to date on the state of a project has become a primary concern for organizations.

Suzanne Reid of Hughes says her group comprises 80 staff members in Germantown, MD, and another 20 in India. The oceans between the two groups are made even wider by the $10^1/_2$-hour time difference: When Maryland is getting into work, India is going home to eat dinner. Their solution to this problem is to run nightly `cron` jobs that spawn ClearCase MultiSite. The program, over a leased line, handles all the complexities of merging the changes made in the two development locations over the course of the day.

Process Customization

In 1991, the Software Engineering Institute at Carnegie Mellon University, Pittsburgh, PA, introduced the Capability Maturity Model for Software (CMM). The report delineates five levels of "process capability," where the first level describes an organization with few, if any, defined processes, most ad hoc and informal (see Figure 1).

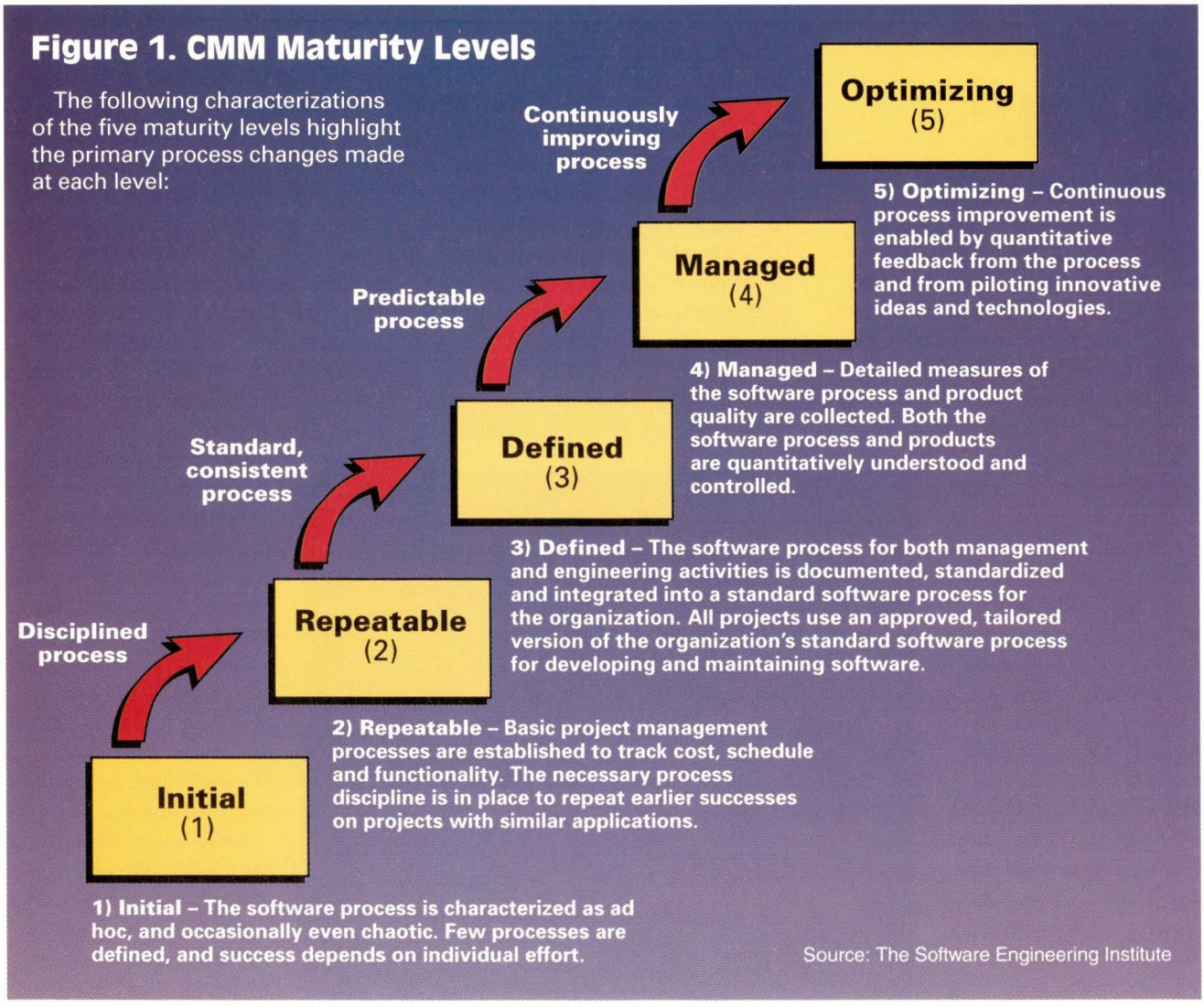
A primary challenge facing development teams hoping to implement a CM package is how to deal with heterogeneous environments.

According to the Software Engineering Institute, a large majority of organizations attempting to implement a CM system are at level one, but because so many tools impose strict processes–processes stricter than the organization is prepared for–CM packages often end up as shelfware.

CM vendors are beginning to address the needs of these smaller, less process-oriented customers. The trend involves letting customers define their own process, and, more importantly, edit the process throughout the development project's life cycle. This should help relieve the fears that development teams may have about the restrictive nature of process-oriented CM, and get them on their way to taking advantage of version control and build management without reservations. ⊷

Figure 1. CMM Maturity Levels

The following characterizations of the five maturity levels highlight the primary process changes made at each level:



Source: The Software Engineering Institute

Easing DBA, Conquering Consoles, and Boosting SPARC

A Motif version of Desktop DBA that might be worth paying for, a system control switch that's simple yet elegant and an easy upgrade from Ross.

Desktop DBA 3.4 for SQL Server

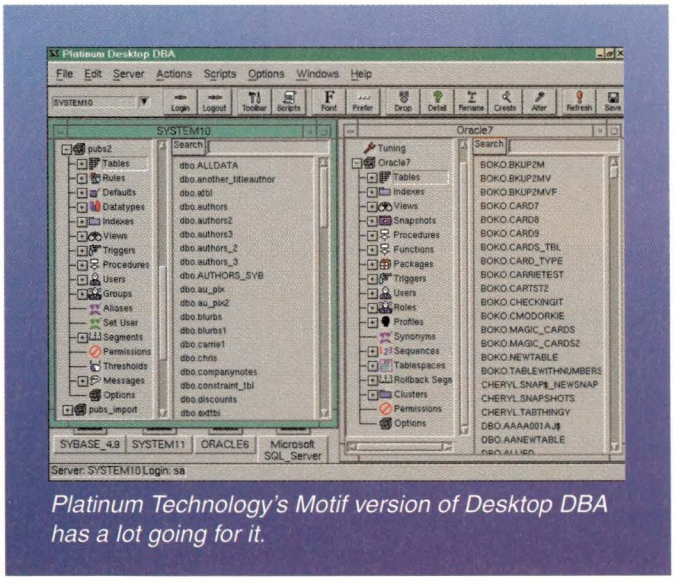
by KAREN WATTERSON

Platinum Technology Inc. has just shipped its first Motif version of Desktop DBA. At $2,490, it may seem an expensive alternative to the built-in database administration utilities that ship with current versions of Oracle Corp., Sybase Inc., Microsoft Corp., Informix Software Inc. or IBM RDBMSs, but it's got a lot going for it.

I've used both Sybase and Microsoft versions of SQL Server since 1989 and Desktop DBA since 1992, when it was a Windows-only product from a company called Datura Corp., Richmond, VA. (Actually, Desktop DBA's precursor, SQL Commander, shipped in August 1991.) Back then, Desktop DBA provided an easy-to-use GUI for administering either Sybase or Microsoft/Ashton-Tate SQL Server and performing routine DBA tasks–tasks that could otherwise be performed by the DBA from a command line interface. As you might expect, I got hooked. Pointing and clicking in Desktop DBA was a lot easier than invoking stored procedures–along with all the right parameters–from the operating system command line interface.

It still is.

So what's happened in the past five years? Well, lots. Now, in addition to Desktop DBA for Sybase and Microsoft SQL Server, you can also buy Desktop DBA for Oracle, Informix or DB2 (you get a price break for multiple RDBMSs). Another big plus is that you're no longer limited to running Desktop DBA from Microsoft Windows (over 17,000 DBAs still do, however)–you can also run it under Motif on Sun Microsystems Computer Co., Hewlett-Packard Co. or IBM workstations. Finally, Desktop DBA is now part of the Platinum Technology family of products. That translates into more development dollars, better integration with Platinum's other tools and better market visibility.



Platinum Technology's Motif version of Desktop DBA has a lot going for it.

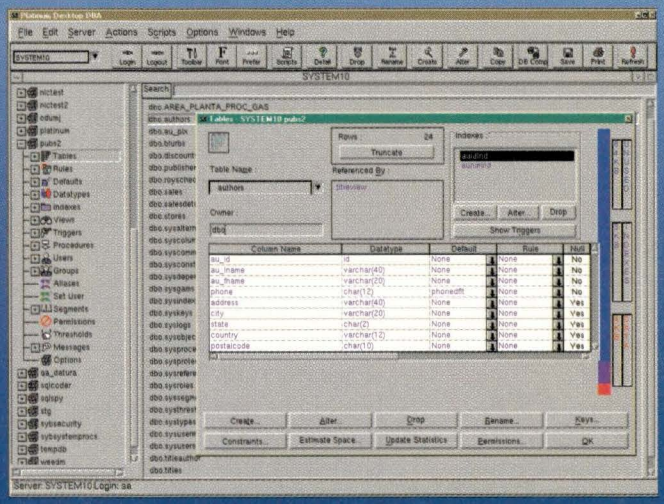
Of course, the RDBMS vendors themselves haven't stood still. Microsoft has had good GUI tools for administering SQL Server for several years (starting with the SQL Object Manager that shipped with SQL Server 4.2), and Microsoft has always bundled them "free" with Microsoft SQL Server–currently Version 6.5.

Sybase's response to Microsoft's SQL Object Manager was an optional (read: costs extra) tool called SA Companion for Windows, which never

caught on much in the macho UNIX DBA environment. With Sybase SQL Server 11, Sybase finally offers an easy-to-use Windows tool, SQL Server Manager, that lets you manage tables, views, users, groups, indexes and stored procedures, for example, in a visual environment. Furthermore, it's free to both Sybase NT and Solaris customers, and works with SQL Server 10 or 11. You still pay extra for other advanced utilities like the SQL Enterprise Manager and Replication Manager, though.

Oracle and IBM have also come under intense user pressure to offer decent visual administration tools, and with IBM DB2 2.1 for NT and Oracle 7.3, they, too, have recently released sorely needed versions of DBA tools. (Some critics still complain about Oracle's "hodgepodge" approach, but at least the new GUI tools are easier to use than the old character-based utilities.)

The new Oracle Enterprise Manager Console, for example, has four main components: the Navigator, which lets you examine databases, groups, names, servers, nodes and parallel server folders in a familiar hierarchical outline format, the Map Window, the Job Scheduling System and the Event Management System. Why couldn't the other stand-alone tools like the Oracle Instance Manager, Schema Manager, Security Manager, Backup Manager, SQL Worksheet, Backup/Recovery Manager, Import/Export Manager and Data Loader (formerly SQL*Loader) have been integrated into a single console as IBM does in its most recent release of DB2 Common Server?



This is the kind of detailed information Desktop DBA shows you about any table you have access to.

And why does Oracle charge extra for the Performance Pack option, which includes performance monitoring, a lock manager, Oracle Trace and a useful configuration-tuning system called Oracle Expert?

Nevertheless, Desktop DBA's fiercest competition comes from the RDBMS vendors themselves. Free is a compelling price.

Why Desktop DBA?

So why bother with Desktop DBA when you can get some decent DBA tools for free from other vendors?

There are several good reasons. First, as far as I know, the newest DBA tools from Sybase, IBM, Oracle and Informix only run under Windows, not Motif. Second, Desktop DBA offers better "backward compatibility" than any of the vendors' own tools.

For example, on the beta version of Desktop DBA 3.4 for Motif that I'm reviewing, I can administer any Sybase or Microsoft SQL Server on the network. And I mean Microsoft SQL Server 4.2, 6.0 or 6.5; and Sybase SQL Server 4.9, 10 or 11. I

Complementary Tools

Platinum Technology offers many complementary tools for Desktop DBA. SQL Server DBAs might be interested in any of the following:

- **Platinum Enterprise DBA** is a sort of "super Desktop DBA" for database administration and object/schema alteration and migration in heterogeneous client/server environments.
- **Platinum DBVision** monitors and manages the performance of Oracle and Sybase databases in distributed UNIX environments.
- **Platinum Fast Load (or Fast Unload)** is used for quickly and efficiently loading or unloading large amounts of data into database tables.
- **Platinum Image Analyzer** speeds and simplifies database backup and recovery by providing two key features not available with Microsoft SQL Server or Sybase: off-line verification of backup integrity, virtually eliminating any impact on normal processing; and the ability to recover data from individual tables, rather than requiring an entire database recovery.
- **Platinum Log Analyzer** for Microsoft SQL Server and Sybase analyzes and maintains log files in SQL Server databases, allows users to audit data changes, undo or redo data changes, and monitors the recoverability of SQL Server tablespaces.
- **Platinum ServerVision** is a UNIX server performance monitoring tool that can store performance history data it collects in a Sybase database.
- **Platinum SQL-Archive** is used for scheduling, executing, monitoring and verifying backups for multiple databases from a single GUI-based console.
- **Platinum Tsreorg** for Sybase reorganizes tables, indexes and tablespaces in distributed environments.

can move data or objects between them. I can upgrade or retrograde and Desktop DBA will take care of tricky details such as data type mapping.

If you're a multi-RDBMS, multi-platform shop, Desktop DBA has the appeal of offering a centralized console for managing multiple servers and their databases including Oracle, Sybase and Microsoft SQL Server, DB2 Common Server (AIX, OS/2, NT, HP-UX, Solaris) and Informix SE and Online.

You also get a special tool, SQL-Port–available on the Options menu–that eases the chore of importing and exporting data from just about any source. For SQL Server users, SQL-Port is an appealing alternative to the much-maligned bcp utility because it's faster and easier to use. SQL-Port lets you import or export not only entire databases (or their structures) but also single or multiple tables, and will automatically create target tables during import if a table doesn't exist. For importing legacy data, SQL-Port lets you customize both field and row delimiters.

Even if you don't need the support for diverse databases, Desktop DBA's features are bound to strike a chord. With Desktop DBA, you can:

- Examine table structures and add, delete or reorder columns
- Manage users, including cloning them and dropping all nonsystem objects associated with a given user
- Compare databases–based on their system catalogs
- Use Desktop DBA's SQL Scripts editor to write or edit SQL associated with DDL, stored procedures, triggers and so on, and view the results in another pane.

Installation

Installing Desktop DBA is fairly straightforward. The main program files can be installed on a local or network workstation, but you need sa/SYS/DBA privileges to install the server components. Once you supply a server name, login and password, Desktop DBA installs several stored procedures on each server administered.

When you run Desktop DBA the first time, you'll see an icon for each server you've installed. If you need to add more, you can do that from Desktop DBA's Server menu. In case you're worried, Desktop DBA also has an uninstall routine.

The Desktop DBA default screen has two panels: one with a list of basic tasks and the other with a list of database objects. On the Sybase System 10 server I used, the left window displayed Tuning, Shutdown, Logins, Audit, Caches, Remote Access, Devices, Drop Database, Add Database and the databases on my server (master, model, tempdb and so on). If, for security reasons, I didn't want all the servers' databases to be accessible, I could have opted to make those nonviewable via the Options/ Preferences menu. Adding or deleting devices, logins, users and so on is simply a mouse click away.

Most DBAs will use the database object tools more. The right-hand panel lets you select any object from the search list of objects, which includes tables, rules, defaults, datatypes, indexes, views, triggers, procedures, users, groups, aliases, set user, segments, permissions, thresholds, messages and options.

Once you select an object, you can drill down to the desired granularity and add, delete or modify any object you have the privileges to work with. When you drill down to a particular table, Desktop DBA displays an extremely useful window with everything you need to know about that table (see screen shot on Page 79). You'll see how many rows it has, who the owner is, what indexes are associated with it, what stored

Desktop DBA 3.4 for SQL Server

Company
Platinum Technology Inc.

Address
1815 S. Meyers Road
Oakbrook Terrace, IL 60181

Phone
(708) 620-5000

URL
http://www.platinum.com

Best Feature
Can be used with many DBMSs, intuitive interface, thermometer displays.

Worst Feature
Price, no built-in "expert system" for configuration tuning.

Circle 220

Pricing Information

Desktop DBA for Motif

	1 RDBMS	2 RDBMS	3 RDBMS	4 RDBMS
1-user	$2,490	$3,740	$4,740	$5,740
2-user	$4,730	$7,110	$9,010	$10,919
5-user	$11,200	$16,830	$21,330	$25,830
10-user	$14,940	$22,440	$28,440	$34,440

Desktop DBA for Windows

	1 RDBMS	2 RDBMS	3 RDBMS	4 RDBMS
1-user	$995	$1,495	$1,895	$2,295
2-user	$1,895	$2,895	$3,595	$4,360
5-user	$4,495	$6,795	$8,495	$10,330
10-user	$6,695	$10,495	$13,095	$13,770

procedures reference it and, of course, information about all of its columns. You'll even see how "full" the table is via a thermometer display.

Managing SQL Scripts

Managing SQL scripts, whether they're DDL or scripts associated with stored procedures, is the other main chore DBAs face, and Desktop DBA makes that easy too. When you choose Scripts from the main menu (another option that can be disabled from the Options/Preferences dialog), you see the SQL Scripts window. There you can open an existing script, create a new one or append another script to the one displayed in the window. You can run scripts directly from the SQL Scripts window, and you'll see an indication "Working" in the results windows until results are returned. Desktop DBA comes with a handful of useful SQL "starter" templates, or you can create your own.

Documentation for the beta version of Desktop DBA 3.4 I reviewed was not available, but the manuals and help files for the Windows version are well done. You probably won't need them, however, once you've completed the installation, because Desktop DBA's interface is so easy to use.

General Information

It should be obvious that I'm impressed with Desktop DBA, but to obtain a detailed product description or to arrange a trial version, go to `http://www.platinum.com/products/dba/desdbaps.htm`. Better yet, to get a taste of Desktop DBA's "look and feel," try the useful interactive demo (I really can recommend it) found at `http://www.platinum.com/products/trifolds/deskdba1.htm`.

Karen Watterson is an independent San Diego, CA-based writer and consultant specializing in client/server and data warehousing issues. She writes a monthly column for *Data Management Review*, is editor of Pinnacle Publishing's *Visual Basic Developer* and *SQL Server Professional* newsletters, and has written two books for Addison-Wesley: *Visual Basic Database Programming* and *Client/ Server Technology for Managers*. Her email is `1119390@mcimail.com`.

System Console Switch

by IAN WESTMACOTT
Technical Editor

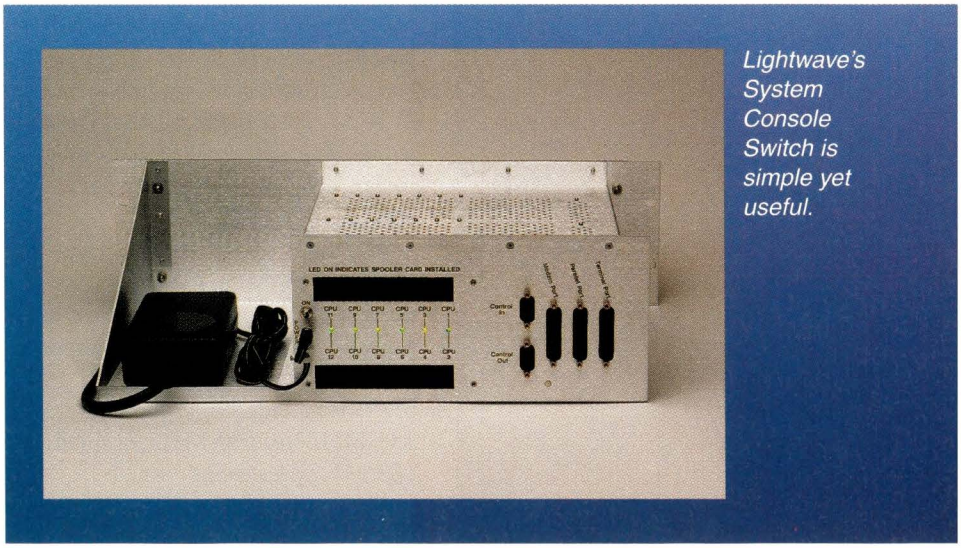
Centralized management. You've got dozens of boxes that need configuration and monitoring, from servers to concentrators, from environmental conditioners to failover hardware. And you want to do it all from one console. That's where the System Console Switch from Lightwave Communications Inc. steps in. This is one of those products that's so simple, yet so useful. With it, you can centralize the management of a collection of console devices without losing information, either locally or remotely.

The System Console Switch comes in rack-mount or mini-tower configurations, and each can accommodate up to 12 devices. Six slots each hold a dual-port module, which connects two RS-232 devices to the switch. Switches can be cascaded, providing a total of 120 ports. To these ports you may attach any RS-232 character-based device, such as server consoles and diagnostic monitoring equipment. The Console Switch may then be attached to a terminal, (parallel) printer and modem, each of which can be switched to any of the connected ports. With one Console Switch you can give yourself single-terminal, single-printer and dial-up access to 12 devices.

Each of the ports operates up to 19.2K baud, and buffers 32 Kb of data. Thus, each port continuously receives data and stores approximately 30 pages of text. When you switch the terminal to any particular port, you can view or print the data. Remote access via dial-up modem connection operates up to 19.2K baud and is password protected. The switch can be configured to disable spooling from dial-up connections, and to control whether dial-up connections are displayed on the local terminal.

The System Console Switch has a scan feature, which allows you to scan through a list of frequently used ports, at user-specified intervals. Each buffer can also have up to four tags inserted into the data stream, to facilitate finding portions of data quickly. Any number of data lines may be spooled to the printer from any port, though the switch does not support continuous print spooling of data.

The desktop version measures 9 by 4.3 by 10.25 inches, while the rack-mount version measures 5.25 by 19 by 10.25 inches. Terminal, printer and modem ports use DB25 connectors, while each of the console ports use RJ45 connectors. Both are well-constructed, with connection ports on the rear panel and module access and configuration dip switches conveniently accessible behind a front panel.



Lightwave's System Console Switch is simple yet useful.

Installation

Installation and setup of the Console Switch is straightforward. Out of the box it can be plugged in and attached to devices in a matter of minutes. Just about any combination of cable and connectors is available from Lightwave Communications, and all ports and protocols follow industry standards.

The console port implements VT100 emulation and can be connected to a dumb terminal, PC or workstation. Once a console is connected, the on-screen menus allow you to configure port line speeds, passwords and scan lists; the whole procedure is quick and easy.

The System Console Switch is a practical and convenient device, and we found no faults with it. It would be nice to see a continuous print feed option, for those instances where you absolutely must have a complete record. It would also be nice to have the ability to spool to any printer port in a cascaded configuration, thus allowing you to use multiple printers with dedicated functions.

Our only real complaint is the high price for the system chassis, though the port modules are reasonably priced.

System Console Switch

Company
Lightwave Communications Inc.

Address
261 Pepe's Farm Road
Milford, CT 06460

Phone
(800) 871-9838

URL
http://www.lightwavecom.com

Price
Chassis: $1,195
Dual-port module: $295

Best Feature
Convenience

Worst Feature
Chassis price tag

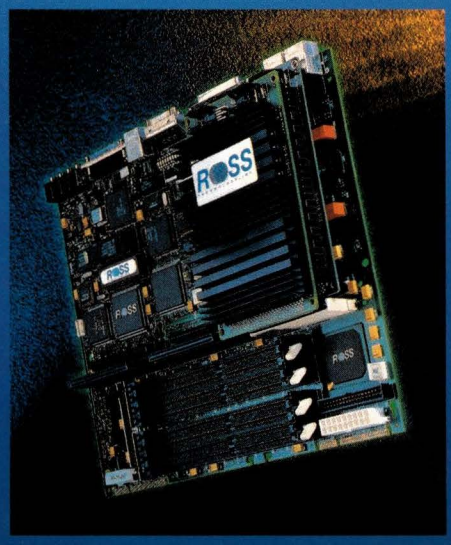
Circle 221

Ross HyperSTATION Motherboard Upgrade

by IAN WESTMACOTT
Technical Editor

If you want to beef up your SPARCstation 5 or 20 box, or need a multiprocessor, Ross Microcomputer Corp. wants to hear from you. The company sells a line of hyperSTATION motherboard upgrades to elevate a SPARCstation 5 or SPARCstation 20 to a quad 150-MHz hyperSPARC multiprocessor in minutes. We upgraded a SPARC-station 5 with a hyperSTATION mB21 with two 150-MHz hyperSPARC modules.

The hyperSPARC is a V8 superscalar implementation of the SPARC architecture with clock speeds ranging from 100 to 150 MHz. The processor is dual issue, with 8-KB and 256-KB L1 and L2 caches, respectively. It is implemented as an MBus module, allowing it to be used in uniprocessor and multiprocessor configurations. Sun uses Ross' hyperSPARC in several models of its own SPARCstation 20.



The hyperSTATION motherboard provides quad 150-MHz hyperSPARC performance on the desktop.

Easy Upgrade

Upgrading a workstation involves replacing the motherboard, and the replacements come in a variety of configurations. The hyperSTATION mB6 features a single 40-MHz MBus slot that supports up to two processors, four SBus slots, up to 512 MB of RAM, 10-MB/s SCSI and optional ISDN. Supported configurations include single and dual 100-MHz and 125-MHz CPUs.

The hyperSTATION mB21 features dual 60-MHz MBus slots for up to four processors, four SBus slots, 1 GB of RAM, 10-MB/s SCSI and optional ISDN. Supported configurations include single and dual 133-MHz and 150-MHz, or quad 133-MHz processors.

The upgrade was quick and almost flawless. Essentially, the steps involved are removing the original motherboard, installing the Ross motherboard and installing the MBus modules. Though this might sound somewhat daunting, Sun motherboards are easy to remove. They slide right out after you remove two screws. You have to disconnect several cables first, and remove any SBus cards and memory SIMMs installed, but the process is detailed clearly in the Ross manual.

Once the original motherboard is removed, the Ross motherboard slides in just as easily. However, we encountered our first problem at this stage. The screws holding the Sun motherboard to the chassis are attached to the motherboard, so Ross provides replacement screws to attach its motherboard to the chassis. The provided screws in our case were the wrong size, so we had to locate correct ones. Nothing to get upset about, but certainly an inconvenience. Once the Ross motherboard is in place, you reattach the cables and reinstall any SBus cards and memory.

Next, the hyperSPARC MBus modules are installed. For SBus and MBus modules, the Ross motherboard includes posts with thumbscrews for holding down the back side of the modules. We ran into another problem at this point. The module and post holes did not line

up correctly. Again, this problem does not prevent the system from working, but it is exactly this kind of attention to detail that distinguishes manufacturers.

Once the hyperSPARC modules are installed, all that is left is to slide on the cover and boot it up. Our SPARCstation 5 was running SunOS 4.1.4, and so we did not have to patch the kernel or do any configuration for the hyperSTATION architecture.

SunOS 4.1.3 and 4.1.3_U1 (Solaris 1.1 and 1.1.1, respectively) users will need to install a provided (on CD-ROM) kernel patch prior to the motherboard upgrade, and Solaris 2.3, 2.4 or 2.5 users will have to perform a complete reinstall of the OS (not an upgrade install) to incorporate the appropriate kernel configuration information. We completed the entire upgrade in 10 minutes, not counting the time spent finding screws that would fit.

System Requirements

There are a few system requirements and incompatibilities to note. You must be using one of SunOS 4.1.3 or 4.1.3_U1, SunOS 4.1.4 and above, or Solaris 2.3 and above. AFX Bus cards in SPARCstation 5 computers will not work with the Ross motherboard, and only SBus graphics options are supported. SPARCstation 5 SIMMs are not compatible with the Ross motherboard, so you'll need to get a SS5 to SS20 SIMM adapter. In addition, the Ross motherboard has only one serial port.

The removed Sun motherboard must be returned to Ross within 45 days of purchase. Currently, Ross simply stores these, presumably to keep them off the gray market.

The documentation is very good and is littered with the Ross tech support hot line number in bold. Unfortunately, Ross tech support seems to be understaffed. When we called, we got a recorded message asking us to leave a message or to try a pager number. We left a message, but our call was not returned for several days. However, the quality of the documentation and simplicity of the upgrade means you should get by without needing to call.

The 40-MHz motherboard supports 100-MHz uni- and dual processors at $5,295 and $7,000, respectively. The 60-MHz board supports 133-MHz uni-, dual and quad processors at $7,795, $11,295 and $18,295, respectively. The 60-MHz board supports a 142-MHz quad processor at $23,795. ⊸

HyperSTATION Upgrade Model 21

Company
Ross Microcomputer Corp.

Address
1701 Directors Blvd.
Fourth Floor
Austin, TX 78744

Phone
(512) 436-2800

URL
http://www.ross.com/

Best Feature
Ease of installation and informative documentation.

Worst Feature
Manufacturing flaws with accessory hardware.

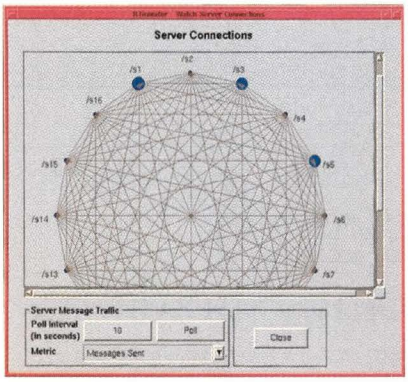
Circle 222

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.

Secure Interprocess Messaging

Talarian, provider of cross-platform software tools, has announced SmartSockets 4.0. SmartSockets is a message-oriented middleware product that reportedly enables programs to communicate quickly, reliably and securely across LANs, WANs and the Internet. Major new features include unlimited scalability, security and the ability for customers to add their own protocols, Talarian says.



According to the company, SmartSockets derives its scalability using many of the same techniques that have made the Internet scalable, including a hierarchical namespace, dynamic routing of messages and recovery from transient network failures. Messages can now be routed in real time to large groups of processes, with the processes organized hierarchically to any number of levels. Talarian says SmartSockets will dynamically reconfigure its routing tables as processes come and go and network topology changes.

SmartSockets 4.0 allows messages to be transferred securely across any type of network. In addition to encrypting messages, SmartSockets can also enforce authentication of programs and users, ensuring they are who they say they are, the company says.

SmartSockets 4.0 reportedly allows customers to link in their own security mechanisms if desired. Because the new version of the product provides an open and published interface for adding new protocols, customers can now customize their applications by adding their own network protocols, Talarian says.

SmartSockets includes a C application programming interface and a C++ Class Library, graphical interface for monitoring and debugging distributed applications, and the ability to customize and extend almost any aspect of the product.

Pricing for SmartSockets 4.0 is per developer; runtime pricing is per connection. For example, the price for a developer's seat on UNIX with 20 connections including the C API, C++ class library, message router and graphical monitor/debugger is $16,000.

Talarian Corp.
444 Castro St., Ste. 140
Mountain View, CA 94041
Circle 101

Precise/CPE Hits U.S. Market

Middleware package Precise/CPE has been released to the U.S. market for the first time. Its maker, Precise Software Solutions, says it helps provide interoperability with more than 40 different computing environments, from mainframes to Java-enabled Internet servers and browsers.

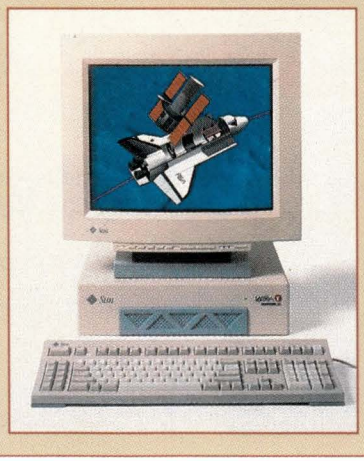
Precise/CPE comes with a single, cross-platform application programming interface. The API is said to incorporate features from CDE, CORBA and OLE 2.0. Its Remote Link Facility has encryption and compression features to ensure system integrity and efficiency, Precise says.

Precise/CPE supports MS-DOS, OS/2 and all versions of Windows. It supports CICS, IDMS/DC, VM, MVS, IMS and other mainframe environments. It supports UNIX servers from Sun, HP, IBM, Olivetti and NCR. In addition, Precise/CPE will

Visualize 3D Satellite Images

Analytical Graphics, a software vendor providing 3D graphics analysis tools for the space industry, has announced that its Satellite Tool Kit/Visualization Option (STK/VO) is now available for the 64-bit Sun Microsystems Computer Co. UltraSPARC. With the availability of the Solaris OpenGL 1.0 Ultra Creator3D Edition, specialized graphics hardware is no longer required to run the product.

STK/VO reportedly allows users to visualize satellites, air, sea and land vehicles, ground facilities, targets and sensors in three dimensions. It can be used to solve problems relating to satellite geometry, telemetry, access and scheduling, according to the company.



STK/VO comes loaded on a Sun Ultra 1 Creator3D Model 170E, with a 167-MHz UltraSPARC processor, 64 MB of RAM, a 2-GB hard disk, 20-inch color display, Creator 3D graphics and Solaris OpenGL 1.0. The entire package, including the workstation, costs less than $23,000.

Analytical Graphics Inc.
660 American Ave.
King of Prussia, PA 19406
Circle 100

work with SNA, TCP/IP, NetBIOS and IPX/SPX network environments.

Precise/CPE is being marketed through a direct sales staff and will soon be available from leading vendors. Pricing ranges from $75,000 to $150,000.

Precise Software Solutions Inc.
50 Braintree Hill Park, Ste. 110
Braintree, MA 02184
Circle 102

Tape Libraries are SSA-Capable

MediaLogic ADL has announced the Scalable Library Architecture (SLA) line of tape libraries, which can be connected to Serial Storage Architecture (SSA) loops. SSA capability is

made possible by Vicom's Serial Loop Interface Cards (SLIC), an SSA controller that lets native SCSI devices connect to an SSA loop.

ADL says its SLA library achieves substantial performance improvements over simple SCSI-based tape libraries (over 300%, the company says), due to the two-port nature of SSA. Each port can carry two 20-MB/s conversations, totaling 80 MB/s. This contrasts with SCSI, which can carry only one conversation over its single port.

ADL also says that each device in an SSA loop can be separated by up to 25 meters without any degradation of the signal, as opposed to SCSI devices, which cannot be separated by more than 3 meters if single-ended cabling is used.

The ADL SLA tape library line comes in the following configurations: the SLA-4 Series of 4mm DAT systems, with a capacity of up to 1.6 TB; the SLA-8 Series of 8mm DAT systems, holding up to 3.4 TB; and the multi-terabyte DLT-based SLA-D product, which supports up to 2.2 TB. Pricing for the SLA tape library starts at $8,500.

MediaLogic ADL Inc.
1965 N. 57th Court
Boulder, CO 80301
Circle 103

Speedy Database Recovery

Veritas Software recently started shipping VxSmartSync, a recovery accelerator designed for Oracle Corp. databases that are mirrored using the Veritas Volume Manager.

VxSmartSync enables interfaces between VxVM and the Oracle database engine that allow the consistency of mirrored Oracle databases to be restored after a system failure and reboot (or failover, in a high-availability server configuration) in a fraction of the time ordinarily required to resynchronize mirrored databases, the company says.

If system failure occurs while databases are being updated in a mirrored environment, data on the multiple copies of the database may not be consistent. The mirroring subsystem (in this case, VxVM) must restore mirror consistency on system reboot or failover. While this recovery is being performed, some of the I/O capacity of the system is reportedly consumed for resilvering, stealing bandwidth from on-line database transactions and applications.

VxSmartSync is said to reduce the time required to restore consistency–traditional methods of mirror resynchronization may take hours or even days for enterprise databases and data warehouses–by using the record of changing data Oracle tracks in its redo logs.

VxSmartSync allows the Oracle database engine to manage the resynchronization process, rewriting only the data known by Oracle to be dirty at the time the system failed. According to Veritas, this may be as little as $^1/_{100}$ to $^1/_{1000}$ of the data that other resynchronization techniques would need to copy.

VxSmartSync is available for Solaris servers running the Oracle7 Server and mirroring their data using VxVM. Pricing for a single-server license starts at $495.

Veritas Software Corp.
1600 Plymouth St.
Mountain View, CA 94043
Circle 104

Nikon Ships Direct-Overwrite MO Drive

Nikon Optical Storage is shipping the Beluga, a high-speed, direct-overwrite magneto-optical (MO) drive.

With a sustained read/write transfer rate of 4 MB/s, the product is reportedly aimed at multimedia organizations, which require high-speed removable storage for large quantities of data.

The 2.6-GB drive is optimized for Nikon's patented LIMDOW, or Light Intensity Modulation Direct Overwrite, media. LIMDOW erasable media improves on MO write performance by 100%, the company says. Nikon says that, unlike older MO media, Beluga does not need to erase previous data before writing to disk.

The Beluga drive can also read and write to ISO-standard 650-MB and 1.3-GB MO media, ISO-standard non-LIMDOW 2.6-GB media and CCW, or Continuous Composite WORM. This lets users continue to access previously recorded MO media, the company says.

The drive will be available through resellers priced at $2,450, with one 2.6-GB disk costing $129.

Nikon Optical Storage
1399 Shoreway Road
Belmont, CA 94002
Circle 105

New Terminal Servers

Specialix has announced a new line of terminal servers called Jetstream for remote access to TCP/IP networks.

The family has three members: Jetstream 6000, an eight-port (upgradable to 32) terminal server that

supports rlogin, telnet, multisessions, multiple terminal definitions and printer and modem grouping; and Jetstream 7000 and 7500 models, which each have eight ports (upgradeable to 16) and are mainly used for remote access, for example, LAN bridging. The products support SLIP/PPP, line speed of 115.2 Kb/s, hunt group capability, SNMP, BOOTP and downloadable terminal definitions.

Pricing for the Jetstream family is variable, starting at $1,695 for the 6000 model and $2,395 for the 7500. The products are compatible with several environments, including ISDN, LAN/WAN under UNIX, and Windows NT and 95.

Specialix Inc.
745 Camden Ave.
Campbell, CA 95008
Circle 106

Check your FORTRAN 90

IPT has unveiled its FORTRAN90-lint software development tool, for use with a FORTRAN compiler.

The impetus for the new tool is the industry's adoption of the FORTRAN 90 standard, the company says. Thus, FORTRAN90-lint was developed to support the new enhancements and intrinsic procedures defined in the new version of the language.

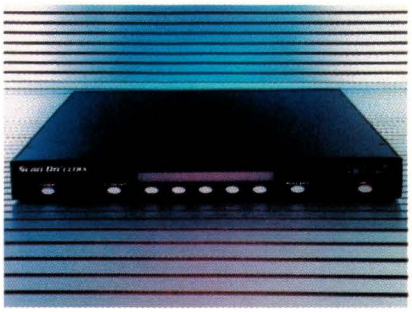
FORTRAN90-lint's main task is to check source code for errors. It can reportedly handle projects over a million lines long and reports back on usage conflicts, unused variables, common block errors and variables that are referenced before initialization, or that are not initialized at all. It also allows for target and host options for cross-platform portability, and provides call trees, document codes and reports, IPT says. Using FORTRAN90-lint makes for reduced development time and more stable code, IPT says.

FORTRAN90-lint is available for most major UNIX platforms, and for Open VMS. A single-user license costs $5,900.

IPT Corp.
1076 E. Meadow Circle
Palo Alto, CA 94303
Circle 107

Workstation-to-Video Scanner

The new Scan Do Ultra, from Communications Specialties, is a combination workstation-to-video scan converter/down converter. The company is touting it as the lowest priced model of its kind.



The Scan Do Ultra is said to support up to 1,600-by-1,280 resolution. It has NTSC/PAL output, as well as VGA, SVGA and Mac-compatible down converted outputs. Other features include Composite, S-Video, RGB & YUV outputs, genlock support, true multiscanning over a wide input range, dual computer input and variable sizing, the company says.

The Scan Do Ultra costs $6,495.

Communications Specialties Inc.
89A Cabot Court
Hauppauge, NY 11788
Circle 108

Z-RAM for the Enterprise

Camintonn Z-RAM is now selling 64- and 256-MB memory kits specifically designed for Sun Microsystems Inc.'s Enterprise server. This will be followed by a 1-GB memory kit, the company says.

The memory kits, which are intended for Models 3000, 4000, 5000 and 6000, are designed as a low-cost solution for Sun users to take advantage of the Enterprise's capacity for standard memory, the company says. Enterprise servers come standard with 64 MB of RAM, but, in the case of the 6000, can be upgraded to 30 GB of RAM.

The 64- and 256-MB kits cost $1,086 and $4,429, respectively.

Camintonn Z-RAM Corp.
22 Morgan
Irvine, CA 92718
Circle 109

Centralized Faxing

The distributed fax system Merkur, developed by SCH Technologies and deployed in Germany, has been introduced into the U.S. market.

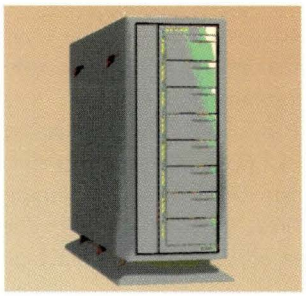
Merkur allows users to install modular fax resources, such as modem servers, document servers and print servers throughout a network. It is said to support centralized administration, unlimited fax lines, inbound routing, digitized signature storage, document markup and resend, Digital Image Design and ISDN compatibility, and Postscript Level 1 and 2 support.

Merkur can be deployed on 15 UNIX operating systems, and optionally, can be integrated with Windows NT and 95. Pricing starts at $685.

SCH Technologies
895 Central Ave.
Cincinnati, OH 45202
Circle 110

RAID Merges with ESP

Andataco has released its latest line of RAID arrays, called ESP RAID Lite. The company says the ESP line merges the fault-tolerant benefits of a RAID system with Andataco's Enterprise Storage Packaging (ESP) system.



ESP RAID Lite reportedly uses single active or dual active/passive controllers, each featuring an Intel Corp. i960 RISC processor. This enables the backup system to keep up with the fastest CPUs and hard drives, at UltraSCSI data transfer rates (40 MB/s). ESP can also support 10,000-RPM drives, Andataco says.

Systems administrators are alerted to potential problems with system disk drives, fans or power supplies via visual, audible, email or Web-based alarms. Remote monitoring is reportedly achieved via the client/server-based RAID Management Utility (RMU Lite).

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Edward Zander, President, Sun Microsystems Computer Company, Corporate Executive Officer, Sun Microsystems, Inc.

12:30 p.m. – 1:15 p.m.
Eric Hahn, Senior Vice President, Enterprise Technology Netscape Communications Corp.

Wednesday, October 9
9:00 a.m. – 9:45 a.m.
William H. Gates, Chairman and Chief Executive Officer, Microsoft Corporation

1:15 p.m. – 2:00 p.m.
Alok Mohan, President and Chief Executive Officer, SCO

Thursday, October 10
9:00 a.m. – 9:45 a.m.
Russell Lewis, Chief Information Officer, Jeffries & Company Inc.

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Equipped with a single active controller, pricing for the ESP RAID Lite system starts at $10,200.

Andataco
10140 Mesa Rim Drive
San Diego, CA 92121
Circle 111

New CORBA Toolkit for Orbix

Black & White Software has introduced Orb/Enable, a CORBA 2.0-compliant tool set for use with Orbix, from Iona Technologies.

Orb/Enable is reportedly designed to help developers browse, manipulate and manage CORBA information, which, the company says, eliminates the need to know and remember coded interfaces.

Orb/Enable has the following features: IDL editing capabilities, which let users develop interface descriptions, import existing IDL files and directly invoke the Orbix IDL compiler; a Visual Interface Repository (IR), for examining CORBA servers; and a Server Manager, with which users can administer CORBA servers via a GUI.

Orb/Enable is compatible with any Orbix product. It is available for standard UNIX platforms. Pricing starts at $1,500 per single-user license.

Black & White Software Inc.
2155 S. Bascom Ave., Ste. 210
Campbell, CA 95008
Circle 112

Tool to Create Ortho Photos

Users needing to create ortho photos–aerial photographs that have been corrected for distortions created by camera orientation and terrain variation–can now use OrthoGIS from Vexcel.

Geographic information systems applications that require a high degree of accuracy–for example, making city and area maps, or updating existing maps–are typical examples of where one might use ortho photos.

OrthoGIS has a simple GUI and is designed to work with any GIS environment. It runs on Sun Solaris, HP-UX, IBM AIX, SGI IRIX and Windows NT. The Solaris version costs $4,950.

Vexcel Corp.
2477 55th St.
Boulder, CO 80301
Circle 113

Data Mine your Documents

Mobius Management Systems is shipping its new data mining tool, DocuAnalyzer, for examining documents and reports stored on a network.

DocuAnalyzer allows users to extract information stored on UNIX, Windows NT, OS/2, NetWare and AS/400 platforms through its Server Transparency feature, the company says.

Once the data is extracted, DocuAnalyzer loads it into tables, charts or graphs. It reportedly formats data using query, sort, filter, analyze and export functions. Users can search for data according to various criteria, and the software will automatically sort the data by fields.

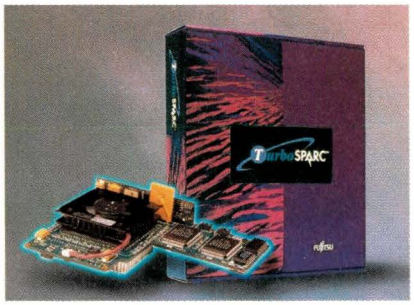
DocuAnalyzer supports most major file types, including Lotus 1-2-3, Excel, dBase, Paradox and delimited ASCII. It is available for all Windows platforms and MVS. Pricing was not available.

Mobius Management Systems Inc.
One Ramada Plaza
New Rochelle, NY 10801
Circle 114

CPU Upgrade for SPARCstation 5

Fujitsu Microelectronics has announced a new 170-MHz TurboSPARC central processor, developed for the SPARCstation 5. Fujitsu says the new processor will double workstation performance.

The TurboSPARC upgrade module reportedly replaces the processor and adds a total of 512 KB of secondary cache. It uses Version 8 of the SPARC architecture and is fully compatible with SunOS and Solaris.



SPECint92 relative performance is 136, compared with 57 for the 70-MHz SPARCstation 5.

Users can purchase the TurboSPARC in one of two installation kits: the start-up kit includes the TurboSPARC module, PROM, tools, electrostatic device (ESD), pad and an installation guide; and the basic kit includes the module and boot PROM with a quick install card. The TurboSPARC costs around $1,500.

Fujitsu Microelectronics Inc.
3545 N. First St.
San Jose, CA 95134
Circle 115

Faster CD-ROM Access on Solaris

Instar is shipping its CDFS-SOL software, which is designed to let users running Solaris 2.x achieve faster access to information stored on CD-ROMs, the company says. CDFS-SOL is mounted on CD-ROM drives with the `cdfs` file system rather than with the `hsfs` file system.

Instar says that CDFS-SOL can randomly open 500 files on a single disc in under one second. The same test performed with Solaris' `hsfs` file system took 55 seconds, according to Instar. These speeds are achieved by minimizing CD-ROM I/O operations, and by caching files and directories to RAM and magnetic disk.

CDFS-SOL comes with the `cdfs` file system, on-line man pages and a user manual. It is priced at $395. Demonstration copies can be obtained from `ftp.instar.com`.

Instar Corp.
205 9th Ave. S.E., Ste. 306
Calgary, Alberta
Canada T2G 0R3
Circle 116

Link VME, Fast/Wide SCSI-2

Pentek has announced its Model 4260 interface adapter, which connects Fast/Wide SCSI-2 and VMEbus DSP and data acquisition system components.

The adapter is compliant with the Intel Corp. MIX mezzanine standard. It is equipped with two C40 communications port interfaces, high-speed

SRAM and FIFO buffers, a fourth-generation SCSI controller and a front-panel serial interface. Transfers occur over either the MIX bus or the front-panel C40, which offers a fourfold performance improvement, Pentek says (20 MB/s over a 16-bit bus).

The 4260 can reportedly connect directly to any Pentek C40 board, and also to other C40 communications port peripherals such as A/D and D/A converters, digital receivers, telecom interfaces and TAXI adapters. In addition, dual FIFOs and a dual-access SRAM address memory and throughput issues.

The 4260 also features a 25-MHz fourth-generation Symbios 53C770 Intelligent SCSI-2 Processor, and a 16550A UART with a programmable baud rate generator covering standard rates up to 38.4 kHz.

Finally, the Pentek's file transfer language, geared toward high-speed, real-time applications, speeds application development. The programming levels include a UNIX-like shell, a library of 4260 SCSI device drivers, and, for C programmers, a library of assembly-coded C-callable functions.

The Model 4260 Fast/Wide SCSI-2 interface adapter costs $2,495.

Pentek Inc.
55 Walnut St.
Norwood, NJ 07648
Circle 117

UNIX Version of Desktop DBA

Desktop DBA, the client/server database administration tool from Platinum Technology Inc., now runs under Motif. Platinum hopes to lure relational database managers from UNIX environments, to add to the 50,000 database managers already running the program under Windows.

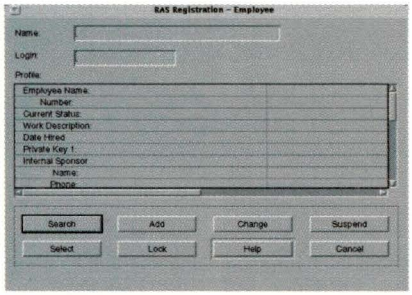
Desktop DBA is designed to do the following tasks: automate database comparisons; alter database objects; drag and drop database objects; and perform routine administration tasks, such as configuring local and remote servers, modifying user permissions and performing catalog reporting.

Desktop DBA has a Motif GUI and runs on HP-UX, Sun Solaris and IBM AIX. Support for additional UNIX platforms is forthcoming, the company says. It currently supports Oracle Corp., Sybase Inc. and Microsoft SQL Server databases. Pricing for the package starts at $2,490.

Platinum Technology Inc.
1815 S. Meyers Road
Oakbrook Terrace, IL 60181
Circle 118

Automate your Security Administration

Technologic Software is now shipping RAS Enterprise, a software package that uses electronic forms to automate security administration across a heterogeneous network. RAS works with existing security, applications, databases and email systems, managing the flow of requests for access or termination, the company says.



RAS works with security administration systems from most major UNIX platforms, MVS, VM, VMS, IBM AS/400, Novell Inc. NetWare, OS/2 LAN Server and Windows NT. User interfaces to Motif, Windows (3.1, NT, 95), OS/2, 3270 and Macintosh are also available.

Pricing is based on capacity (the number of login IDs), and on the number of "agents," or supported platforms. Pricing for an entry-level RAS Enterprise license starts at around $30,000, with additional agents priced at $1,500.

Technologic Software
University Tower
4199 Campus Drive
Irvine, CA 92715
Circle 119

Correction

The correct price for Platinum Technology Inc.'s Fast Unload for Oracle ("Speedy Tool for Oracle Databases," August 1996, Page 71) is $5,000 per server.

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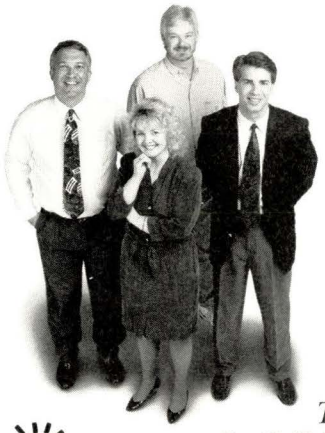

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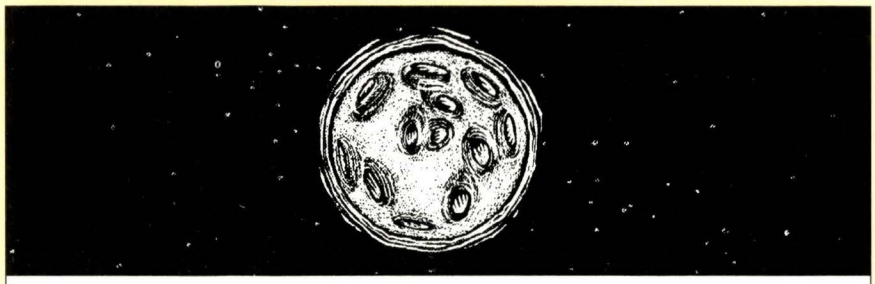

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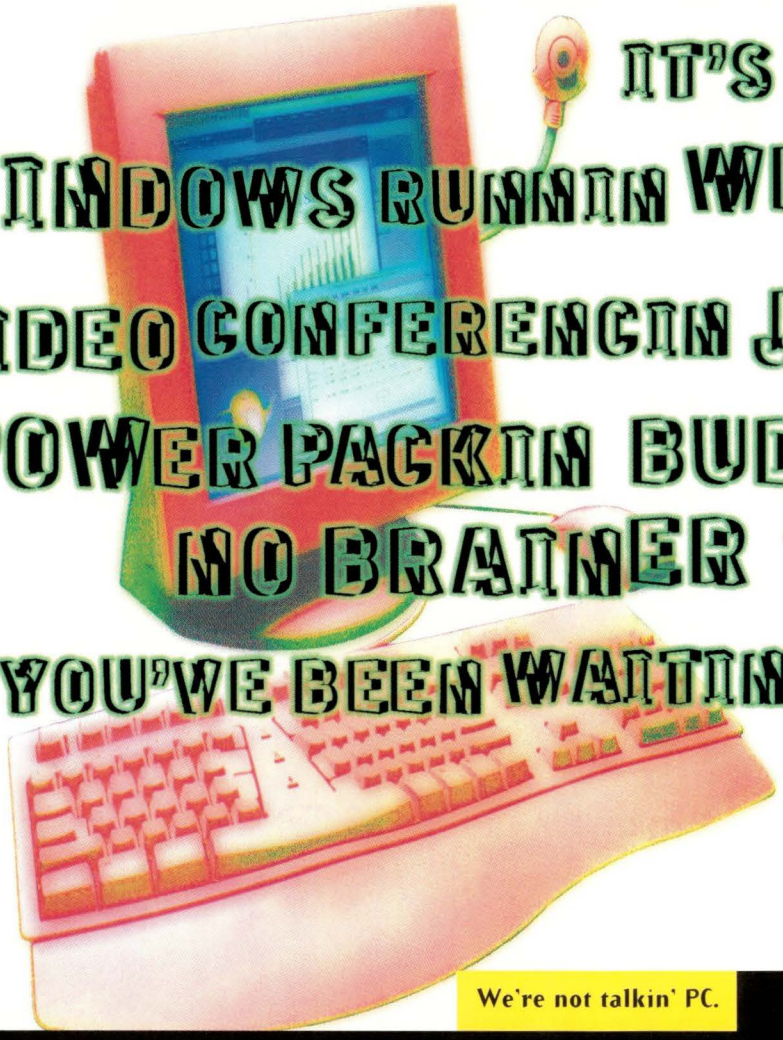

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