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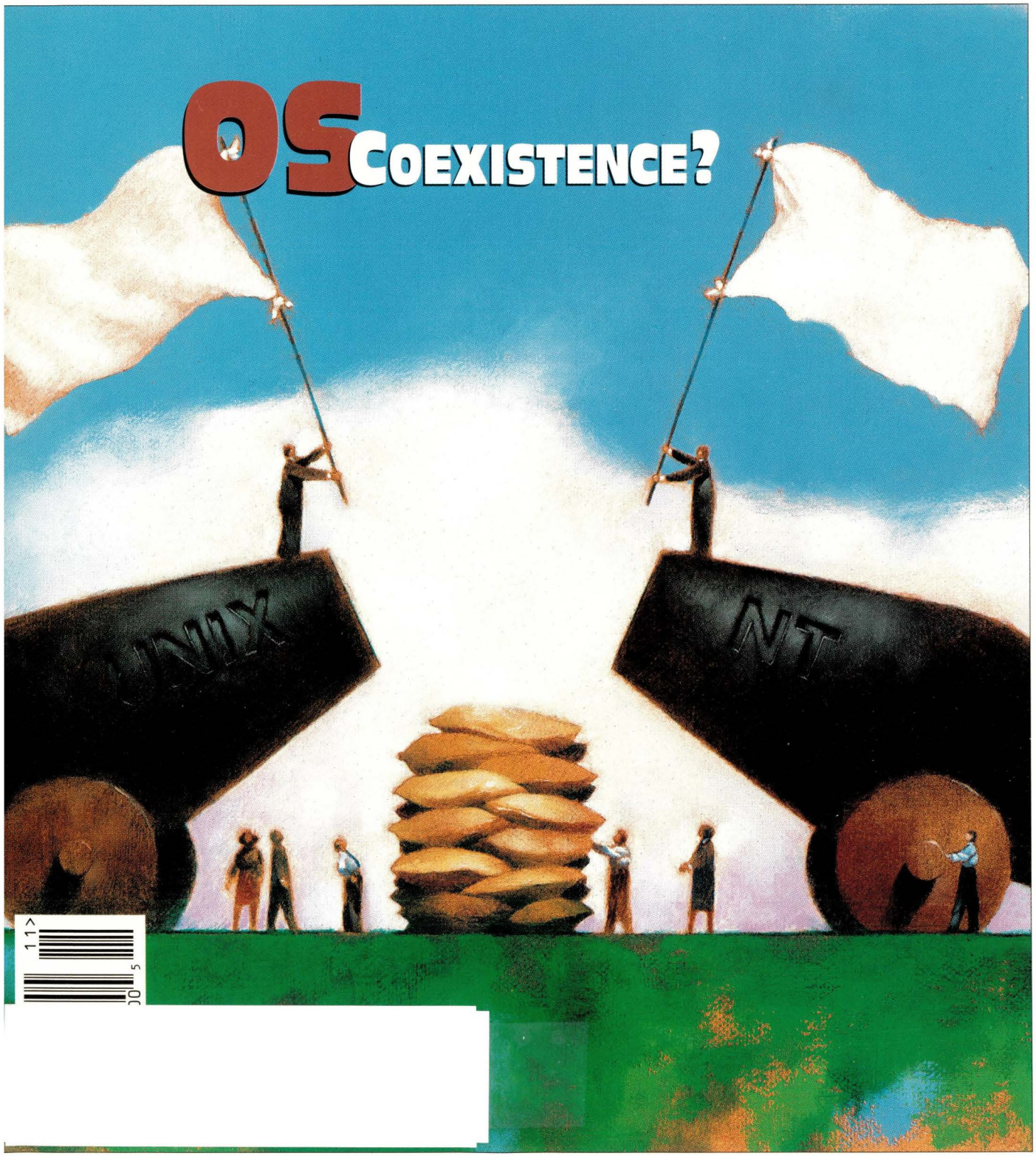
# SUNEXPERT

The Server/Workstation Magazine for UNIX/NT IS Managers

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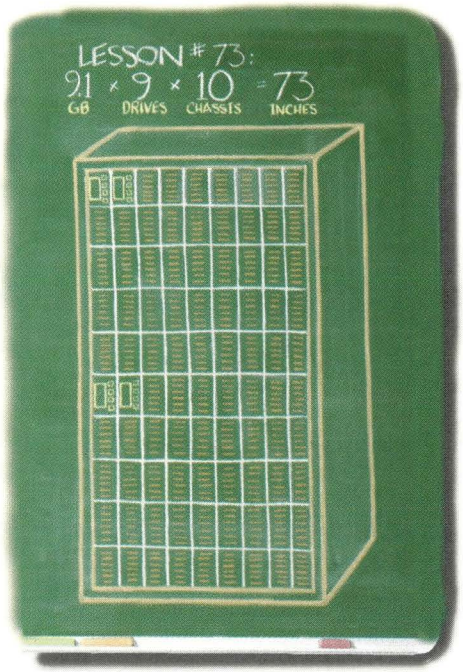


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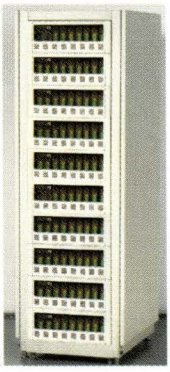

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# SUNEXPERT

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*Karen Watterson*

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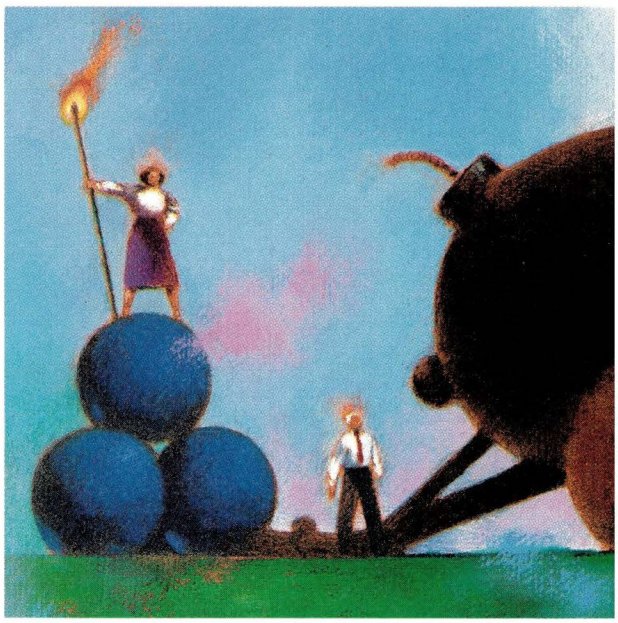

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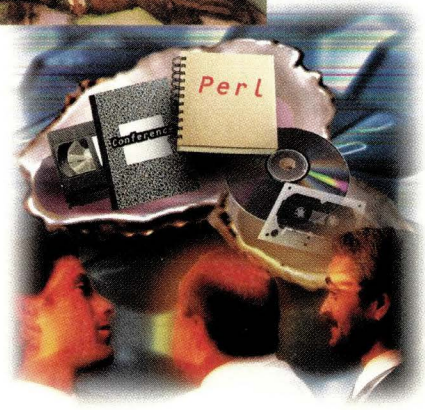


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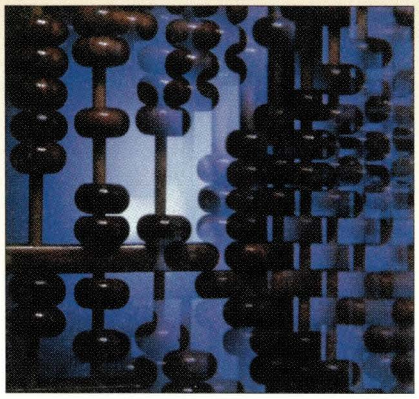

## Feature


**64 Reducing Your Network Costs**

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Investigate requirements in advance and then reap the rewards of a carefully planned network.


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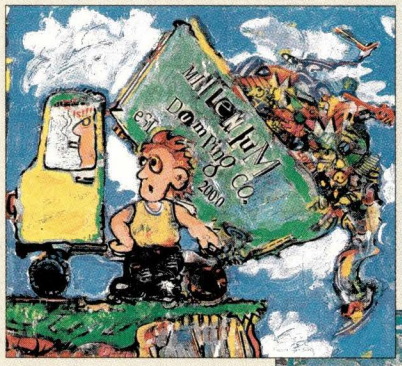


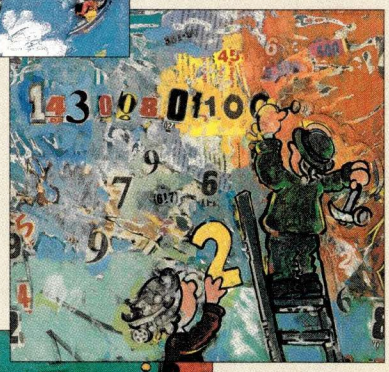

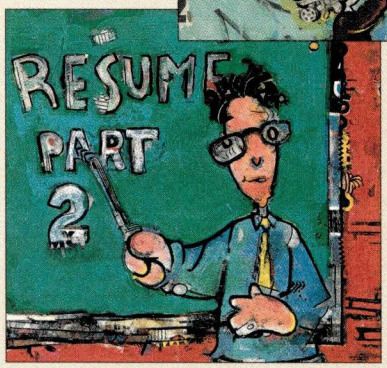


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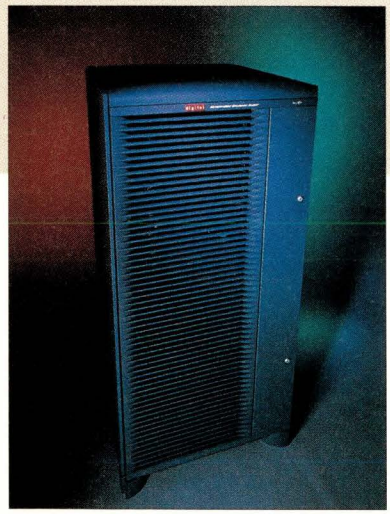

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# EDITORIAL

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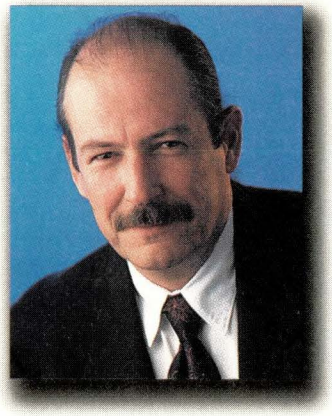

## Enemies and Networks

This month, *SunExpert* looks the enemy squarely in the eye, so to speak. At least that's how most UNIX aficionados will think we should have described the gist of Karen Watterson's cover story, "OS Coexistence?" While there may be some rough-and-tumble wrestling going on over desktop space, many savvy IT or MIS managers have or will come to realize that the UNIX/NT proposition is not either/or but both/and in the midrange and large server markets. Most systems vendors–IBM, HP, DEC and so on–support both operating systems. As Karen points out, "Sun Microsystems seems to be a notable exception." But even Sun has begun to acknowledge the need to coexist with NT. At a recent NCR/Sun teleconference, Scott McNealy quipped, "It's down to Coke and Pepsi," meaning NT and Solaris. But if you go to Sun's Web site and simply search for the letters "NT," you'll discover that there's support lurking where you would least expect it.

"UNIX vendors may not love NT, but most of them are listening to their customers," Karen writes. Let's just hope that these vendors heed users' calls for real solutions to the problem of getting their UNIX and NT systems to work together. That's what the article is all about.

Also in this month's issue, Allan Packer and Shanti Subramanyam tell us how to plan a cost-effective network. It may well be true that the aphorism "the network is the computer," coined in the '80s by Sun Microsystems Inc., has finally come of age. Everyday companies are scrambling to assess the impact of the Internet, intranets and the World Wide Web on how they do business. Sure, these are the hot topics now, but even pedestrian topics such as online transaction processing (OLTP) and decision support systems (DSS) can have significant network requirements. And they often prove difficult to quantify in advance. Accounting for the workload and demands these systems make on networks can prove in the end more critical to successful network management.

In fact, it is still network bandwidth for everyday work that has an important bearing on application performance and user satisfaction. According to Allan and Shanti, "An understanding of the trade-offs in choosing a network strategy is vital to the success of application deployment. But it is equally crucial to anticipate the way application design and middleware will affect your network." Let us know what you think.

Doug Pryor

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SunExpert NEWS

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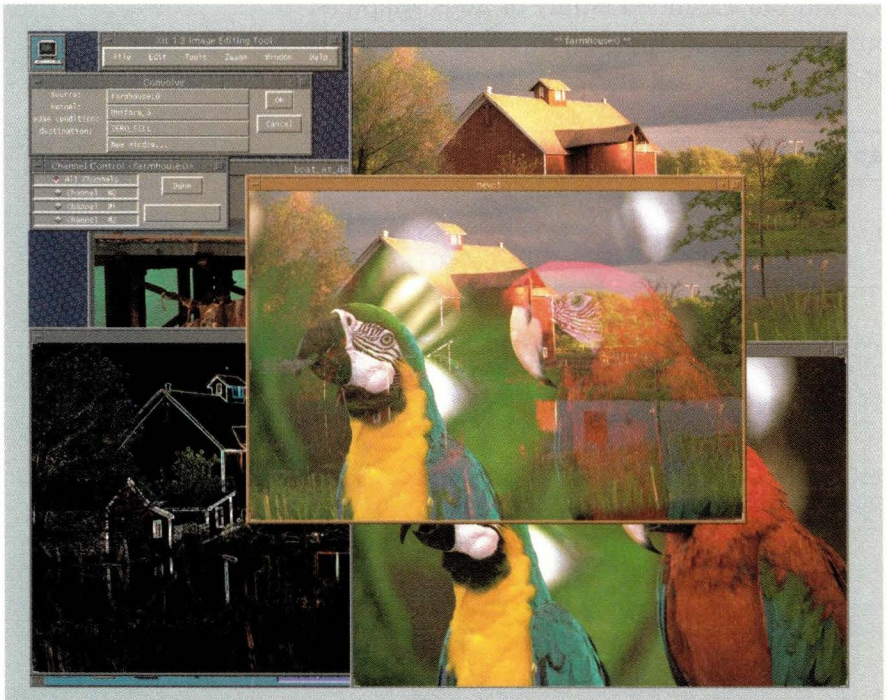
# Sun Fortifies Image Library, Speeds Up OpenGL

Sun Microsystems Inc. continues its efforts to establish itself as a front-runner in the technical imaging market by shipping a major upgrade to its object-oriented 2D graphics application programming interface (API), XIL, and announcing what it calls a three-fold performance increase in its 3D OpenGL API for Solaris.

XIL 1.3, announced at Siggraph in Los Angeles in August, is aimed at easing the task of developing graphics applications in a number of data-intensive visualization markets, such as geographical information systems (GIS), color prepress and medical imaging. The software library gives software developers image manipulation features that can serve as building blocks for creating multimedia applications, including video–used in business and technical markets, and that can also be used to enhance content creation applications such as word processors–Web authoring tools and desktop publishing software, according to Sun.

"We have been offering other graphics APIs, including XGL and PEX, but based on feedback from software developers involved with imaging on the SPARC platform, decided these were not really complete," says Paula Sager, vice president of Sun's Power Client Software Group, Menlo Park, CA. "With XIL, we provide exact sets of primitives for developing very advanced 2D applications, such as those used to analyze CAT scans, satellite imagery or geographical information."



*XIL 1.3, the latest release of Sun's object-oriented 2D graphics API, features a new image-processing architecture that enables image tiling, a multithreaded processing model and a redefined GPI.*

XIL is being shipped as part of the base Solaris 2.6 operating environment, and Sun also offers a companion book, *Developing Visual Applications – XIL: An Imaging Foundation Library*, by William K. Pratt, Pretice Hall, ISBN 0-13-461948-X, which covers a variety of image processing application types and includes many examples and demonstration programs. A CD packaged with the book contains ports of the XIL library (Release 1.2.1) for Windows 95/NT and HP-UX. Sun has expanded its reference port information to include Silicon Graphics Inc. and Linux environments. XIL 1.3 is downward compatible with XIL 1.2.1.

Sun has been shipping XIL for several years. Its beginnings can be traced to 1991, when SunSoft began work on an object-oriented image processing and video compression/decompression library with integrated display capabilities. This latest release features a new image-processing architecture that enables image tiling, a multithreaded processing model and a redefined graphics programming interface (GPI).

Tiling is useful when software developers want to let application users manipulate only portions of a large image, rather than having to work with multiple-megabyte GIS maps or satellite images, for example. XIL can process images on a "per-tile" basis before swapping that tile to disk.

Says Sun's Sager: "Tiling lets us take a very large image and chop it up into smaller squares, and execute instructions on only that little portion of the image. You can zoom in and refine only a small area of a satellite image, for example, instead of manipulating large amounts of data that make up the entire image. You can simply update a chunk at a time."

The underlying XIL libraries use multiple threads to permit image processing on multiprocessor systems. What's more, the application can use

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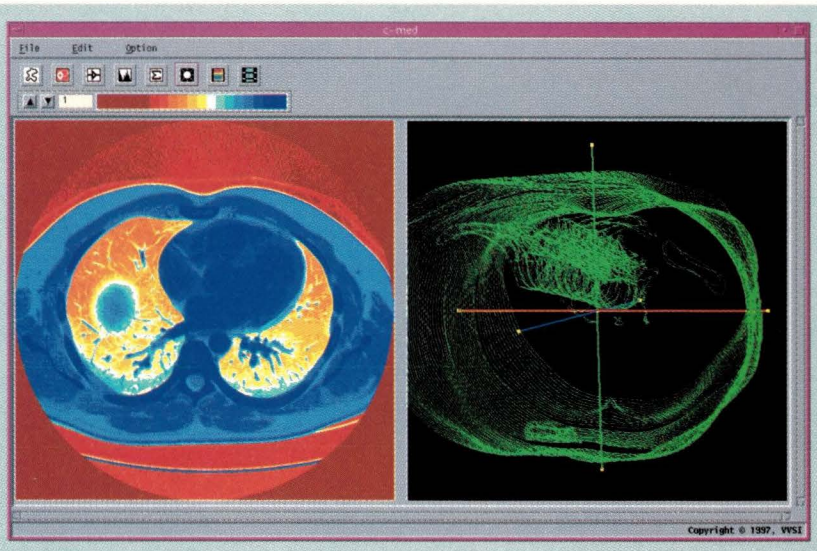
multiple threads calling the XIL API without locking, Sun says. One medical imaging software developer that has been using XIL to develop a 2D visualization package, called C-MED, for the Solaris/SPARC platform confirms that the software library has drastically reduced development time and helped optimize the application for Sun hardware.

"The real key is we replaced our in-house imaging code–about 70,000 lines worth of the application specifically relating to imaging–with Sun's XIL," says Dennis Sigel, president of Virtual Visions Software Inc., Cupertino, CA. "By using XIL, we also don't have to worry about writing code to take advantage of Sun's imaging hardware."

Not only has Sun more firmly positioned itself as a serious player in the 2D imaging software market by beefing up XIL, its Ultra 2 hardware architecture, most notably, multiprocessing–with multithreading capabilities built into Solaris–and the visual instruction set (VIS) provide two very attractive features to developers looking to make their applications speedy and efficient on the UltraSPARC machines.

According to Sun, VIS is a set of RISC instructions that are extensions to the SPARC V9 architecture. The instructions are designed to accelerate multimedia, image processing and networking applications, especially in applications dealing with numerical analysis, computational fluid dynamics and other data-rich operations. If developers wish to use VIS without writing applications with XIL, they must write VIS instructions directly in assembler. But if an application uses OpenGL, XIL or XGL, Sun's proprietary graphics library, it will automatically take advantage of VIS because these libraries have been accelerated by VIS. Furthermore, areas within Solaris are VIS-accelerated, so UltraSPARC users automatically get VIS benefits by default.

Add to that JPEG and MPEG-1 video compression algorithms and you have a software library that can handle diverse 2D imaging operations, without applications developers having to code those operations into their imaging programs, Sun says.




*C-MED, from Virtual Visions, uses Sun's XIL 1.3 to perform image processing and edge detection. These edge contours are then used to generate geometric models using Sun's OpenGL 1.1, as shown here.*

According to an article that appeared in a recent Sun newsletter, *Sun Developer News,* written by John L. Furlani, a staff engineer at SunSoft, "What makes the XIL library unique is its transparent acceleration, which takes advantage of a system's special capabilities without modifying the application. On [Sun's] Ultra platforms, many common image-processing operations, as well as JPEG and MPEG-1 decompression, are accelerated using the UltraSPARC VIS instruction set."

Complementing its rollout of XIL 1.3 was the announcement that OpenGL on Solaris is now faster, which Sun officials say is primarily an outgrowth of optimization of the 3D graphics API over time for Sun's Ultra architecture. Sun first shipped OpenGL on Solaris last year.

Sun says the latest version, OpenGL 1.1 for Solaris, delivers significant performance increases, primarily for 3D surface rendering, important to developers of CAD/CAM, GIS, petroleum exploration, animation, industrial design and modeling, and other spatial imaging markets. OpenGL 1.1 for Solaris 2.5.1 and 2.6 is available for free download from Sun's Web site at `http://www.sun.com/solaris/opengl`. The full OpenGL for Solaris development kit costs $495.

The company announced the two enhanced APIs together at the Siggraph show because, in many cases, developers wish to include both 2D and 3D image-manipulation features in their applications, and Sun sees OpenGL and XIL working together, with very little overlap, to help those developers provide both to users.

Sun officials and analysts state that, whereas OpenGL has gone through the de rigueur industry standardization process to gain its place as *the* 3D imaging API used by the entire computer industry, be it UNIX or Windows environments, with XIL 1.3, Sun is taking the opposite tack for 2D imaging software.

"My first impression of XIL was that it's great, but other vendors, including SGI and HP, had already added imaging extensions to OpenGL for 2D software operations," says Greg Weiss, research analyst at D.H. Brown Associates, Port Chester, NY. "Sun's response with XIL 1.3 was to get the [independent software vendors] on their platform, provide the reference ports, and set the standard later–to take the de facto standard approach."

While several vendors have added 2D imaging extensions to OpenGL, that API still requires developers to work in a 3D framework, even when using the 2D extensions, adds Sun's Sager. XIL, on the other hand, is geared to 2D imaging from the ground up.

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**Circle No. 13**

such as Virtual Visions, the coexistence of the two APIs with Solaris means that many of their 2D and 3D imaging needs are "preprogrammed" for Sun hardware, with plenty of port information available for HP, Windows and, in the near future, SGI platforms.

"Two or three years ago, we took our 2D information in C-MED and integrated it with applications that had 3D imaging capabilities, like [Parametric's] Pro/Engineer," says Virtual Visions' Sigel. "OpenGL wasn't available on Solaris back then. Now we can use both toolkits to do edge detection on a CAT scan of a bone, for example, and extract the geometry information into OpenGL to create a 3D model using all the neat stuff in that API, like texture-mapping and rendering pipelines."

And what does the future hold for Sun's new one-two punch of imaging APIs? Sun's Sager says that we'll see more use of Java wrappers around the APIs, using parts of the Java 2D and 3D toolkits, putting Java code on top of an XIL/OpenGL software application to allow it to run on any Java Virtual Machine. By the same token, any Java application developer could use the APIs to place 2D and 3D imaging features into their programs.–*jsw*

## Sun Stakes Out Embedded Systems Territory

Sun Microsystems Inc. went on a shopping spree recently, buying up first Diba Inc., Menlo Park, CA, an "information appliance" technology vendor; second, Integrity Arts, a San Mateo, CA-based start-up whose specialty is smart card technologies; and finally, Chorus Systems S.A., a French embedded systems software vendor. Exactly how all these new technologies will be folded into the Sun machine remains to be seen, but one thing is clear: Expect Sun to play a bigger role in the embedded systems market than it has so far.

Further proof of the push toward embedded systems is that Sun is creating a new division, the Embedded Systems Software Group, announced in September. The group will take over development of Chorus Systems' technologies, the JavaOS and, presumably, an operating system that spans the two. Sun also announced in September that eight real-time operating systems (RTOS) vendors, among them market leaders Wind River Systems, Alameda, CA, and QNX Software Systems Ltd., Kanata, Ontario, have licensed both PersonalJava and EmbeddedJava.

To date, Sun's involvement in the embedded systems market has been low-key. Through Sun Microelectronics, embedded systems manufacturers could purchase SPARC components with which to build their devices; and SunSoft offered a configurable Solaris to be used as an embedded operating system. But despite the low profile, says Paul Zorfass, analyst at International Data Corp., Framingham, MA, Sun has actually been quite successful in this marketplace. "Of the embedded UNIX operating systems, Solaris is the most popular," Zorfass says. Examples of where you might find an embedded Solaris OS include copy machines, where Solaris acts as the engine behind the operator control panel.

## DCOM for Solaris Announced

Another phase in the UNIX vs. NT saga began in September when German company Software AG announced an implementation of Microsoft Corp.'s Distributed Component Object Model (DCOM) running on Solaris, Digital UNIX and Linux. An MVS 5.22 port of the EntireX DCOM series was also released into beta in October. EntireX DCOM can be downloaded from Software AG's Web site, *http://www.sagus.com*.

Commercially shipping versions of DCOM on UNIX platforms validate Microsoft's claim that DCOM is not inherently linked to Windows platforms. On the other hand, the Object Management Group's Common Object Request Broker Architecture (CORBA), a competing object model, has long had cross-platform support, a major selling point in the heterogeneous enterprise computing world.

The UNIX community has been underwhelmed by the news of the EntireX DCOM release, to say the least. While Software AG claims more than 600 downloads of EntireX DCOM for Solaris during the beta period, virtually no mention of the commercial release was to be found on USENET, much less any debate.

This lack of enthusiasm among UNIX developers doesn't surprise J.P. Morgenthal, analyst at NC.focus, Hewlett, NY. "The general consensus among UNIX people has always been 'Who cares? I would never use that stuff under UNIX anyway.'"

However, according to Steve Vandor, general manager of the ActiveX Technology Group for Software AG, the fact that USENET is not raising a ruckus about the news doesn't mean that developers don't care. "I think a lot of the rancor over the project was expressed when the preview release [of EntireX DCOM for Solaris] was first announced. Today's product has a lot fewer bugs." Vandor adds that he's been privy to some great testimonials. "We've heard a lot of people say that it works just the way they expected it to."

Those developers that will use EntireX will no doubt come from the Windows world, says Morgenthal. "No UNIX guy is going to go, 'Look what I can do with COM,' but for a Windows person who needs to integrate a UNIX element into their COM-based system, this is a very feasible solution."

Which is to say, UNIX and CORBA aficionados, don't brush off DCOM for UNIX just yet. By wrapping UNIX resources in a DCOM wrapper, but performing the brunt of the work on an NT server, EntireX DCOM arguably places UNIX in a subservient position to the NT server. "This stuff may seem like a joke now, but remember that Microsoft doesn't need an immediate kill–it has the money to wait around for a couple of years," Morgenthal says.–*as*

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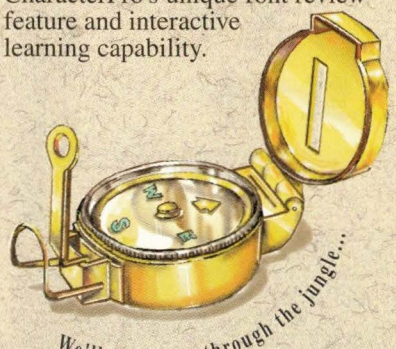

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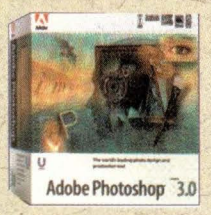


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**Circle No. 4**

Clearly, though, Sun is expanding into uncharted territory. With the acquisition of Chorus Systems' technologies, Sun is now poised to play in the telecommunications industry, where the CHORUS/OS can already be found on products such as portable phones, PBXs and ATM access switches. With JavaOS, and its derivatives EmbeddedJava and PersonalJava, Sun is set to play a role in the so-called information appliance world–for which Java's predecessor Oak was partially designed.

Sun is not forthcoming on exactly how it will use these new technologies, and analysts can only speculate on how it will all pan out. Tom Starnes, principal analyst for embedded microcomponents at Dataquest Inc., Austin, TX, believes that Sun has on its hands three separate operating systems–Solaris, JavaOS and CHORUS/OS–that will have to find their own markets as three distinct products.

On the other hand, Martin Marshall, industry analyst for Zona Research, Redwood City, CA, sees Sun using elements of CHORUS/OS to bolster JavaOS against other network-aware embedded operating systems, most notably Microsoft Corp. Windows CE and Lucent Technologies Inc. Inferno RTOS. "Windows CE is already partially out there," says Marshall. "Its timetable is on the table."

People who think of Sun and rival Microsoft as limited to traditional computer markets sometimes balk at the idea of Sun in their phones, or Windows in their cars, as Microsoft's Bill Gates announced in September. But like it or not, that's where they are headed. "This is a great business to get into," says Marshall. "In terms of new deployments, it is potentially the largest area of adoption for JavaOS. People aren't exactly throwing away their PCs, and there are a lot of microcontrollers in the world." Marshall adds that the embedded software market isn't dominated by any one player, an important consideration when expanding into a new market. "Sure, Sun's going to come up against Microsoft, but they won't already own 85% of the market."–*as*

## New Java Tools from Sun

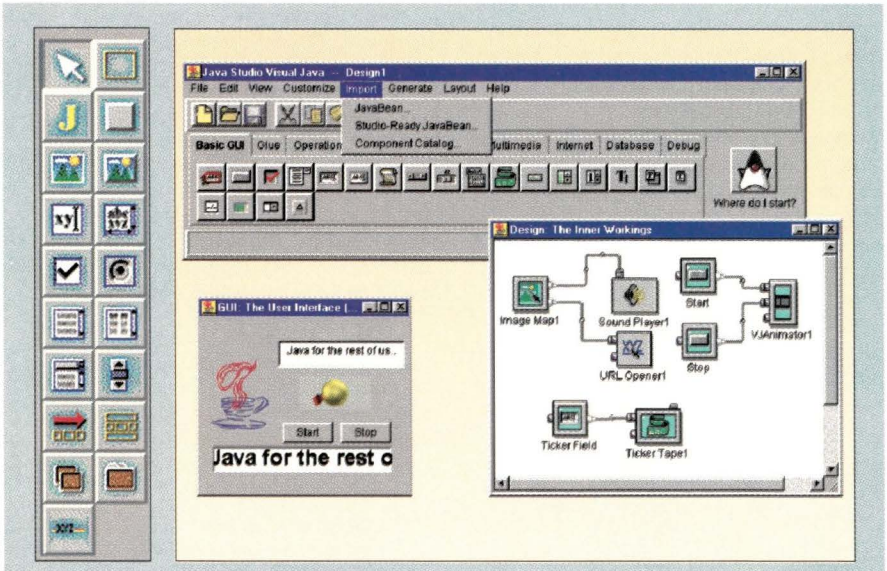
Sun Microsystems Inc. subsidiaries SunSoft and JavaSoft recently made several new development tools available. In August, SunSoft took Java WorkShop 2.0 and Java Studio 1.0 into final beta. Meanwhile, also in August, at the Java Internet Business Expo (JIBE) in New York, JavaSoft announced Java Blend, a database application programming tool that will be available to early access customers this month.

These product releases address the needs of three distinct kinds of developers: Java WorkShop caters to advanced Java application programmers–those who require a full-function integrated development environment (IDE), complete with source editor, debugger and GUI palette; Java Studio, marketed with the slogan "Java for the rest of us," is aimed at nonprogrammers who nevertheless want to create Java applets; and Java Blend provides object-relational mapping capabilities for writing Java programs that access data stored in relational databases.

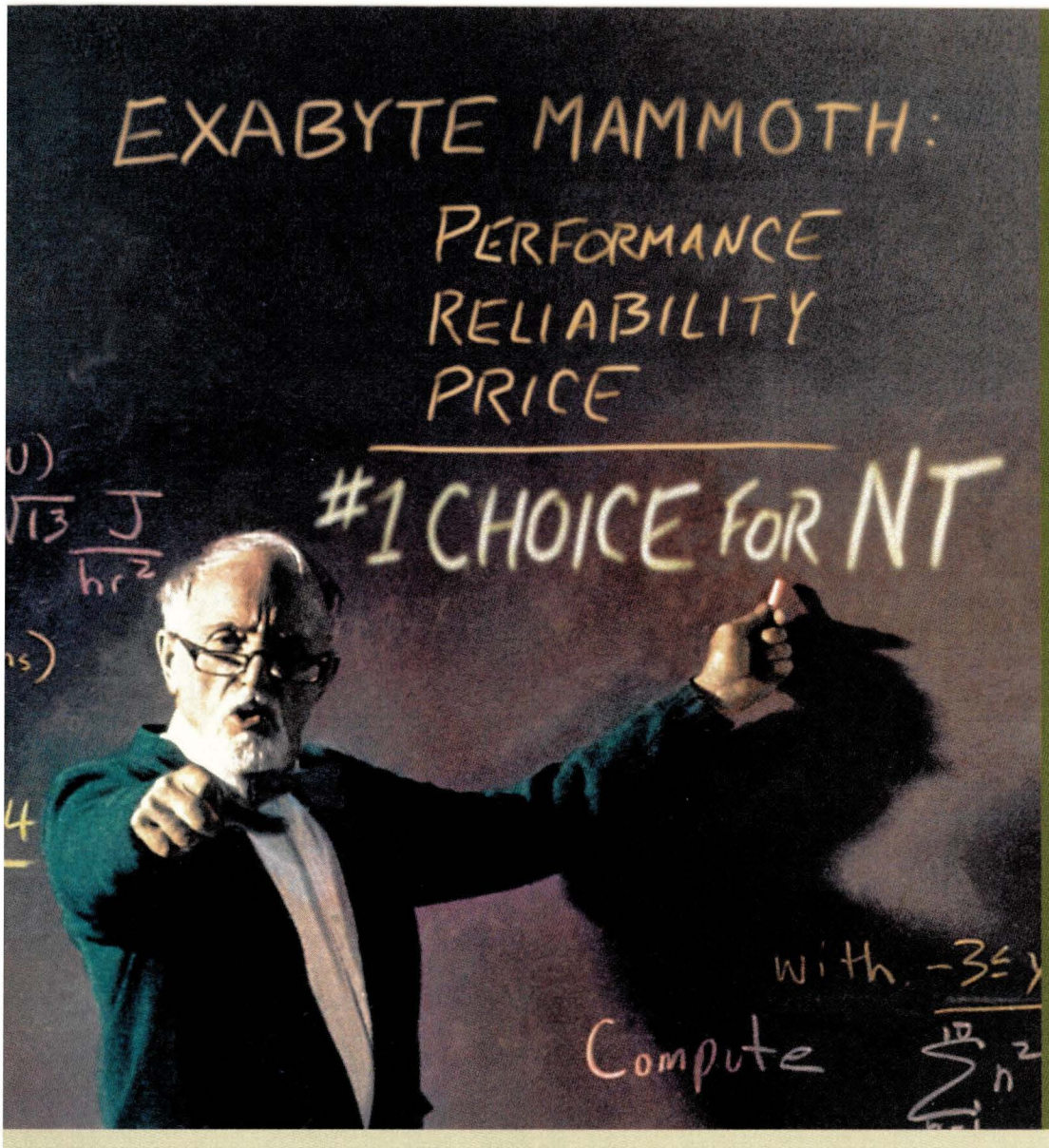
New features of Java WorkShop revolve around performance and usability enhancements. For example, Java WorkShop now comes standard with a built-in Java JIT (Just-In-Time) compiler and new wizards that walk users through the process of creating projects and portfolios. In addition, Java WorkShop 2.0 now supports the Java Developer's Kit 1.1.1, as well as JavaBeans.

Java Studio, meanwhile, is a visual environment for assembling applications (or applets) out of JavaBeans, renamed Visual Java Components. Sun contends that with Java Studio, users can write entire applications without having to write or edit a single line of code. Instead, users create an application by dragging components onto a palette and specifying the behavior and relationships between them. In a separate window, Java Studio displays what the application looks like. Java Studio comes bundled with several components and can also import and export new JavaBeans.

Java Blend consists of two parts: a developer's tool that generates mappings between Java objects and RDBMS tables; and a runtime tool that performs the translations once the application is in use. The benefit of using such a tool, JavaSoft says, is that developers need only be required to know one language–Java–rather than Java as well as SQL.




*SunSoft's Java WorkShop 2.0 and Java Studio 1.0 development tools took a step closer to full commercial release in August. WorkShop 2.0 caters to advanced Java programmers, and includes a source editor, debugger and GUI palette (shown at left); Studio 1.0, meanwhile, is aimed at nonprogrammers who wish to create Java applets.*

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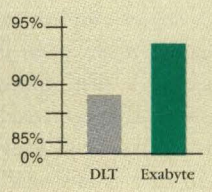


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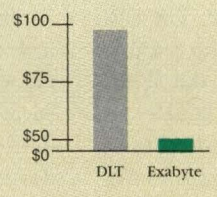


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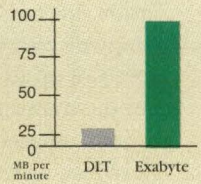


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Java Blend enters an already competitive market. Several other tools on the market offer Java-to-RDBMS object-relational mapping, for example, CocoBase from Thought Inc., San Francisco, CA, and EPIC DB Blend, from Novera Software Inc., Burlington, MA. However, according to Sally Sheward, product manager for Java Blend, "none of the competing products do exactly the same thing as Java Blend." In particular, Sheward says, Java Blend is unique in its ability to provide two-way mappings. That is, Java Blend can generate a mapping to a database schema from a Java object, or, vice versa, a mapping to a Java object from a database schema.

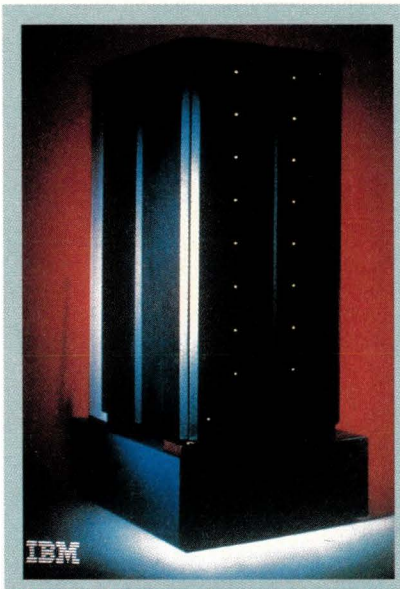
Another key feature of Java Blend is that it is written to the Object Database Management Group (ODMG) standard, which, for certain corporate environments, is very important. "If I've written something in ODI, and I want to go against an Oracle database," says Ward Mullins, chief technical officer at Thought, "then Java Blend is a godsend."

All three of the new Java tools are written in Java. Java WorkShop and Java Studio are available for download from SunSoft's Web site (`http://www.sun.com/`) and Java Blend is available from JavaSoft (`http://java.sun.com/products/java-blend/index.html`).–*as*

## IBM Improves SP Performance

While chess buffs may have been sad to hear that IBM Corp. has placed Deep Blue in retirement, at least in terms of its chess career, fans of the RS/6000 SP, the supercomputer behind Deep Blue's chess success, may be pleased to know the SP has received a few new products designed to improve its performance.

The SP houses one to 512 nodes. The nodes come in three types; thin, wide and high. Specifically, IBM has introduced several software enhancements and a new node called the Symmetric Multiprocessor (SMP) High Node, based on the PowerPC 604e introduced earlier in the year as part of a stand-alone server. "The new node will deliver customers up to 58% more performance at the same price [of previous high nodes]," says Eric Rosencrans, manager of marketing operations for the RS/6000. The base price for the SMP High Node is $59,000.




*IBM's RS/6000, the supercomputer behind Deep Blue's chess success, has received some software enhancements and a new node to improve its performance.*

"It's a speed up," says Mike Kahn, president of The Clipper Group, a Wellesley, MA-based market research company. According to Kahn, the SMP High Node replaces the old High Node, which was based on the PowerPC 604, and is targeted at the user who "wants more power." This promise of improved performance has already intrigued customers. Randy Johnson, SP project manager, city of Seattle ESD/Technology, says his division has already ordered the new SMP node for that very reason. "We're in the process of ordering them. We see ourselves buying a number of SMP nodes," he says. "For about the same price, it doubles performance."

In addition to the new node, IBM has released several software enhancements. For example, High Availability Cluster Multiprocessing (HACMP) for AIX Version 4.2.1 is now available. The clustering software is designed to support clusters of up to 16 nodes on the SP system, the company says. This doubles the previous support for eight-node clusters. "Next year, we're going to double to 32," Rosencrans says.

Other software enhancements include Parallel System Support Programs (PSSP) for AIX Version 2.3, which is designed for systems management on the SP system, and will offer support for up to 64 SMP nodes, a new graphical user interface and an online help facility; Parallel Environment (PE) Version 2.3, which is designed for use with developing, tuning and executing parallel applications; and Recoverable Virtual Shared Disk (RVSD) Version 2, which offers transparent recovery for disk adapter and disk cable failures.

IBM plans to make both General Parallel File System (GPFS) and Network Tape Access and Control System (NetTAPE) Version 1.2 for AIX available this quarter. This latest release of GPFS is designed to provide file access from any GPFS node and provide recovery for most node failures without operator intervention and maintain UNIX standard file interfaces. NetTAPE, on the other hand, centralizes tape operations management and tape device access across networks and provides a single system image to users of data stored on tape.

The new products are a continuation of IBM's SP philosophy, which is to allow users to expand their system with new nodes and software enhancements. "Our customers have asked us to migrate slowly and allow them to migrate their applications to newer technology when they are ready," Rosencrans says.

With the improved performance of the SP, it might be for the best that Deep Blue no longer concerns itself with pawns and knights. The fragile egos of chess grand masters might not be able to take another trouncing by a machine in a thinking person's game.–*ptc*

## Barriers to Network-Attached Storage are Down

High-end data center administrators have two fewer reasons to shy away from Network Appliance Inc.'s "filer" approach to data serving–with this approach, a dedicated network-attached storage device acts in lieu of a traditional file server. In September, Network Appliance,

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Santa Clara, CA, announced in conjunction with Oracle Corp., Redwood Shores, CA, that NetApp filers had been certified for use with Oracle databases. In a separate announcement (also in September), NetApp revealed that it would integrate the ACEnic Gigabit Ethernet adapter from Alteon Networks Inc., San Jose, CA, into its filer line, as well as offer the ACEswitch server switch under the Alteon brand. NetApp's Laura Pickering, director of marketing development, also indicates that NetApp is certifying the filer for other databases, namely Informix Software Inc. and, eventually, Sybase Inc. Thus, IT managers will no longer be able to reject a NetApp filer purely on the basis that their database vendor does not support it, or that the filer doesn't support a high-speed backend connectivity scheme.

In an Oracle environment, the benefits of using a filer revolve mainly around performance, the two companies say. In informal benchmark tests, NetApp claims a two-fold performance increase when using a filer over a comparable, traditional file server. The companies cite two sources for performance gains: NetApp's WAFL (Write Anywhere File Layout) file system, which is optimized to reduce I/O bottlenecks, and the offloading of file management overhead, freeing up CPU cycles to perform database-specific tasks. Meanwhile, some database administrators are opting to run their databases using raw I/O, mainly to eke out better performance. But according to NetApp, the performance benefits of raw I/O over using file system utilities are offset by the difficulties involved with troubleshooting such a system, or performing backup and recovery.

Some Oracle database administrators were already running their databases off of NetApp filers, but because of the way the filer's Data ONTAP operating system normally handles battery-backed nonvolatile RAM (NVRAM) failures, they were doing so at a slight risk. For example, if both the NVRAM and the filer were to go down, there might be a situation where data stored in the NVRAM was inconsistent with what the Oracle database believed to have been written to disk. To eliminate that possibility, NetApp and Oracle agreed to modify Data ONTAP so that, when the filer boots up after an NVRAM failure, rather than commit any data still in memory, Data ONTAP stales out any NFS file handles. The Oracle administrator would then be alerted that there had been a disk media error and could proceed with their database recovery steps as appropriate.

Oracle, for its part, is hailing the network-attached storage approach as an integral component to the network computing architecture, where "specialized devices are dedicated to specific tasks," according to Oracle CEO Larry Ellison. Whether Oracle will endorse other network-attached storage devices remains to be seen, but as NetApp's Pickering points out, "Oracle doesn't do exclusives with anyone."

Equipped with an Alteon ACEnic Gigabit Ethernet adapter, meanwhile, the NetApp Filer can reportedly handle 10% more traffic than with two FDDI adapters. Therefore, not only are users realizing a performance benefit, they're also economizing a valuable PCI slot. Coupled with an ACEswitch server switch, administrators can implement proprietary Alteon technologies such as Jumbo Frames. For example, an 8,000-byte NFS datagram can be transported in a single Ethernet packet rather than in six 1,500-byte packets. This, Alteon says, reduces the amount of necessary host processing.

Data ONTAP has thus undergone two sets of optimizations: one for the Oracle database, the other for Alteon's Gigabit Ethernet products. But rest assured, says Anna Early, NetApp product marketing manager, the Data ONTAP operating system still ships on a single floppy.–*as*

## Three Tiers for PeopleSoft

PeopleSoft Inc., cited by *Fortune Magazine* in 1994, 1995 and again in 1996 as one of the fastest growing companies in America, develops, markets and supports a suite of enterprise solutions for finance, materials management, distribution, supply chain planning, manufacturing and human resources. With PeopleSoft 7, the Pleasanton, CA-based company has acknowledged the influence of the Web by introducing a Java-based Web client and so-called Universal Applications. Also, by including an applications server to allow users to adopt a three-tier processing model, this new release stresses the role of servers, especially those running Windows NT, Digital UNIX 4.0, HP-UX 10.20, AIX 4.2.1 and Solaris 2.5.1.

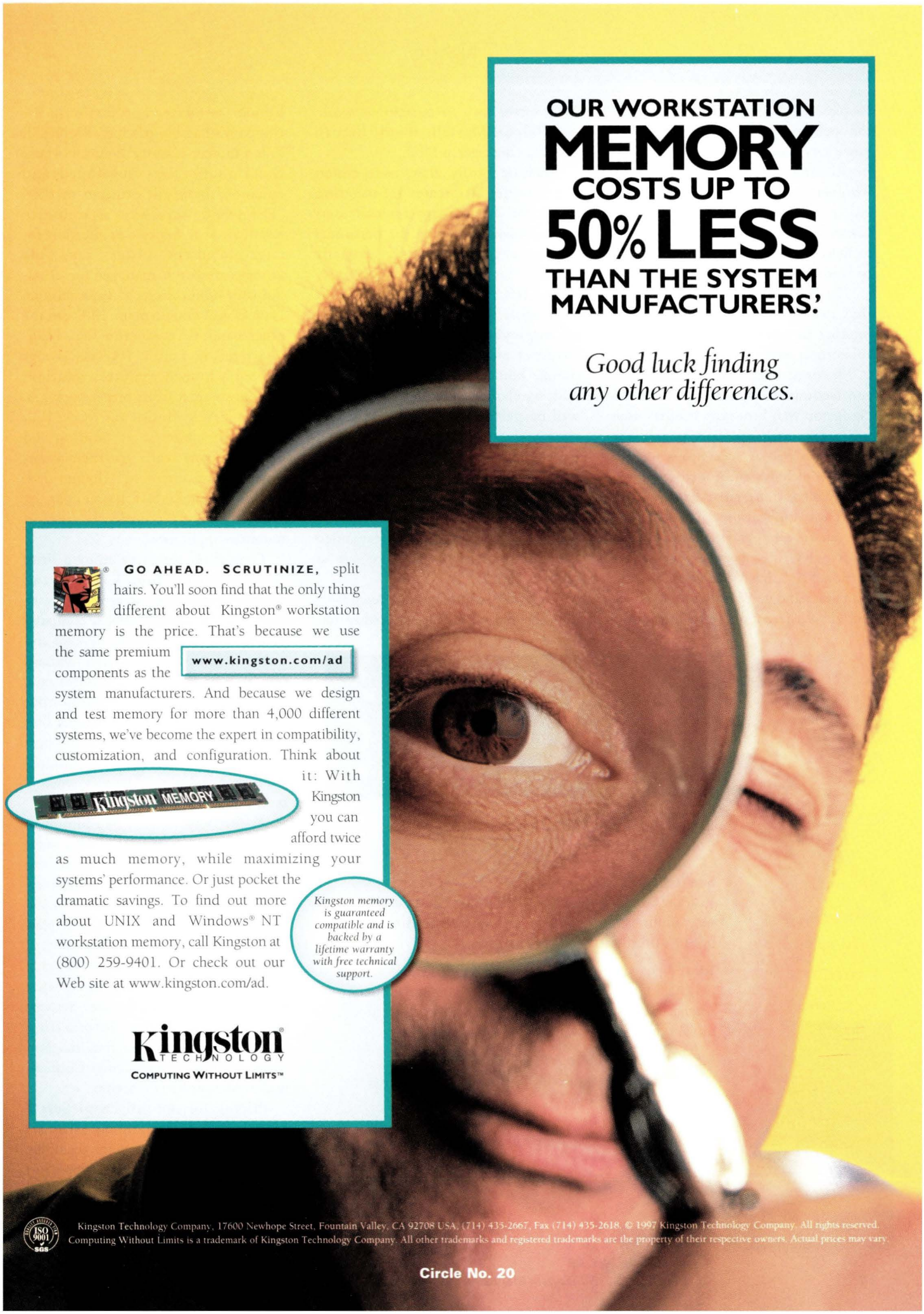
Universal Applications is PeopleSoft's name for self-service transactions on the World Wide Web. These include Employee Self-Service, which enables employees to update and review personal data; Vendor Self-Service, which provides a company's vendors with online access to their information; and Customer Self-Service, which allows customers to access information such as account balance, payment status and sales order status online.

Also new in this release are an integrated development tool, Application Designer, and two new applications for distribution and manufacturing, Product Configurator and Engineering.

Perhaps the most significant change is its support for three-tier architectures. Clients can be configured for either two- or three-tier transaction processing. The three-tier architecture support allows users to move the processing layer of PeopleSoft applications from desktops to the server.

Three-tier processing should improve performance by minimizing network traffic over both LANs and WANs. If processing chores can be efficiently split between the application server and the client, the result will be increased speed, performance and security for each transaction. Transactions are managed by BEA Tuxedo middleware from BEA Systems Inc., Sunnyvale, CA, on the PeopleSoft 7 application server.

In contrast, two-tier architectures, in which processing is done on desktops that access a database server, have proven to be a problem in terms of performance and misused network bandwidth. Norman Muttitt, technical project leader at Mobil Oil Co., Dallas, TX, who runs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Circle No. 20

PeopleSoft 5 human resources and payroll applications, says that Mobil plans to move very quickly to Release 7, mainly for its three-tier architecture. Muttitt, who watches over PeopleSoft installations on 20,000 desktops across the United States, adds, "Making the move to Release 7 would relieve much of the network strain and user frustration."

The new Web Client is a Java applet that uses the BEA Jolt middleware product to connect to the PeopleSoft application server. The Web Client runs in Microsoft Corp.'s Internet Explorer and Netscape Communications Corp.'s Navigator Web browsers. It offers users full access to PeopleSoft panels and queries, as well as access to work lists from PeopleSoft's embedded workflow. The Web Client runs PeopleSoft's Universal Applications. DHL Airways Inc., an air cargo carrier based in Redwood City, CA, currently running Version 5.1.1, has decided to skip the 6.0 release and go directly to 7.0, which will allow the company to integrate a Web server into its current network, says Glenn Marfell, senior human resources manager at DHL.

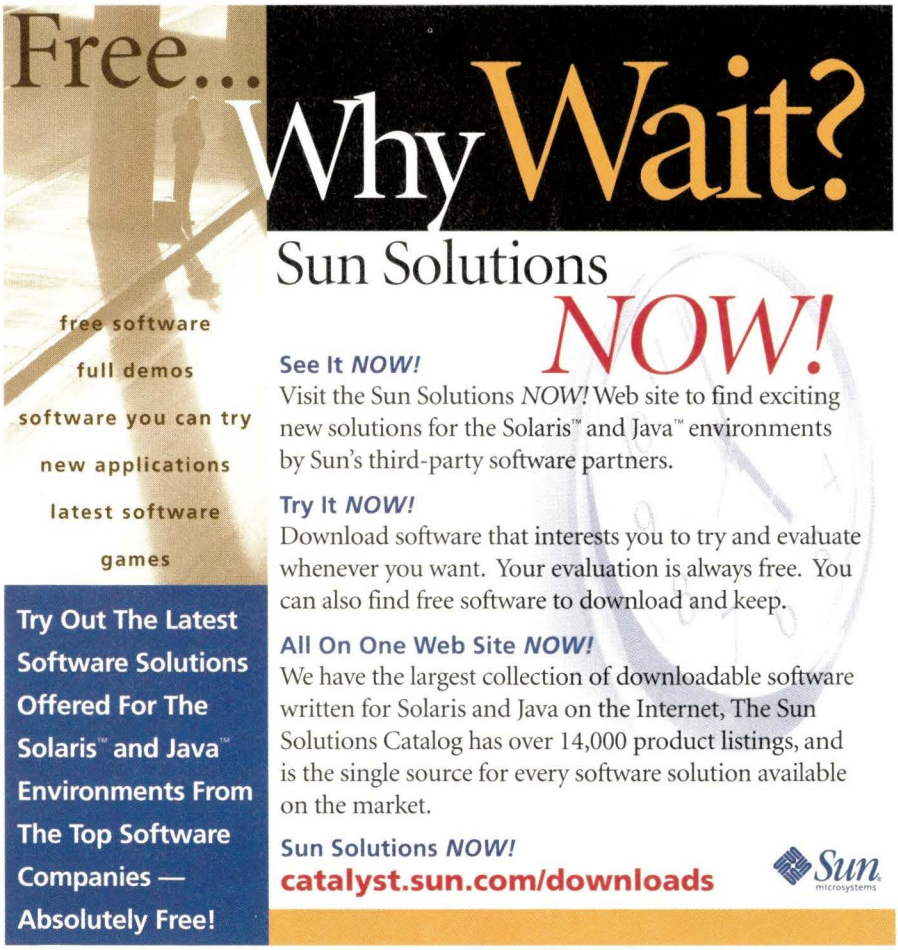
"Release 7 truly allows us to exploit the Internet. It creates information access for the nondepartmental users [those working outside the personnel department] who were traditionally left out," says Row Henson, vice president, HRMS product strategy at PeopleSoft. PeopleSoft sees a variety of employees benefiting from this Internet-empowered environment. Simple human resources tasks such as address changes and benefit updates will be performed by the employees themselves, thereby freeing up HR department to concentrate on other tasks. "Internet enabling is not just about taking a system and putting it out on the Internet," Henson says. "It's about changing the way an expanded community of people now are able to use that data."

It's hardly surprising that PeopleSoft is so focused on user functionality and human resources applications, the company's flagship product, PeopleSoft 7, is a human resources solution whose functionality was developed and enhanced before it came to market. "PeopleSoft has always seen human resources as a strategic application for large global enterprises," says Judy Hodges, research manager for cross-industry applications at International Data Corp., Framingham, MA. On the other hand, SAP America Inc., headquartered in Lester, PA, has always offered a human resources solution, but only as part of its bigger packages. "Their [SAP's] thrust was focused on the supply chain, so accounting and manufacturing really got their attention first and foremost," Hodges says. Recently, though, SAP has announced that it will de-couple its human resources application.

PeopleSoft seems to enjoy a little friendly competition, however, and recently amnnounced an agreement with ADP Inc., a payroll services company based in Roseland, NJ, to develop and market country-specific payroll solutions for the European market. Hodges says, "One of PeopleSoft's weaknesses has been its lack of presence in Europe. This partnership proports one of the best means for them to infilitrate Europe, which has traditionally been [Germany-based] SAP's territory."

As for PeopleSoft 7, in addition to the application server platforms mentioned above, it now supports database processing on the following server platforms: Digital OpenVMS, IBM OS/390 and OS/400, and UNIX platforms from Data General Corp., Digital Equipment Corp., Hewlett-Packard Co., IBM Corp., NCR Corp., Santa Cruz Operations Inc., Sequent Systems Inc., Siemens Nixdorf Information Systems Inc., Silicon Graphics Inc., Sun Microsystems Inc. and Unisys Corp., as well as Microsoft's NT Server.

Pricing for the full PeopleSoft 7 Manufacturing, Distribution, Financial and HRMS application suites, including PeopleSoft Engineering and PeopleSoft Product Configurator, starts at $100,000 per application and varies depending on software products licensed and size of organization.–*mm*



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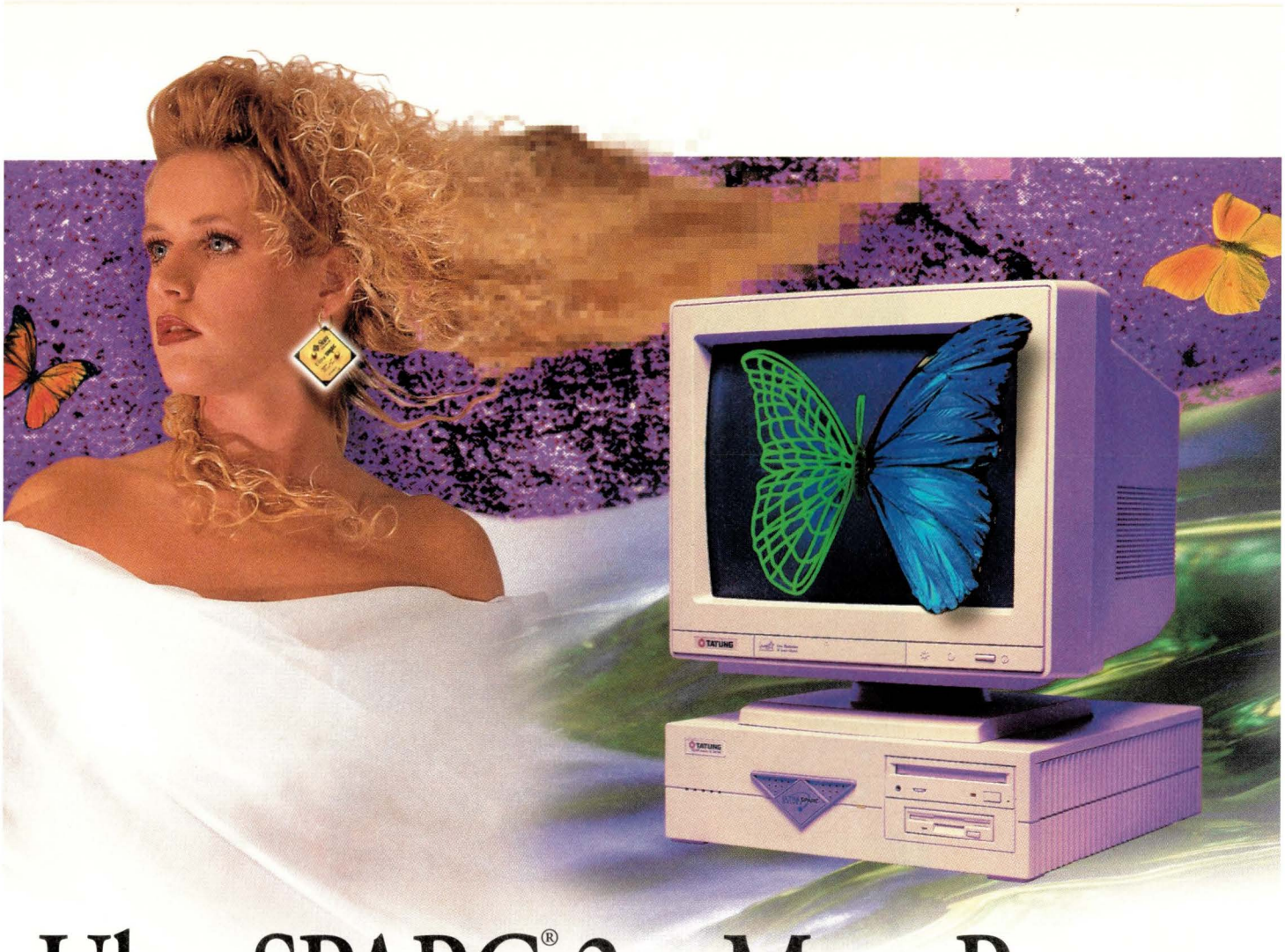

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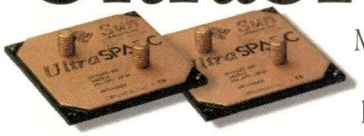

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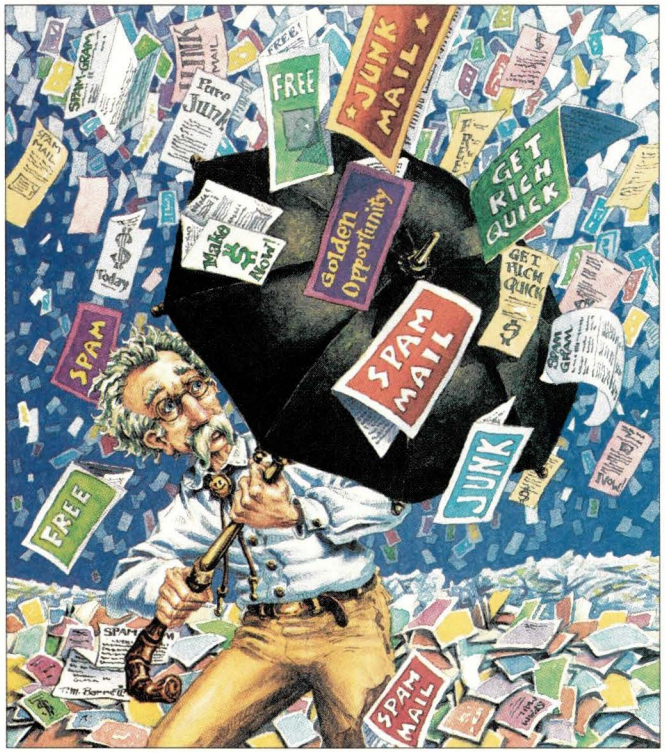
# Ask Mr. Protocol

*by Michael O'Brien*




TOM BARRETT

*"Neither snow, nor rain, nor hail, nor sleet, nor dark of night, shall have the slightest effect on MAE-East–it's going to be down no matter what."* – Whoever

*"UUNET will no longer peer at no charge with any network which is not national in scope."* – Whoever else

*"Stick 'em up!"* – Only a matter of time, folks.

# Mr. P. and the Art of Making Money

**Q:** *What is with all this (^(*&(& spam in my mailbox? Don't these people know I don't have time for all this garbage? I'm busy figuring out how to use the Internet to make gobs of money! Can't they see that?*

**A:** Mr. Protocol, unable as he is to see the irony in an iron, was at a loss as how to respond to this. I, on the other hand, was tempted to just let it lie there as a piece of self-explanatory prose, which would have made for a real short column this month. Wiser heads (namely the ones with the checkbook) prevailed.

Once I explained things to Mr. P., he seemed relieved. He had previously thought that the 800 or 900 spam email messages he gets per day (being on every mailing list in existence, he gets every spam email message sent) represented some sort of obscure failure of SMTP. His theory was that because he already gets almost all email sent, his server's few remaining filters had finally broken under the load. He thought he was getting a copy of every piece of email sent on the Internet. I explained that no, that was only mostly true, and that he was being specifically targeted for all of that mail. His reaction, after the relief wore off, was one of unbridled joy. Doesn't it just figure? He just loves to get mail.

I figure this is just fine. He answers the spam email, every last piece of it. The result is that most of those people are never heard from again. I suspect most of them are down at Auntie Sparrow's Refuge for the Querulous. He tends to have that effect. Certainly, he's kept old Auntie in business for years. In fact, he gets sizable checks from her on a regular basis. I don't like to think about it. People who question Auntie Sparrow's ethics tend to wind up as clients of Uncle Sparrow's Tutelary Establishment for the Altered of Outline. The one time I did wonder out loud in the pub of an evening just what was with the name "Sparrow," there was a general silence, until one old codger said, "Most birds are carnivores," and slipped out the door into the night.

Be that as it may, we do get a lot of email spam. How the heck do these people get our addresses? This is where we see some real ingenuity at work. It's also a real eye-opening microcosm of market economics, too, demonstrating how they can force a market to sabotage itself in a perfectly straightforward manner.

## Go Right to the Source

There are two major sources for email addresses: mailing lists and the Usenet. Let's take them in that order.

Mailing lists are a weapon all by themselves. Internet mailing lists, as originally constituted, were maintained by hand. For a mailing list named `foo`, with a corresponding address of `foo@bar.org`, you sent email to `foo-request@bar.org` to get added to or deleted from the list. You sent a message in regular English either way, because a human was going to be reading it.

Eventually, someone out on Bitnet invented the Majordomo automated list maintainer. No one ever wrote up a stan-

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dard for how to talk to one of these, so there are lots of different variations on a theme, but mostly you now send a message to `foo-request@bar.org` or `majordomo@bar.org` or `listserv@bar.org` or goodness knows what, and put a command like `subscribe foo` in the body of the message. Some automated mailing list software, in an attempt to spare the list membership from mistakes or ignorance, scans all mail sent to the list for words such as `subscribe`, `unsubscribe` and `help`, and redirects those messages into a bin for a human to look at, or else just throws them over the fence automatically to the list processing machinery and devil take the hindmost.

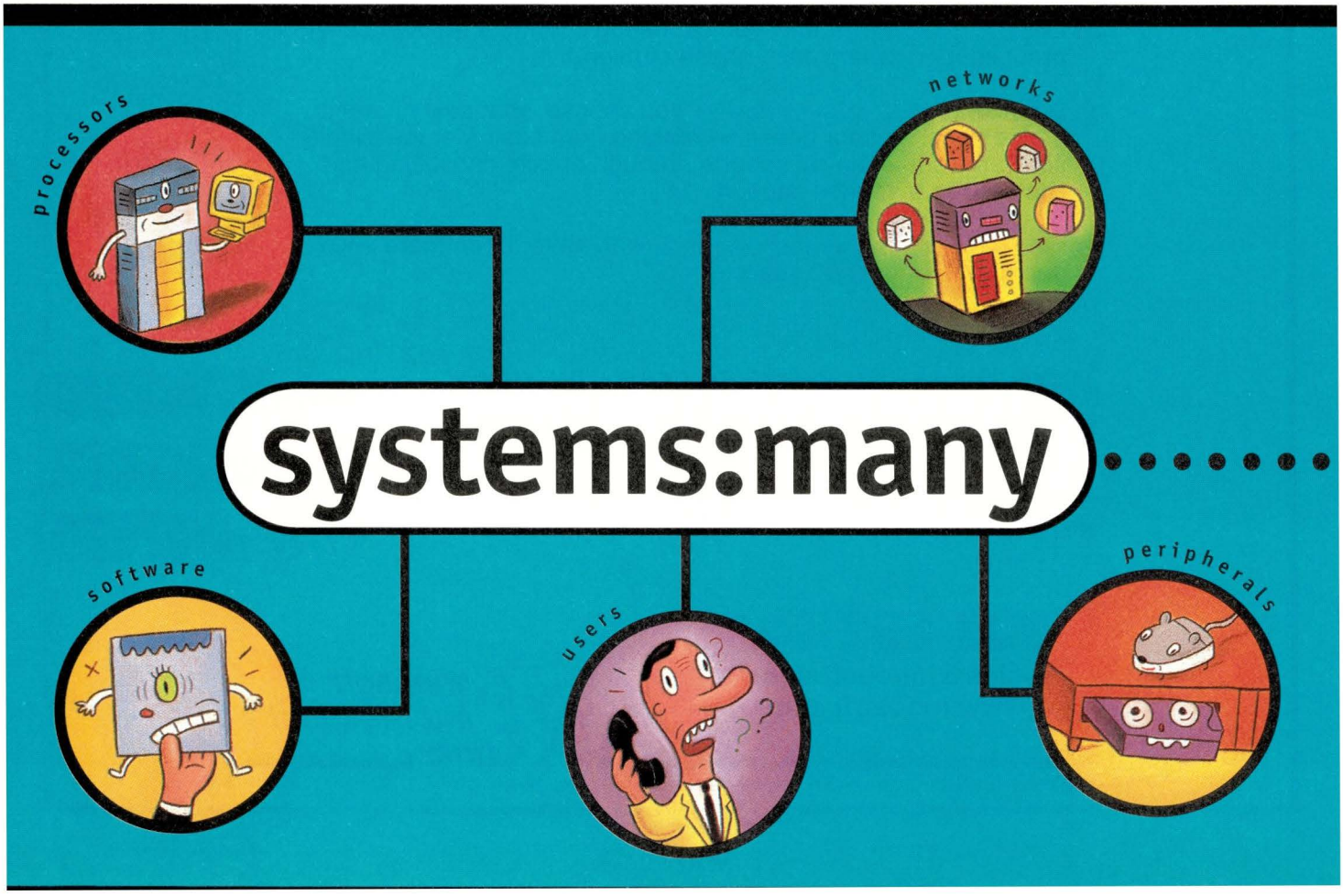
This has been a big boon, for the most part, to mailing list maintainers, though some sort of uniformity in either the addressing or the command language would be a Good Thing. However, the technology is not without its drawbacks. Because it is easy enough to forge email, with only the `Received-from:` line to give you away, it is considered the height of humor and good fellowship in some quarters to feed the email address of a despised enemy into a shell script that will subscribe him or her to every mailing list known to man. This causes mailbox inflation of thermonuclear proportions, often followed by an item in the local police blotter.

One feature offered by many automated list servers is a command to return the list of subscribers to a mailing list. This has always seemed odd to Mr. Protocol, as the list of subscribers never used to be available to readers of a list until these automated maintainers started providing it. Unless, that is, the list was kept on a Massachusetts Institute of Technology ITS system, where everything was available to everybody. Wanna be on a mailing list? Edit the list and add yourself. Oops, what's that? You just accidentally deleted the FTP server instead? No problem, there's a special system service to put you online to a system operator, just tell her, don't worry, happens all the time, they'll hang a tape and put it back. Yowzah! What a system. Mr. Protocol misses it more than you can know. The only justification for writing a PDP-10 emulator is to bring back ITS.

Of course, the real problem with making the membership list available is that anyone can get it. Even if you restrict the availability of the list to current list members, all Billy-Bob Spammer has to do is join the mailing list for just long enough to grab the list of recipients. After doing that several hundred times, and maybe eliminating duplicates ("Only da highest quality!"), there we have it: a sizable mailing list of people who, guaranteed, read their email.

So much for Method A. With Usenet, the process is even more crude: shovel a full news feed into an elementary string-matcher that mines the input stream for anything that looks like an email address. About a week of that sort of thing and you'll have an even bigger list than you'd get with Method A.

Both Usenet and mailing lists can be used to generate targeted lists. Divide up the mailing lists, or the Usenet newsgroups, by subject area,



and presto! Targeted lists. Most people who generate spam email, however, are not bright enough to do this. Motivated entirely by greed, and lacking the ability to make money any easier way, they will take quantity over quality every time. Therefore, the most valuable thing to them is the size of the mailing list, not the quality of the list. They believe that the larger the size of the initial mailing, the larger the quantity of responses that will be generated.

They do notice bounce messages, though. Of course, they mostly never see them. That's because essentially all email spam is forged, using one of a variety of special purpose so-called "stealth" mailers. These are simply ordinary SMTP mailers that have been made multithreaded, on the grounds that most SMTP mailers spend their time waiting for the SMTP servers to get around to responding. Therefore, a large number of simultaneous SMTP deliveries can be attempted over even a dialup line, because at any given moment, most of the connections will be idle, waiting for a response from the far end.

In most cases, this does little good because, most of the time, a given instance of email spam is filtered through a single system, that of an innocent (if ill-configured) system that allows the submission of "third-party" email. This is a system (System B) that allows an outsider (System A) to connect to System B's SMTP server, and submit mail that is not destined for System B, but for a third system, System C. In the case of email spam, actually, several thousand identical messages are submitted, destined for System C, System D, System E, ... Well, you get the idea. Most often, these submissions are targeted for around 7 p.m. in the time zone of System B, when all of System B's administrators will have gone home, leaving about 12 hours for System A to submit several tens of thousands of messages.

When Mr. Protocol is out of the room, I'm ready to admit that this is where the Internet is showing real growing pains. Most of the Internet's growing pains are safely out of sight, although they're hardly unnoticeable: When the large routing hubs such as MAE-East and MAE-West develop gastritis, suddenly nothing moves. Anywhere.

But the most noticeable growing pain is email spam. When the marginal cost of sending email is infinitesimal, the only thing that will eliminate it completely is a return to vigilante hangings. Only the sure knowledge of imminent and unavoidable physical damage will keep some of these people from engaging in this travesty of salesmanship.

It's this psychology that results in the self-sabotage of the marketplace. If subscriber mailing lists were established that routed this stuff, it would probably attract a respectable subscriber base. Some people will do anything for email. However, as it is, the thing that sells these mailing lists to the spamsters is size. The bigger the mailing list, the better, no matter who's on it. This has resulted in increasingly sophisticated trolling software. Usenet postings, in particular, are showing evidence of posters mangling their own return

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addresses in ways that can easily be reversed by individuals who want to reply to the posting by email. Current address trolling software now routinely examines these addresses for strings such as `NOSPAM` and eliminates the extra string from the address before entering the address into the mailing list database.

And this is where you just gotta wonder. What are these people *thinking* of, putting people who have already gone to lengths not to receive this mail, onto their mailing list? Are they going to suddenly look at a piece of spam and behave as if Cupid has been playing at archery again? "Oh! I never knew! I cannot live without the BassMaster! My life has been changed forever! The scales have fallen from my eyes! I shall order immediately! Several times!" How likely is this?

Mr. Protocol is glad you asked. He wishes the spamsters would ask. He fears he knows the answer: Mailing list size is all. Never mind that 98% of the recipients would cheer if some helpful person sledged the originating machine into bent iron and sand. If they're valid email addresses, they're good to go.

## Plugging the Holes

There is a certain amount of finger-in-the-dyke work that can be done to combat this. At the lowest level, one can look at the `Received-from:` line that was generated by one's own mail server, showing which machine actually delivered the message. As mentioned above, this is usually some Internet service provider who is totally ignorant of what's going on. If you catch the message as it comes in you can try running `whois` and calling the technical contact. The words, "Your system is under attack" will generally get their attention.

Failing that, mail a copy of the incoming message to the `postmaster` and `abuse` addresses at that domain. Mr. Protocol will also usually sling a copy of the message to the administrative and technical contacts for the domain, too, on the basis that these days, everybody who thinks they're an Internet provider should know that mail servers that allow third-party submissions are a bad idea. Be civil, though. Mr. P. usually uses the standard phrase, "This email spam either originated at your site, or was injected there via a misconfigured email server." Usually, the parties you'll be sending mail to are guilty of no more than cluelessness.

There is cluelessness in abundance, though. It is obvious that what the spammers are now doing is trolling throughout the Internet looking for servers that allow third-party submissions. Because many software distributions of operating systems come this way (shame!), the more clueless sites are running them that way. Very often, these days, the injection sites are located outside the United States, often at a provider who can't read either the spam or the complaints about it.

Usually, such a site is good for one injection. After that, there's a lot of heartburn and a quick reconfiguration of the mailers. Sometimes, at very large providers, there's even more heartburn and a really slow reconfiguration of the mailers, often allowing repeated injections to take place over a period of weeks or even months.

The pace of plugging the holes in the dyke just about keeps up with the rate of a new dyke being built with holes in it; that is, the rate at which new, clueless providers come online. Welcome to the glory days of the oil biz, when anyone who could throw up a derrick could start an oil company. That's the Internet now. Mr. Protocol knows nothing of the oil biz, but his amanuensis had a grandfather who started a steel construction company in the heyday of that industry, and to him, it's *deja vu* all over again.

There are worse criminals out there, though. The ones who start their own sites with the express purpose of generating and pushing out spam email. Rightly or wrongly, they are served by backbone providers who do not think it is their business to censor what comes out of their clients' machines. The backbone providers, whose customers are entire networks, do not have the same "acceptable use policies" as their customers place on sales to individuals. The whole notion of an acceptable use policy descended from the days of the ARPANET, which had an extremely stringent policy that governed the traffic generated by the member organizations on the Net. The notion of an acceptable use policy was never extended to the upper levels of the network hierarchy when the Internet ceased to be a flat network.

This leaves the problem with the end user. Typically, end networks who decide to be proactive in the spam wars will program their routers to drop packets from hosts and networks that have proven themselves to be nothing more than spam generators. This is a very good solution, actually. The spamsters' machines time out waiting for a connection that will never happen, and the only expense suffered by the blocking network is the trivial effort of having a router drop a number of TCP SYN (connection request) packets on the floor from time to time. If you're running your own network, this is great stuff, and highly recommended.

The only problem with this is that one or two providers are offering very inexpensive email access, and (apparently) underwriting it by allowing spammers to use their facilities unchecked. Blocking these providers really cuts down on the spam, but it also pushes some legitimate users out into the cold. As this is being written, the Internet Engineering Task Force is having a small debate on what to do about this. Some of the IETF volunteer sites that run mailing lists for working groups of the IETF who block these sites, are now caught between continuing to block them to protect their customers, and unblocking them so that legitimate users from these sites (and there are a few) can subscribe and contribute to the working group mailing lists. No easy answers here, folks.

The long-term solutions are more wrenching. It has been pointed out that the reason there is so much spam email is that the marginal cost of sending it is much lower than the marginal cost of receiving it, especially for those recipients who pay hourly access fees over relatively slow phone lines. Some proponents urge that the entire charging scheme of the Internet be reversed so that "sender pays" is the order of the day. In fact, it has been argued that the reason that cellular phone usage and per capita market penetration is so much higher in Europe than in the

about who called it with what request, although there can be speed advantages in doing so. Altavista generates and caches several pages from a single request, and keeps them hanging around to send you with the expectation that you will cycle through several pages. Altavista will re-create the pages if you go away and come back much later.

## Ordering Systems

Placing the state information in a URL like this works well. There does have to be a logical chain of pages, each page passing the information from previous requests to the next page. Search engines are good candidates for the technique because they generate a sequential set of pages that can be re-created on the fly, given a starting point in the sequence. There are many situations where the data stored on the server cannot be sequenced in this way or where you cannot tie the necessary information to a specific URL.

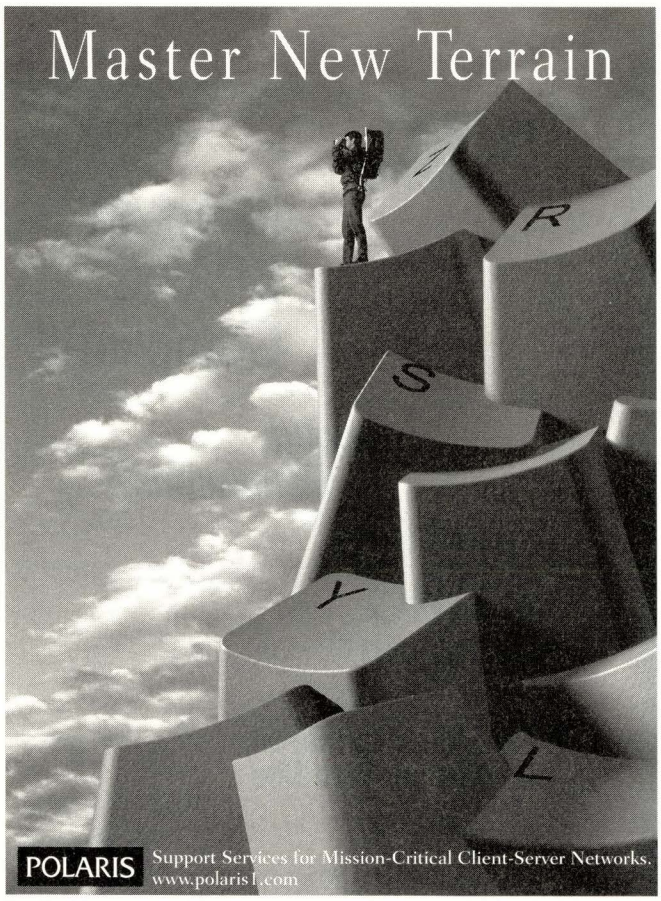
Take, for example, an online ordering system where you want to have one page per product or perhaps one page per category of product. This kind of system is probably best maintained from a relational database that allows different kinds of searches on the products. Actually, you may choose to implement the whole thing as a set of generated pages driven by a program run by the server. I generally prefer to compile the pages from the database and leave them lying around on the disk so that viewers can have a fast turnaround when they access the pages. Also, it's easier to get the pages into those all-important search engines.

How do you expect someone to use an ordering system? Well, it's possible that you can have a central order form with some selection system, where the user decides what they want and returns to the form to place the order. But it's much better to have a "buy me" button on each page to allow the viewer to wander from page to page picking up what they are interested in. Most people call this type of interface a *shopping cart*. The user travels randomly from page to page, adds things to the cart and eventually approaches the checkout where they sign in and pay.

The problem is, how do we maintain the contents of the cart? We've seen that we have to store information in the browser client. Well, if we generated all the pages automatically from a program, then it would be possible to pass the information about the choices that the user has made in URL links and transfer this information from page to page as the user traverses the site. Each link on the pages would need to be modified to retain the information about the user's previous choices.

## The Cookie Mechanism

I hope you can see that the approach using URLs quickly gets messy. What happens when the user chooses the back button on their browser? They'd lose information. What happens if the user is called away from their terminal and wants to come back tomorrow to finish the ordering process? Web pages are transient, and turning the browser off loses the chain of links.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needed data until the page is rendered on the screen.

My point is that all the information specifying the request, for a page, for an image, or for the output from a program, is contained in a single message that is sent to the server. The server satisfies the request based on the URL, sends back the information and gets on with the next thing that it needs to do.

Web forms use exactly the same transaction mechanism. With a form, the user types information into boxes, makes selections from menus or supplies information using checkboxes. This information has to find its way into the server and be passed to a program that does the work of dealing with the form. When the `SEND` button is hit, the information on the form is parceled up as a set of *name=value* strings. The data in these strings is encoded to ensure that it can get to the server intact and is then added to the end of the URL sent to the server. The server will pass the strings into the program that is handling the form. (Yes, there are two ways of passing information from forms; I'm ignoring the second method in this article.)

You can see the URL being extended if you go to a search engine like Yahoo, type something into the search box and hit the button. The next page will contain a URL that contains the string that you typed. Here, I've typed "Hillside" into the Yahoo search engine, hit the `Search` button, and this URL was sent by my browser to Yahoo's server:

```
http://search.yahoo.com/bin/search?p=Hillside
```

Yahoo's system ran the `search` program and generated a page with references to "Hillside." The information after the question mark was used as input to the `search` program; it took the string, searched the database and generated a page for my browser.

Because the server is generating the page, it can create information on that page that retains the original information from the user. The server doesn't keep any information on the request that you made. Instead, it's embedded in the page that is sent back to you. This is also the way that those "Next 20 matches" buttons work.

When the server creates the page, it seeds the page with links that contain information about the request that was made. The `Next 20 matches` link on the page points to

```
http://search.yahoo.com/search?
            p=Hillside&h=s&b=19&hc=2&hs=103
```

I've split the line for printing. You can see the original search string and some new parameters that tell the `search` program to generate the second page of the matched set. When you hit that button on the generated page sending the new URL, the server will rerun the program looking for the same references in the database but this time will generate the second page of information.

So it's possible to use the URL to maintain the state of a transaction. The server doesn't have to keep any information

Circle No. 41

Circle No. 34

```
corp:/acctg >ls general.ledger
UX:ls: ERROR: Cannot access general.ledger:
No such file or directory

corp:/acctg >ls payroll.1qtr
UX:ls: ERROR: Cannot access payroll.1qtr:
No such file or directory

corp:/mfg >ls inventory.cont
UX:ls: ERROR: Cannot access inventory.cont:
No such file or directory

corp:/mfg >ls order.entry
UX:ls: ERROR: Cannot access order.entry:
No such file or directory
```

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**Circle No. 11**

United States is that "caller pays" is the order of the day under the European Post, Telephone and Telegraph administrations' version of the GSM phone standard (obviously, the interoperability and easy roaming features of GSM have something to do with it too).

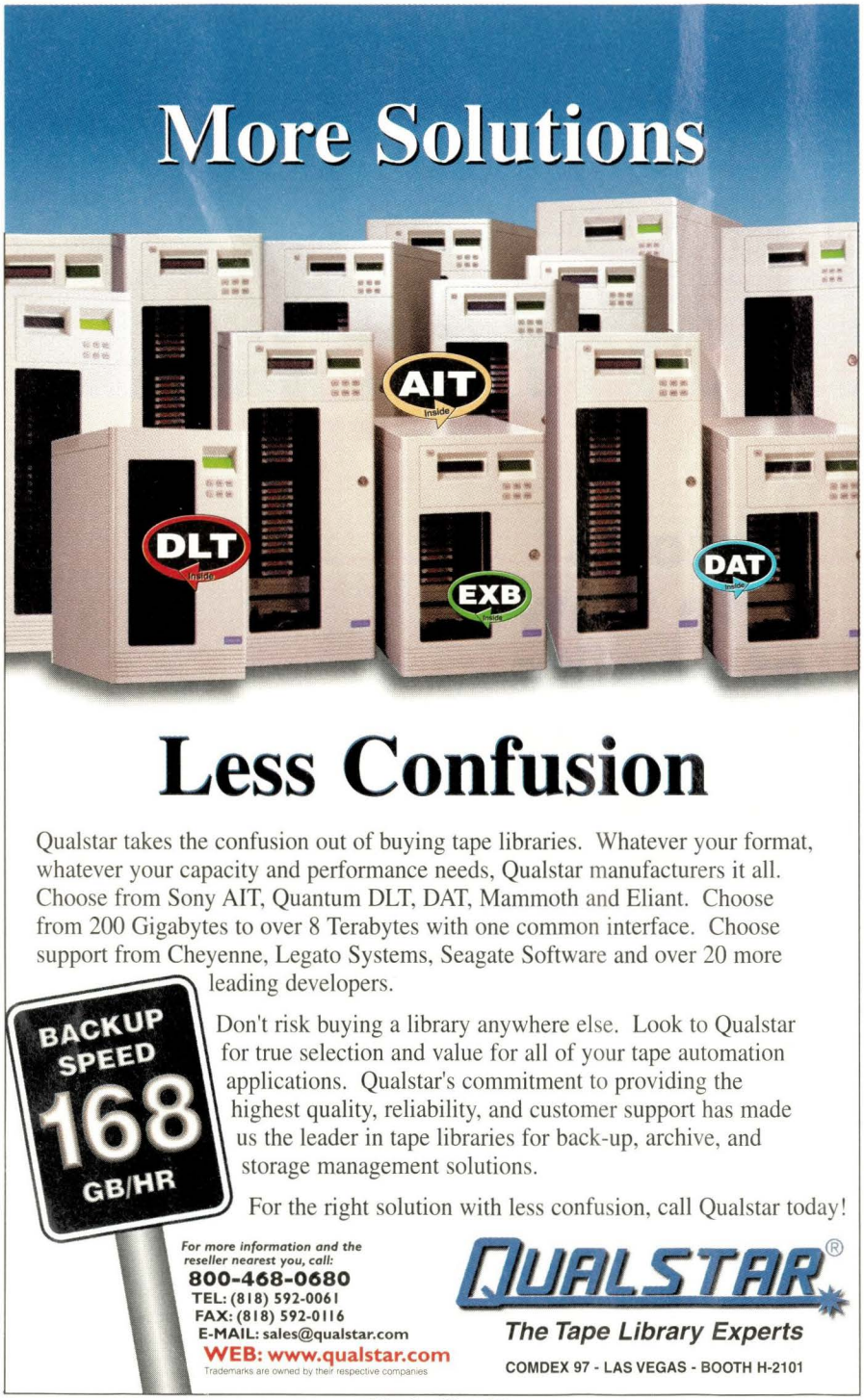
However, one must then note that "sender pays" is the model of the U.S. Postal Service as well, and this hasn't exactly led to a cessation of junk paper mail. On the other hand, a lively constituency of bulk mailers has resulted in a highly differential rate structure for mail. On the third hand, it's claimed that bulk mail subsidizes first class mail, despite the high cost of first class mail vs. bulk mail. Round and round it goes till you're dizzy.

It seems clear that one of two things will happen. Either the Internet will develop an economic model that makes spamming unprofitable, or else the culture of the Internet will adapt to putting up with spam email, probably through a running war of filtering software vs. mail header forgery. It also seems likely that new legal and technological ground will be forged as people begin to work through the problems of identifying rogue third parties who inject email into their servers, and take them to court. This has already begun in the case of some of the largest spammers, such as CyberPromo, which has apparently been kicked off every large backbone provider in the United States except one. See the URL at the end of this column to find out more about the one big provider that seems to welcome spammers.

Advertising has definitely come to the Web, though there is no real proof that this advertising, or indeed anything else about the Web, constitutes a viable economic model for doing business on the Internet. Spam email is a really economically viable model–it makes money, certain–but trying it could become hazardous to your health.

==========

For more information, see The Spam FAQ at `http://digital.net/~gandalf/spamfaq.html`.



Circle No. 28

***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`.

by Peter Collinson, Hillside Systems

GARY DAVIS

# Cookies

Providing pages for the Web is becoming quite complicated. My first HTML article for *SunExpert* was printed in October 1994 ("HyperText Markup Language," Page 28) and, at that time, there was some consensus on what the contents of a Web page should be. Since then, the world has moved on considerably. We've had the continuous browser wars between Netscape and Microsoft, each generating their own "experimental features." As a page author, using the features is no problem if you have control of the browser that your viewers are using–perhaps when you are delivering pages over an intranet to a fixed constituency. It's harder if you are providing public pages when you have no idea who is using what to view your pages.

My personal philosophy with Web page design is that my pages should look approximately the same to all viewers. I try to use a subset of the various HTML flavors that I think will work with everyone's browser. Of course, I mean viewers using "graphical" browsers. Some people use text-based browsers, and I do want users of such programs to be able to deal with my pages and get something from them as well.

My pages are tested on all the platforms and browsers to which I have access. Actually, there are myriad tiny differences in the way that standard features are processed by the imaging engines of the various browsers. If you care about layout, it's actually very hard to get pages to look the same on all platforms with all browsers. One browser will add extra spacing pixels in one place, and another browser will add some space in some other part of the page image. A request for a large heading on one browser will generate a font size that is so large relative to the rest of the text that it looks awful; on another browser it will look fine.

I certainly attempt to avoid HTML features that will cause someone out there to not see the page at all. I really don't like the business of providing alternative pages for the poor deprived person who doesn't have access to the latest greatest SumatraScript language that is wholly supported by Browser A, but that Browser B only pretends to support because the company that is giving it to you is pushing its own BaliScript language.

## Storing User State

Recently, I've found myself creating more and more interactive pages: pages that elicit a response from the viewer, access a database and generate a new page on the fly. One problem with this type of Web application is that the Web operates using transaction-based communications. When you type a URL into the box and tell your browser to get that page, that's just what it does. It talks to the named server and says, "give me a page that matches this URL." The server sends the page to the browser, which in turn may contain further elements, perhaps images, that will require additional information from the server. For each element, the browser will reach out again to the appropriate server to obtain the

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**Circle No. 38**

What is needed is the ability to store ordering information somewhere. Some time back, Netscape foresaw this need and invented the notion of the *cookie*. All the major browsers now support cookies, even though Netscape's support page (for a URL, see below) still states "Preliminary Specification – Use with Caution."

The cookie mechanism allows a server to store a *name=value* pair in the browser's filestore. The information is tied to a particular URL and is returned automatically to the server whenever that URL is accessed. Actually, the matching algorithm is a little more complicated; I'll get into that. Many different *name=value* pairs can be tied to a particular URL, and all the values will be sent when that URL is accessed.

The cookie can be set with an expiration date that defines the lifetime of the cookie. If the server doesn't set an expiration date, then the cookie is not stored onto disk and exists only in the current browser, dying when the browser is terminated.

To set a cookie, the server sends a command as part of the HTML page header. The command contains the *name=value* pair, the expiration date, the domain name to be used for matching, a path to be matched within that domain and a secure flag. If the secure flag is on, then the cookie will only be sent to a secure server.

Notice that the server can set a domain name and a path, allowing the cookie to be returned to a wider set of URLs than just the page that originated the cookie. When thinking about returning a cookie, the browser first matches the domain part of the URL that is being accessed with the domains found in its set of stored cookies. This test uses "tail matching," meaning that the domain in the table is matched against the tail of the fully qualified domain of the URL being accessed.

So if the domain in the URL is `www.hillside.co.uk` and there's a cookie stored with `server.hillside.co.uk`, then the match will succeed. If you look in your `cookies` file (see below), you'll find many references like `.somesite.domain`, allowing any machine in that domain to be sent the cookie. Note that the leading period is needed because the standard insists on having at least two periods to prevent people setting cookies attached to generic top-level domains.

After a successful domain tail match, the browser matches the stored path string with the pathname part of the URL being accessed. The match here is done from left to right, thus (stealing an example from Netscape), a stored value of `/foo` will match `/foobar` and also `/foo/bar`. You'll find that many cookies are set with just `/` as their path and so will be sent with every page access on the designated site.

Incidentally, tail matching is also used when the cookie is set; the standard insists that the domain information that is sent matches the tail of the fully qualified domain name of the originating site. Therefore, I cannot directly tell my server to establish cookies in your browser aimed at matching


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Circle No. 26

Circle No. 16

the URL of a third party.

I talked above about looking at the cookies that are stored on your system. On UNIX versions of Netscape, permanent cookies are retained in a file called `cookies.txt` in the `.netscape` directory in your home directory. On Windows systems, Netscape Navigator used to store a generic `cookies.txt` file, but recent versions have created one that is related to the user. Try using the `FIND` utility to look for `cookies.txt`.

You'll find that all these files are text; each cookie has a record on a line. The file is only written when Netscape exits, so to see what is happening you'll need to stop and start Netscape. There are dire warnings about editing this file, but there seems to be no problem in doing so. I'll guess that you'll need to stop Netscape first.

For Internet Explorer, cookies are stored in a bunch of separate files in the `Windows\Cookies` directory. If you are running on NT, remember that the `Windows` directory may be called something different. The files are named `user@domain` and contain binary data.

## Uses of Cookies

At the moment, I've used the cookie mechanism in two places on some of the systems I run. First, I felt that my tour of Canterbury (for URL, see below) would benefit from a way of remembering where you were, so people could leave and return later to the place where they left. So I've added a button on each of the 350 pages that stores a cookie with the URL of the page. There's then a new button on the first page that accesses the cookie and jumps to the stored URL. The cookie has a two-week expiration period, which seems about right to me. Second, I've created an extensive shopping cart system for my local book shop, which has an extensive list of books about the city of Canterbury. I find that this interface works well, allowing random access to a fixed set of pages that are built on disk.

Certain sites use cookies to store personalized information that permits you to have your own "front page" to their site. Some sites store identification details such as a user name and password, so that when you log in they can recognize you. This sounds fine, but the password is often in plain text in your `cookies.txt` file, so this file needs looking after.

Cookies can be used to track users accessing a Web site. Doing this is controversial. Many people think that it's an invasion of privacy. Each new individual is given a cookie with a unique number, and their progress across the site can then be monitored by looking at the logs generated by the Web server. The idea is that you can obtain user-based information that is more accurate than conventional logs based on IP addresses.

There are some perhaps less benign applications. Several companies now offer methods of targeted marketing using cookies. If you've done any surfing and come across any of those ads that flash annoying messages at you, then you've

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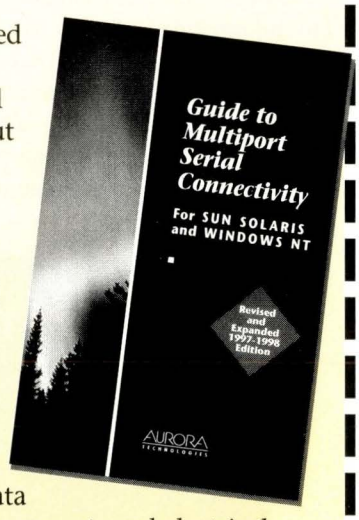


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Circle No. 8

very probably been registered as an entity on a database. You can see these sites in your `cookies` file. You'll find some cookies from sites that you are convinced you have never been near.

It works like this. You visit a site that has bought into one of these advertising schemes, say, Altavista, which uses the services of DoubleClick Inc. As part of the Altavista page, you'll see an ad. This ad is not delivered by Altavista's server. Instead, it's an image that is pulled from a machine owned by DoubleClick. The image is delivered using a script that sends a cookie to your browser. Because your browser is talking directly to the `doubleclick.net` domain to obtain the image that is the ad, the cookie can be set by a machine in that domain.

So, without realizing, you've acquired a cookie from a third party that you didn't know you were talking to. The cookie simply contains a unique number. What has DoubleClick acquired from you? Well, it knows your IP address, the type of browser you are using, your service provider and the operating system of the machine you are using. It is also told where the connection came from, so the DoubleClick machine knows that you came from Altavista. If you've used Altavista to look for something, then the DoubleClick machine is told that too. This information is used to select which ad appears on the Altavista page that you are given as a part of your Web search.

Now, when you surf off to another site that also happens to be a DoubleClick member, you'll see another ad. DoubleClick will also see the cookie that was previously set, and it can use the unique number to look you up in its database. DoubleClick's software can attempt to ensure that it sends you a different ad from before, which is helpful and perhaps eases the tedium. But it also has a knowledge of things you are looking for on the Web; it knows where you have been and what you have been looking for in the search engines. It would be possible for DoubleClick to use this information to target your machine with certain ads. It's not clear whether it does. The company's Web page states the cookie is only used to control ad frequency so that you don't get bored witless seeing the same flashing image all the time.

## Stopping Cookies

If you want to stop cookies being stored on your machine, then all browsers have an option that asks you whether you want to be warned when someone tries to set a cookie. You are given a dialog box and have the opportunity to say no. Of course, you may be happy to say yes to certain cookies, perhaps if they are the basis for an online ordering system. Be aware that if a site is using cookies for page tracking, then you will be supplied with an enormous number of these dialog boxes and it can get tedious to keep saying no.

The yes/no question has been extended in Version 4 of Netscape Navigator, and there's now an option to disallow a cookie being set from a third-party domain. This has been implemented as a result of RFC 2109, which specifies greater user control over the cookies that are set into your browser.

If you access the Web from a Windows 95 or NT platform, then Luckman Interactive Inc. has created a freeware program that allows you to hide your existing cookies. It works by moving your cookies files to a safe place and placing read-only empty dummies in their place. When you decide to uncloak, the old files are moved back to their rightful positions.

Finally, you can always edit the `cookies.txt` files to remove entries.

## Useful References

The original Netscape cookie page is `http://home.netscape.com/newsref/std/cookie_spec.html`. Much of the information in this article on the dark side of cookies was derived from a site called Cookie Central, `http://www.cookiecentral.com`. Yahoo has a good index page for Cookies; look for "Persistent Cookies."

You'll find Luckman's site at `http://www.luckman.com`. DoubleClick is found at `http://www.doubleclick.net` and contains a lot of information on how things work. If you want to find other companies that are using cookies for ad targeting, see the Cookie Central site. My Canterbury Tour is `http://www.hillside.co.uk/tour` and now uses cookies to store your last position. The Albion Bookshop shopping cart application is `http://www.cantweb.co.uk/books/albion`.

***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`.

Circle No. 40

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**Circle No. 23**

*by Richard Morin and Vicki Brown*

ERIC YANG

# Perl Conference Report

In August, Vicki Brown and I ventured into the wilds of San Jose, CA, in search of Perl arcana and lore. The O'Reilly Perl Conference, held at the Fairmont Hotel, promised to give us a clear picture of this rather baroque gem. As expected, we found plenty of things to report on. Here are our collaborative trip notes, folded into a (mostly) digestible format.

## Overview

O'Reilly and Associates Inc. (`http://www.oreilly.com`) is well known as a publisher of UNIX-related books. Its authors range into some very specialized corners of UNIX lore, providing a depth and breadth of coverage that is unmatched by any other publisher. If you are not on O'Reilly's mailing list, join now!

O'Reilly has not, however, been known as a provider of technical conferences. Given its stable of authors, it would seem to have few problems in finding speakers. The logistical aspects of conference management, on the other hand, are most likely new to the publisher. Also, the entire Perl Conference was conceived and implemented in a very short period of time (under four months), so a few things could be expected to slip a bit.

There was no message board at first, although one was found and set up upon request. The lack of a BOF (birds of a feather) sign-up board made life difficult for prospective BOF attendees. The "break-out" sessions should have had signs detailing topics and times. Finally, a continuously staffed "information" booth would have helped confused attendees to resolve minor problems.

Our overall impression, however, was quite positive. The O'Reilly conference staff was alert and helpful; the registration went smoothly, the materials were well-prepared and no particular snafus occurred. In fact, this conference managed to provide some new and valuable innovations, including the "Perl on ICE" Web pages.

## Perl on ICE

We were quite impressed with the "Perl on ICE" (Interactive Conference Environment) Web pages, provided by Songline Studios. Using these pages, we were able to explore the conference program, sign up for BOFs and other events, and participate in discussions with other attendees. The conference organizers could use our feedback to determine session attendance and room sizes ahead of time. Although some of the pages were difficult to navigate, we believe that this can be corrected in future implementations. The basic idea is very sound and we recommend it to SUG, USENIX and other technical conference organizers.

The Perl on ICE Web pages (`http://perl-conf.songline.com/`) will remain available for some time, so you may be able to visit them. In addition, you may find pages for other conferences at the main Songline Web site (`http://www.songline.com`).

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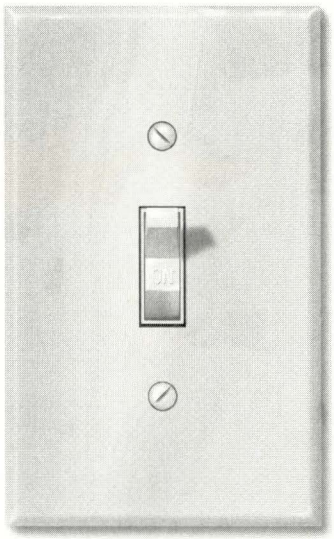
Circle No. 29

# SCSI Switching As Simple As This



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Circle No. 3




## The Culture of Perl

The keynote talk, "The Culture of Perl," was given by Perl's inventor, designer and principal architect, Larry Wall. Aside from being an irrepressible punster (note the title of his talk), Larry is a talented and prolific software developer. While we may consider Perl his masterpiece, Larry has also contributed a variety of other innovations to the free software community, including an OS-sensitive "configure" script, a source code patching utility (`patch`) and a newsreader (`rn`). Clearly, Larry is a very funny, imaginative and productive guy.

As might be expected, Larry's talk was very worthwhile: amusing, educational, interesting and provocative. The theme was the need for balance between order and chaos. Punctuating his remarks with prerecorded sound effects, Larry tied together themes from evolution and religion, and human and computer language design. Keep an eye on the O'Reilly Web site, in case it decides to post Larry's talk.

## The Web is the API

According to Andrew Schulman, consulting editor, O'Reilly and Associates, in his talk, "The Web is the API," (`http://www.sonic.net/~undoc/perl/talk/webapi1.html`) the World Wide Web is the applications programming interface for global, distributed, parallel processing. Each time a `GET` message is sent, some machine responds by exporting a Web page. In the process, the remote machine may do an arbitrary amount of calculation.

More and more servers are coming online all the time, offering a vast range of information retrieval and lookup services. Although these are intended for use by human users, there is nothing to stop access by other programs. By taking advantage of this access, we can develop second-level information resources of various sorts.

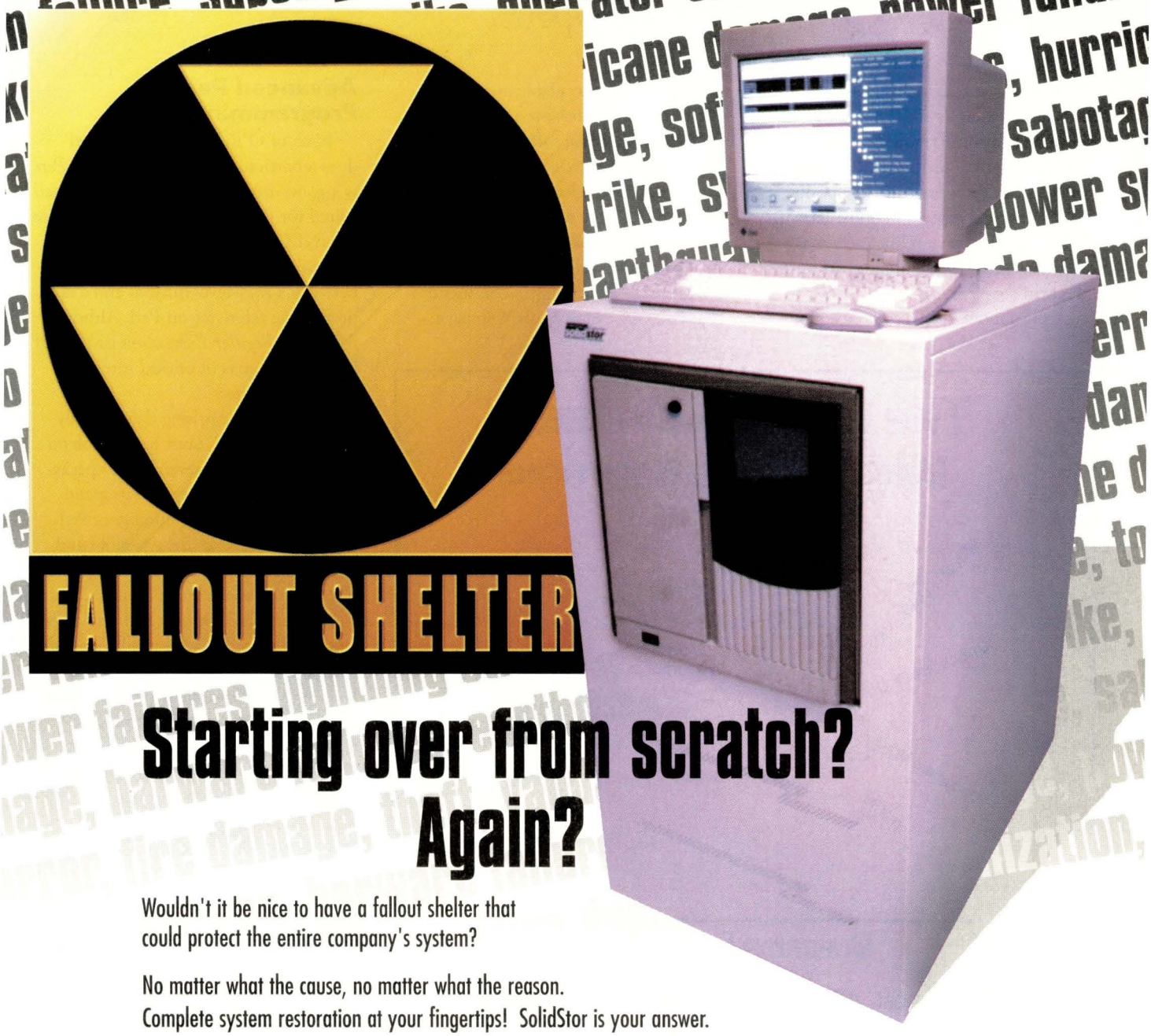
And as programmers begin to comprehend the power of this interface, we may see some sites installing pages that are specifically intended for access by programs. We have always been told, you see, that distributed programming is hard; what will we do when we realize it's really very easy?

## The Cathedral and the Bazaar

Eric Raymond is best known as the editor of *The New Hacker's Dictionary*, 3rd Edition, MIT Press, 1996, ISBN 0-262-18178-9. His talk on "The Cathedral and the Bazaar" is a fascinating look at the ways (free) software is developed. Eric has given this talk at several venues and has even created a Web page for it, see `http://www.ccil.org/~esr/writings/cathedral.html`.

The cathedral model attempts to issue "perfect" releases, using a small set of highly skilled developers and relatively long release cycles. This model allows users to have a relatively high degree of confidence in the issued code, at the expense of a somewhat slow development cycle. In the cathedral model, users must never see bugs. Many freeware projects use the cathedral model; it is almost universal in commercial software development.

The bazaar model, by contrast, issues new releases when-

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ever significant changes have been made. No claim is made for perfection, but releases come frequently and incorporate bug fixes promptly. ( In order to shield naive users from the perils of rapidly evolving code, most bazaar-based projects have release schemes that provide both debugging and production snapshots.)

Confounding Eric's preconceptions and much of the available literature, the bazaar model has been shown to work for substantial software projects (for example, Linux). What's more, the code tends to develop (and become bulletproof) at a very rapid rate. Eric has analyzed the reasons for this and performed a small-scale experiment to test his theories. We strongly recommend that you take a look at his Web page.

## Advanced Perl Programming

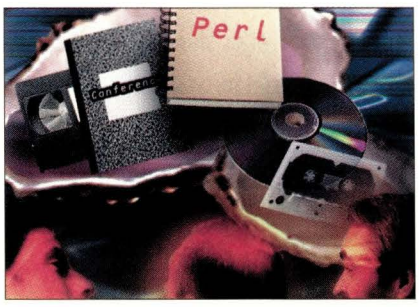
Each of O'Reilly's books on Perl does a particular job well. *Learning Perl* is a good introduction, particularly well suited for programmers with experience in UNIX-ish languages such as `awk`. *Programming Perl* is a well-done cross between a mid-level tutorial and a comprehensive reference on Perl. Although *Mastering Regular Expressions* isn't a Perl book, its topic is of critical interest to Perl programmers.

So, it is not surprising that O'Reilly has issued another "must have" book on Perl. We have spent several hours perusing this book and are certain to spend many more. It covers a number of Perl topics–closures, eval, tie, typeglobs and so on–that are only hinted at in O'Reilly's first two Perl books. Each chapter closes with notes comparing the Perl implementation of the feature with similar facilities in other languages (for example, C/C++, Java, Python, Tcl/Tk), giving the reader some useful perspective. In a thoughtful–and productive marketing–move, O'Reilly handed out free copies of the book to all conference attendees.

## The Perl Institute

It is quite clear that O'Reilly intends to play a large part in both the development and commercial exploitation of Perl. By publishing books, holding conferences and, most recently, sponsoring a major Perl Web site (`http://www.perl.com`), it is assuring itself of a strong position. At the same time, it is giving the Perl community a valuable source of continuing support, organization and other resources.

O'Reilly is a single commercial entity, however, not a voice for the Perl community as a whole. As such, it may be tempted to restrict commercial use of the Perl Camel (which O'Reilly has

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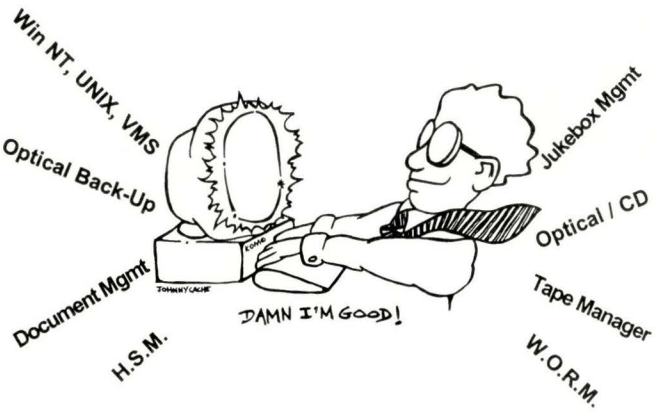


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recently trademarked), access by other vendors to the Perl Conference, mentions of non-O'Reilly books in its authors' writings and so on.

So, while we applaud O'Reilly's efforts in support of Perl, we encourage you to support The Perl Institute (`http://www.perl.org`) as an independent voice for Perl–send some money, buy a T-shirt and frequent its Web site. You'll be well rewarded.

## The Importance of Perl

Perl has been around for quite a few years now, progressing from a cool UNIX script language, admired by systems administrators, to its current position as "tool of choice" for use with the World Wide Web. Perl has been ported to numerous non-UNIX platforms and has found converts and adherents everywhere from universities to large commercial organizations.

According to Tim O'Reilly, O'Reilly and Associates, and Ben Smith, Ronin House, in a white paper distributed at the conference, "the real job of 'activating the Internet' belongs to Perl." The paper's authors contend that Perl "will become increasingly more important, not just for the Web but as a general-purpose computer language." We think so, too.

***This conference was a first step in bringing Perl further into the spotlight, in showing managers and commercial entities that freeware can be just as good as (or better than) commercial software, and that Perl is not a 'flash in the pan.'***

This conference was a first step in bringing Perl further into the spotlight, in showing managers and commercial entities that freeware can be just as good as (or better than :-) commercial software, and that Perl is not a "flash in the pan," to be replaced by Java, ActiveX or anything else any time soon. The first annual O'Reilly Perl Conference drew nearly 1,000 attendees, well-known speakers and interesting presentations. We're looking forward to seeing what next year's conference will do. ⊸

***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`.*

***Vicki Brown*** *has been working with UNIX systems since 1983. She started working with Perl in Fall 1995 because with Perl she could do pretty much everything she wanted (and needed) to do on the Macintosh, without the benefit of UNIX and a shell :-).*

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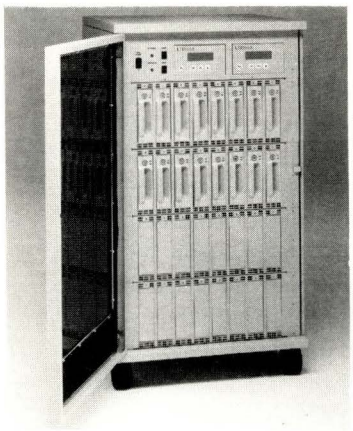

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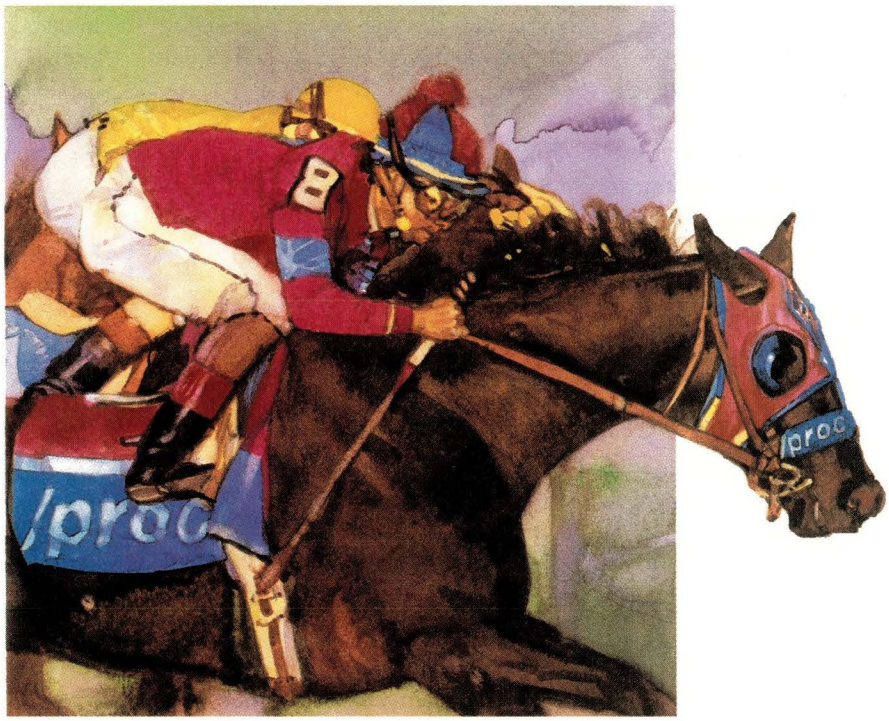
by S. Lee Henry




KEN CALL

# The /proc File System

The `/proc` file system is an example of the `procfs` file system type that was new to SunOS with Solaris 2.x. For systems administrators who seldom wander into the `/proc` directory, its utility may seem practically nonexistent. What does one need, after all, with images of running processes? What could one *do* with them? Good questions.

The concept of a *virtual* file system seems odd at first and no more appealing than a virtual lunch. Try watching the faces of fellow systems dweebs when technotalk delves into virtual file systems and you'll see what I mean.

"Virtual file systems," I grin. "They don't take up disk space." "Good idea," says the guy watching the coffee pot filling up. "Maybe they should *all* be virtual. Think of the disk space I'd save."

In fact, `procfs` file systems (only one of a number of virtual file system types), don't occupy space on disk, but look and act like disk-based file systems. What I mean by this is that they provide us with a familiar interface for debugging running processes and add to the information available to us through commands like `ps`.

Take a look at the files in `/proc`. You'll notice that their names reflect the `procIDs` of the particular processes with prepended zeroes (for example, `/proc/00441`). Each file is owned by the user running the particular process, and only he has read and write privileges. The size of each file is the size of the process image. Try the command in Figure 2. Interestingly, all of the files are in units of 4 KB. This isn't a coincidence, of course, but tells us something about the way memory is allocated. If you watch these files over time, some of them will disappear. The commands or applications that they correspond to will finish processing or be killed. Others will appear to be constant. Take a look at `/proc/00000`, for example. This file has a size of 0 and a date reflecting your last reboot. This file corresponds to the scheduler. The `/proc/00001` file corresponds to the `init` process. You'll notice that this file also has the timestamp of your most recent reboot (even if you've changed run states since), as shown in Figure 3. Notice that the size of `/proc/00001` is considerably larger than the size of the `/usr/sbin/init` binary. Executing processes allocate memory for data manipulation and storage, so their process images are always larger than the binaries on disk (see Figure 1).

Most process images will stay the same size while they are running. That is, they allocate the memory required up front. Processes can change size, especially when they suffer from memory leaks.

Memory leaks occur when memory

**Figure 1. Process Image Size**

```
-r-xr-xr-x 1 root   sys    28064 Jul 16 1994 /usr/sbin/init
```

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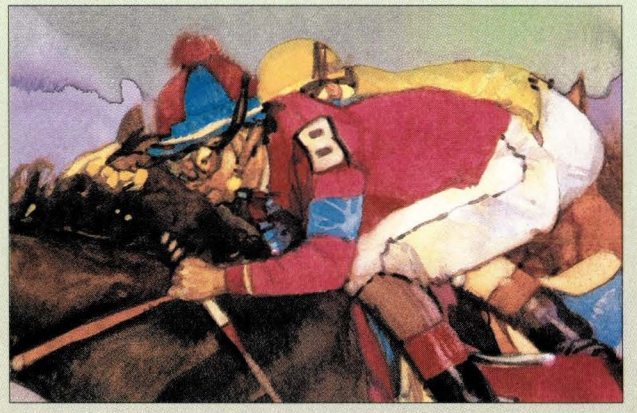
### Figure 2. /proc File Sizes

```
radman:/home/svr=> foreach SIZE (`ls -l /proc | awk '{print $5}'`)
? echo $SIZE | awk '{print $1 / 4096}'
? end
0
197
0
0
2004
2008
2008
2004
1270
437
328
364
350
338
435
```



### Figure 3. The /proc/00001 File

```
boson:/home/slee=>     ls -l   /proc/00000  /proc/00001  /proc/00441
-rw-------     1 root       root            0  Sep 16  17:31  /proc/00000
-rw-------     1 root       root       806912  Sep 16  17:31  /proc/00001
-rw-------     1 slee       dweebs     954368  Sep 16  17:34  /proc/00441
```

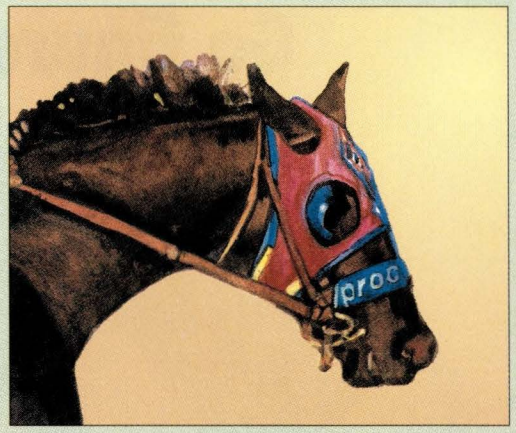
### Figure 4. The ps Command

```
boson:/home/slee=> ps -efl | head -12
 F S   UID PID PPID   C    PRI  NI      ADDR   SZ      WCHAN     STIME   TTY    TIME   COMD
19 T root   0    0  66      0  SY  f0187950    0                17:31:52   ?      0:01   sched
 8 S root   1    0  80     41  20  fc0bd998  187   fc0bdb68  17:31:55   ?      0:05   /etc/init
 8 S slee 441  438  36     99  20  fc41d990  233   fc52d71e    Sep 16   pts/8  0:00   /bin/csh
```

### Figure 5. Sample C Program

```
#include <sys/types.h>
#include <sys/stat.h>
#include <sys/signal.h>
#include <sys/fault.h>
#include <sys/syscall.h>
#include <sys/procfs.h>
#include <stdio.h>
#include <netinet/in.h>
#include <errno.h>
#include <fcntl.h>
#if 0
typedef struct prstatus {
        long    pr_flags;               /* Flags (see below) */
        short   pr_why;                 /* Reason for process stop (if stopped) */
        short   pr_what;                /* More detailed reason */
        siginfo_t pr_info;              /* Info associated with signal or fault */
        short   pr_cursig;              /* Current signal */
        u_short  pr_nlwp;               /* Number of lwps in the process */
        sigset_t pr_sigpend;            /* Set of signals pending to the process */
        sigset_t pr_sighold;            /* Set of signals held (blocked) by the lwp */
        struct sigaltstack pr_altstack; /* Alternate signal stack info */
        struct sigaction pr_action;     /* Signal action for current signal */
        pid_t   pr_pid;                 /* Process id */
        pid_t   pr_ppid;                /* Parent process id */
```

```
        pid_t   pr_pgrp;                /* Process group id */
        pid_t   pr_sid;                 /* Session id */
        timestruc_t pr_utime;           /* Process user cpu time */
        timestruc_t pr_stime;           /* Process system cpu time */
        timestruc_t pr_cutime;          /* Sum of children's user times */
        timestruc_t pr_cstime;          /* Sum of children's system times */
        char    pr_clname[PRCLSZ];      /* Scheduling class name */
        short   pr_syscall;             /* System call number (if in syscall) */
        short   pr_nsysarg;             /* Number of arguments to this syscall */
        long    pr_sysarg[PRSYSARGS];   /* Arguments to this syscall */
        id_t    pr_who;                 /* Specific lwp identifier */
        sigset_t pr_lwppend;            /* Set of signals pending to the lwp */
        struct ucontext *pr_oldcontext; /* Address of previous ucontext */
        caddr_t pr_brkbase;             /* Address of the process heap */
        u_long pr_brksize;              /* Size of the process heap, in bytes */
        caddr_t pr_stkbase;             /* Address of the process stack */
        u_long pr_stksize;              /* Size of the process stack, in bytes */
        short   pr_processor;           /* processor which last ran this LWP */
        short   pr_bind;                /* processor LWP bound to or PBIND_NONE */
        long    pr_instr;               /* Current instruction */
        prgregset_t pr_reg;             /* General registers */
} prstatus_t;
#endif

char    *progname;
char    *procfnum;
FILE    *procfile;
int     procfd;
int     retval;
struct  stat *procstatus;

void
main ( int argc, char **argv )
{
char ch=' ';

struct prstatus p;

progname = *argv++;
argc--;

if(argc == 0) {
   printf("Usage: %s <filename>\n",progname);
   return;
}

procfnum = *argv;

if ((procfd = open(procfnum,O_RDONLY)) == NULL) {
   printf("cannot open input file\n");
   return;
}

if (retval = ioctl(procfd, PIOCSTATUS, &p) == BADRET) {
   printf("unable to access file %s\n",procfnum);
   printf("errno = %i\n",errno);
   return;
}

printf("parent process is:      %i\n",p.pr_ppid);
printf("size of process heap:   %i\n",p.pr_brksize);
printf("size of process stack:  %i\n",p.pr_stksize);
}
```



allocated by a process is not deallocated when it is no longer needed. Available memory appears to dwindle. Several memory leaks can cause a process to run out of memory and can chew up the swap space available on your system to a point at which all processes begin to suffer.

The "beauty" of the `/proc` file system is that it provides a way to query and, with care, control running processes without requiring that the processes be child processes of a debugger. Using standard system calls–`open(2)`, `close(2)`, `read(2)`, `write(2)` and `ioctl(2)`–you can manipulate the process images in much the same way as you would any standard file (any standard *binary* file, that is). Remember, these files will resemble core dumps more closely than they will resemble letters to Mom.

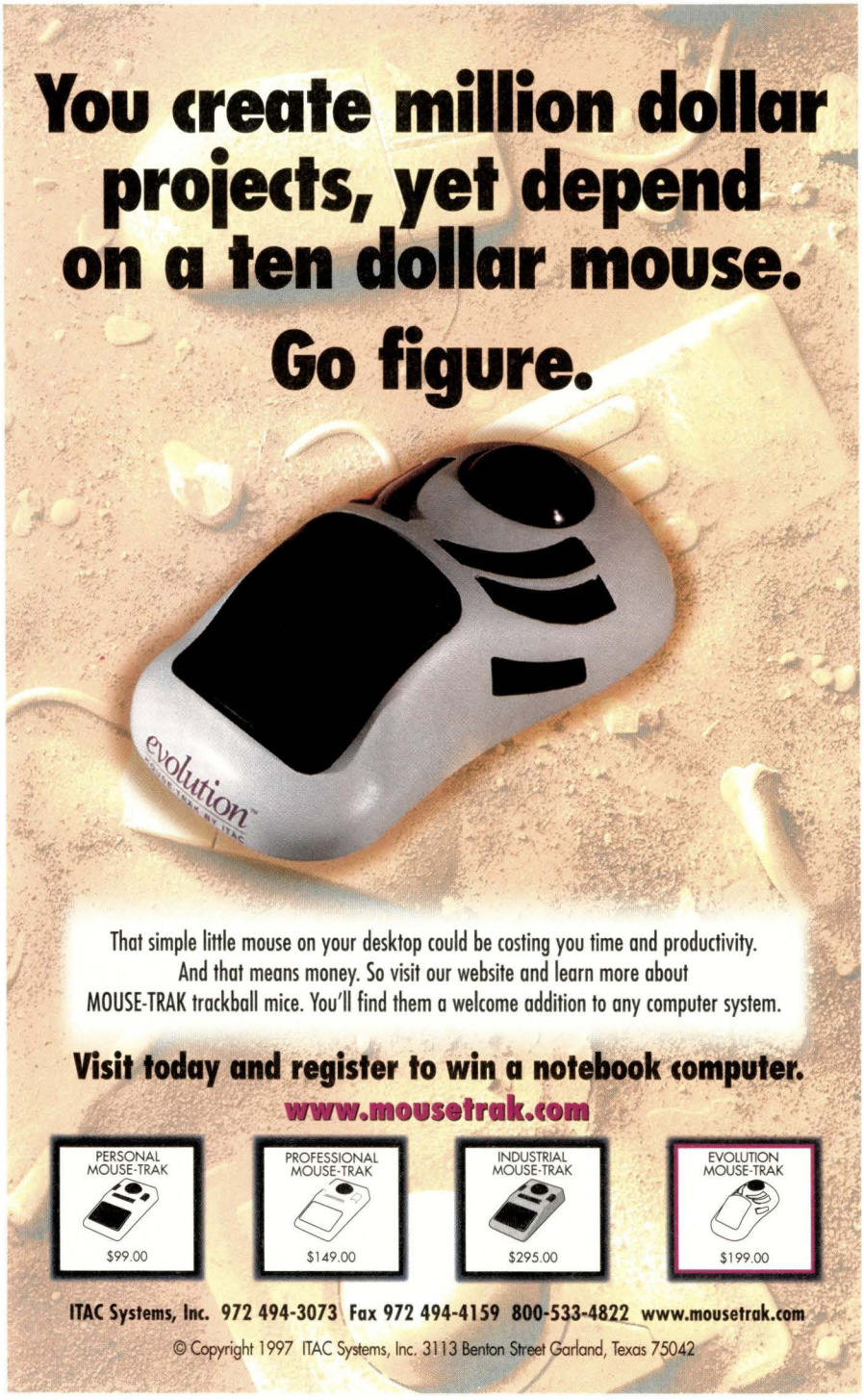
To make this point a little clearer, I've included a sample C program (see Figure 5). This program pulls some data out of whatever `/proc` file is given as an argument and displays it. Notice that the data structure used is separated by `#if 0` and `#endif` commands so that it is not compiled with the rest of code. This structure is defined in the `procfs.h` header file and is included with the code only to make it easier to follow.

Much of the information available with the `/proc` file system is also available through the `ps` command, as shown in Figure 4.

Take a look at the `proc` man page for more information on the data available through the `procfs` interface.

---

***S. Lee Henry*** *is a security engineer at Infonet in El Segundo, CA, and lives in a part of LA that may secede and be called Gridlockia before you read this column. Send your virtual thoughts to her using the address* `slee@cpg.com`.

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Circle No. 2

*by Æleen Frisch*

JOE COLUCCI

# Introducing the NT Registry

*Editor's note: The following is excerpted with minor modifications from Chapters 1 and 8 of* Essential Windows NT System Administration *by permission of O'Reilly & Associates Inc.*

This month, we'll take a first look at the Windows NT registry and the administrative tasks and concerns that accompany it. The Windows NT *registry* is a central database of system configuration settings (it contains some application-specific settings as well). Readers familiar with AIX should note that the registry performs a function analogous to AIX's Object Data Manager database. The registry serves to replace the scores of initialization (`.Ini`) files found on Windows systems. Although Windows 95 contains a similar facility, the Windows NT registry uses a different format and is more complex.

The registry is stored in a series of binary files usually located in the directory `%SystemRoot%\System32\Config`. Logically, the registry is a collection of named *keys* and their *values.* Registry keys form the structure of the registry, and they are organized in a hierarchical structure; locations within the registry are referred to using a syntax analogous to subdirectory pathnames. Values are terminal nodes in the registry tree, which contain actual system settings (known as *data*). Put most simply, in most cases, keys are like directories and values are like files, with data corresponding to file contents. A subtree of keys and values that are stored together in a single file is known as a *hive.*

The registry is composed of a series of five tree-structured groups of keys, each headed by a *root key*:

- `HKEY_CLASSES_ROOT`: Definitions of known system file types.
- `HKEY_USERS`: Configuration data for the default and defined user accounts.
- `HKEY_LOCAL_MACHINE`: Local system configuration data.
- `HKEY_CURRENT_USER`: A pointer into the `HKEY_USERS` tree for the currently logged in user.
- `HKEY_CURRENT_CONFIG`: A pointer into the `HKEY_LOCAL_MACHINE\System\CurrentControlSet` subtree for the current system configuration.

You will typically access those keys within the `HKEY_USERS` and `HKEY_LOCAL_MACHINE` trees. (This list ignores the `HKEY_DYN_DATA` pseudo key accessible only to programs.)

Registry key values have one of 11 data types. Those you will likely encounter are the following:

- `REG_BINARY`: binary data.
- `REG_DWORD`: integer data (often displayed in hexadecimal notation).
- `REG_SZ`: character string values.
- `REG_MULTI_SZ`: a list of character strings (appearing one per line in the Registry Editor).
- `REG_EXPAND_SZ`: a character string value containing expandable parameters (variables replaced by their actual values when the key is used).

The other defined data types are:

- `REG_DWORD_BIG_ENDIAN`: holds a 32-bit integer, high byte first.

• REG_FULL_RESOURCE_DESCRIPTOR, REG_RESOURCE_LIST and REG_RESOURCE_REQUIREMENTS_LIST: complex data types used for hardware configuration and system resource data (such keys are not editable).

• REG_LINK: a pointer (symbolic link) to another location within the registry.

• REG_NONE: used for untyped data.

## Using the Registry Editor

Ideally, you should never have to worry about the system registry and certainly never have to modify the values of any of its settings. However, as of the current version of Windows NT, this ideal is far from achievable; there are many system features that are accessible in no other way. While it is a very bad idea to make random, experimental or gratuitous changes to the registry, from time to time you will need to modify registry entries for a variety of reasons: to change the way the system functions, to correct a problem, to add or modify keys or values to enable additional system features and so on.

Windows NT provides a utility known as the Registry Editor for accessing and modifying the registry: `regedt32`. By default, neither an icon nor an entry in the **Administrative Tools (Common)** menu is present, but you can always create them if you want to. The Registry Editor is a powerful tool that requires care when it is used. Microsoft's standard warning about it is worth paying attention to:

"WARNING: Using Registry Editor incorrectly can cause serious, system-wide problems that may require you to reinstall Windows NT to correct them. Microsoft cannot guarantee that any problems resulting from the use of Registry Editor can be solved. Use this tool at your own risk." [Microsoft Corp.]

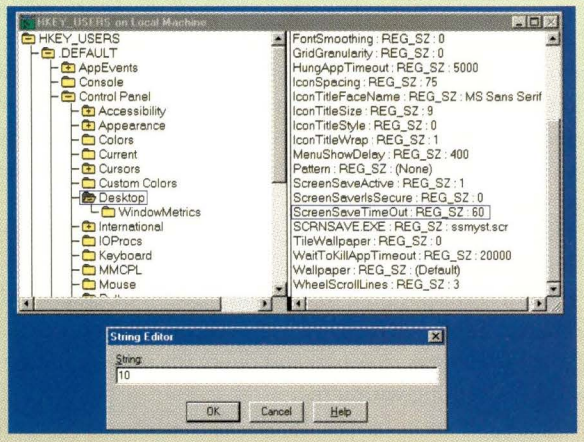
Prudent use of the Registry Editor involves taking several precautions:

- Back up the registry files before you begin.
- Be sure that you have a known-to-be-bootable saved configuration that you can fall back on if necessary.
- Plan your actions before you undertake them, and test them afterwards.
- Use the Registry Editor with care. Keep in mind that changes to the registry are immediate and that the editor has no undo command. Use the utility in read-only mode (**Options=>Read Only Mode**) when you just want to examine registry entries.
- Keep records of the changes you have made.

Figure 1 illustrates the process for changing the value of an existing registry value: Select the windows for the desired root key in the Registry Editor and then navigate to the desired key by selecting successive items in the left side of the browsing window. The values and associated data stored at the current location appear in the right side of the window (values and data are separated by colons; if your window is missing one of these sections, select **View=>Tree and Data**).

To modify a value, double click on its entry in the right side of the browsing window. A dialog box will appear containing the current setting, which you can modify as necessary (note that the value's data type is indicated in the dialog box's title bar). For example, the illustration changes the `HKEY_USERS\DEFAULT\Desktop\ScreenSaveTimeOut` value from 60 to 10 (seconds in this case). Once you click `OK` to close the dialog box, the change is made immediately (the `Cancel` button may be used to abandon any changes).

**Figure 1. Using the Windows NT Registry Editor**




The Registry Editor may also be used to add new keys and values to the registry via these two options on its **Edit** menu:

- **Edit=>Add Key**: Adds to the structure of the registry only, by creating a new subkey of the current key. The Registry Editor will prompt you for the name of the new key.
- **Edit=>Add Value**: Adds value (a terminal leaf) to the current key in the registry. The Registry Editor will prompt you for the value name, its data type and the desired data setting.

The Registry Editor is an easy way to change the value of a particular registry setting (or to add a new one). Sometimes, though, you will want to find a registry component whose name you don't know. The Resource Kit provides the `scanreg` utility for searching registry key names, value names and value data for strings; it is a command line utility with the following syntax:

```
scanreg -s string scope-options [other-options]
```

One or more options specifying the items to be searched must be included: `-k` scans key names, `-v` searches value names and `-d` scans the data. For example, the following command searches all key and value names for the string `cd` (but does not search the current settings themselves):

```
C:\>scanreg -s cd -kv
Key  : "\Software\Microsoft\Multimedia\Audio\WaveFormats"
Value : "CD Quality"
End of search: 1 matching string(s) found.
```

The Resource Kit includes a help file that documents registry keys and values. The file is named `RegEntry.Hlp`, and it may be searched using the normal Help facility methods.

## Key Ownership and Permissions

Like files and directories, registry keys have owner and permission settings. Note that ownership and permissions are set at the registry key level (and not on individual values or settings).

It is imperative that you consider the consequences carefully before you make modifications to registry key ownership and permissions. Limiting access may result in unintended side effects and loss of normal system functionality. Test any changes you decide to make first on a nonproduction system.

Table 1 lists the defined access permissions for registry keys.

There are two defined permission sets for registry keys:

- **Read**, corresponding to the combination of **Query Value**, **Enumerate Subkey**, **Notify** and **Read Control**. This permission set allows users to search and query the registry but not to modify anything within it.
- **Full Control**, corresponding to all available permissions.

The **SecurityPermissions...** menu path in the Registry Editor may be used to view and modify registry key permissions. An example is illustrated in Figure 2. The **Registry Key Permissions** dialog box is very similar to the one used to set access control lists (ACLs). Its **Type of Access** field specifies the access allowed for the selected user or group, one of **Read**, **Full Control** and **Special Access** (the latter allows you to assign arbitrary sets of basic permissions). The **Add...** and **Remove** buttons enable you to add or delete entries, respectively.

## Remote Registry Access

Versions of Windows NT prior to 4.0 allowed any user to access the registry on a remote system. This proved to be an unacceptable security practice, so under Version 4.0, by default only members of the *Administrators* group are allowed to do so.

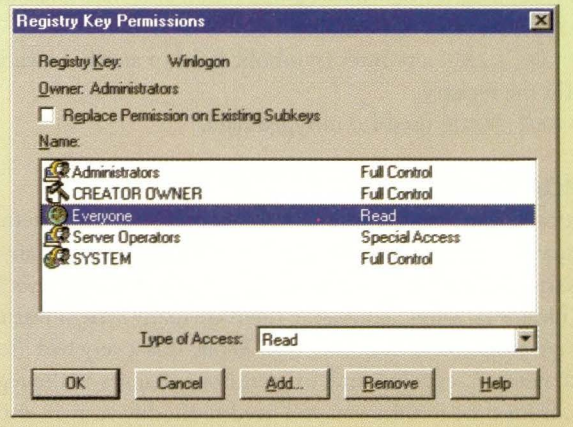
Remote access to the registry is controlled by the `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\SecurePipeServers\winreg` registry key. If this key does not exist, you can create it as well as a value named Description (type `REG_SZ`) and set it to "Registry Server" (include the space). The permissions on this key specify users who are allowed to access the registry remotely. The default permissions assign **Full Control** to *Administrators* and contain no entries for other users or groups. You can add other items to these permissions as needed for system services (for example, the print spooler or replicator services) or systems administration requirements at your site.

The `AllowedPaths` subkey of the `winreg` key is used to specify registry locations for which these restrictions do not apply.

**Table 1. Registry Key Permissions**

| Access Permission | Effect |
|---|---|
| Full Control | Shorthand for all permissions. |
| Query Value | Determine a key's current setting. |
| Set Value | Modify a key's current setting. |
| Create Subkey | Add a subkey to a key. |
| Enumerate Subkey | View the subkey tree under a key. |
| Notify | Enables the auditing of changes to a key. |
| Create Link | Create link to this location within the registry. |
| Delete | Remove the key. |
| Write DAC | Modify the permission settings for a key. |
| Write Owner | Take ownership of a key. |
| Read Control | View a key's security settings. |

**Figure 2. Registry Key Permissions**




## Disabling Registry Access

You can choose to disable registry access by anonymous connections (the ability to do so was introduced as the "secfix" Hot Fix to Service Pack 2 and is included in Service Pack 3 and later).This is accomplished by adding the `RestrictAnonymous` value to the `HKEY_LOCAL_MACHINE\System\Control\CurrentControlSet\LSA` registry key (type `REG_DWORD`) and setting it to 1.

Disabling anonymous registry access will result in the loss of some functionality. For example, users from other, untrusted domains will not be able to retrieve lists of users for your domain (for example, when adding entries to an ACL). See article Q143474 in the Microsoft Knowledge Base (`http://www.microsoft.com/kb`) for more information. ⊸

***Æleen Frisch*** *is systems administrator for a very heterogeneous network of UNIX and NT systems. She is also the author of the book* Essential System Administration *(O'Reilly & Associates Inc., now in its second edition) and is finishing up another on Windows NT systems administration. In her (almost nonexistent) spare time, she enjoys painting and lounging around with her cats, Daphne, Susan, Talia and Lyta. Email:* `aefrisch@lorentzian.com`.

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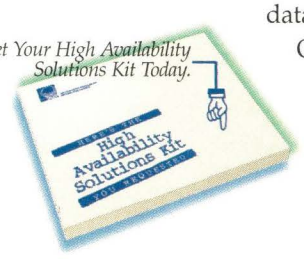


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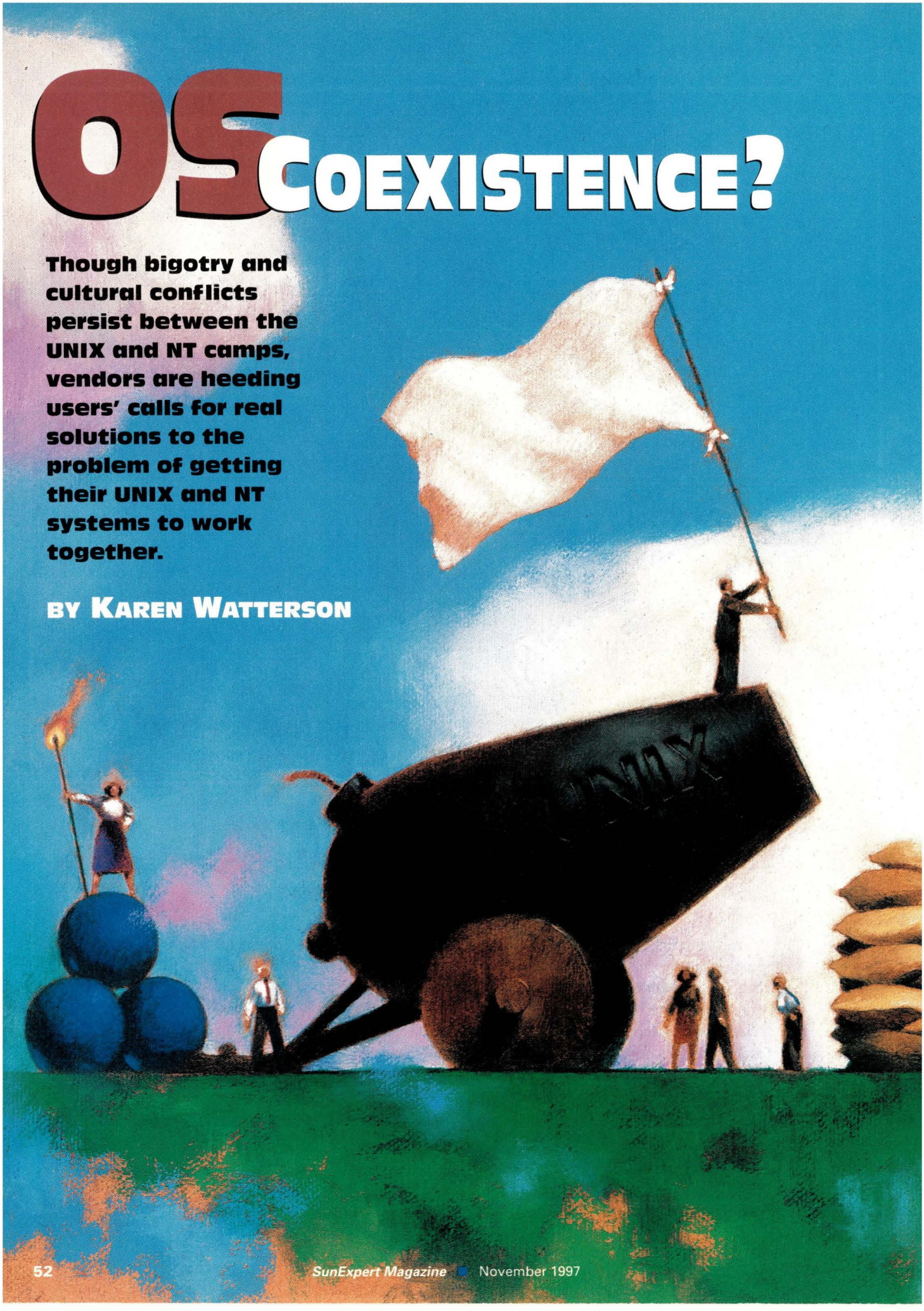
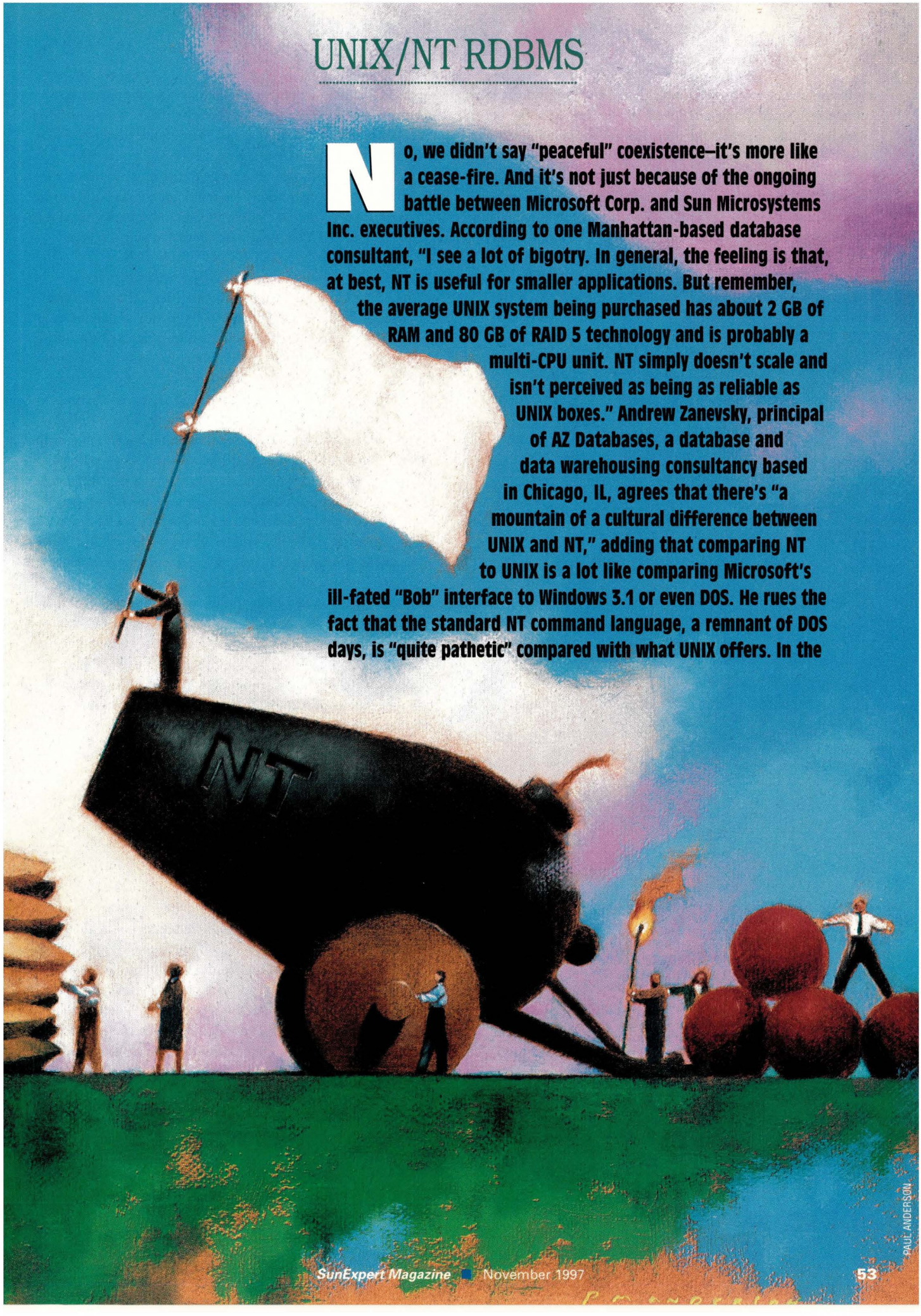
# OS Coexistence?

**Though bigotry and cultural conflicts persist between the UNIX and NT camps, vendors are heeding users' calls for real solutions to the problem of getting their UNIX and NT systems to work together.**

BY KAREN WATTERSON



# UNIX/NT RDBMS




**No, we didn't say "peaceful" coexistence–it's more like a cease-fire. And it's not just because of the ongoing battle between Microsoft Corp. and Sun Microsystems Inc. executives. According to one Manhattan-based database consultant, "I see a lot of bigotry. In general, the feeling is that, at best, NT is useful for smaller applications. But remember, the average UNIX system being purchased has about 2 GB of RAM and 80 GB of RAID 5 technology and is probably a multi-CPU unit. NT simply doesn't scale and isn't perceived as being as reliable as UNIX boxes." Andrew Zanevsky, principal of AZ Databases, a database and data warehousing consultancy based in Chicago, IL, agrees that there's "a mountain of a cultural difference between UNIX and NT," adding that comparing NT to UNIX is a lot like comparing Microsoft's ill-fated "Bob" interface to Windows 3.1 or even DOS. He rues the fact that the standard NT command language, a remnant of DOS days, is "quite pathetic" compared with what UNIX offers. In the**

PAUL ANDERSON

long run, however, Zanevsky feels that UNIX will retreat to an increasingly small "high end," with NT emerging as the network backbone. "It will take time, but it's inevitable. I don't think Microsoft can be stopped," he says.

Sequent Computer Systems Inc.'s vice president of marketing, Jeff Pancottine, observes that "nobody's going to jeopardize their mission-critical data center applications on NT today, but that's the direction the industry is heading." Beaverton, OR-based Sequent, traditionally associated with mainframe-like high-end systems running Dynix or Dynix/ptx UNIX, underscored its commitment to UNIX/NT interoperability at the high end by demonstrating NT and UNIX running on the same NUMA-Q 2000 server at the September IT Expo held in New York. (Don't call Sequent yet. The ability to run the two operating systems in separate partitions is still a year off.)

UNIX vendors may not love NT, but most of them are listening to their customers. (Sun Microsystems seems to be a notable exception. "It's down to Coke and Pepsi," said Sun Chief Executive Officer Scott McNealy during a recent NCR/Sun teleconference. "It's NT and Solaris.")

The same can be said for the DBMS vendors. Oracle Corp., IBM Corp., Informix Software Inc., Sybase Inc. and Progress Software Corp. all have NT versions of their software, and most have segments of their Web sites devoted specifically to NT (see `http://www.ntsolutions.oracle.com/`, `http://www.software.ibm.com/nt`, `http://www.informix.com/nt`) and special sales forces and channel efforts devoted to NT. That's not surprising. The so-called "high-end" database vendors don't want Microsoft's NT-only SQL Server to gain a foothold. The message they convey is this: We understand that you may want to use NT for small departmental applications, or perhaps for "quick and dirty" proof-of-concept applications, but make sure you've got a migration path to UNIX. Most will be glad to offer migration tools to ease the pain, however, if you're unlucky enough to be "stuck" with another vendor's database.

Clearly, most data center staffers would prefer to run their important applications under UNIX as opposed to NT, but they're under pressure to deploy NT as a cost-saving alternative to UNIX. According to a staffer at the Environmental Protection Agency in Washington, D.C., cost is a prime incentive driving the EPA to begin migrating some of its Oracle databases from Data General Corp. boxes onto NT.

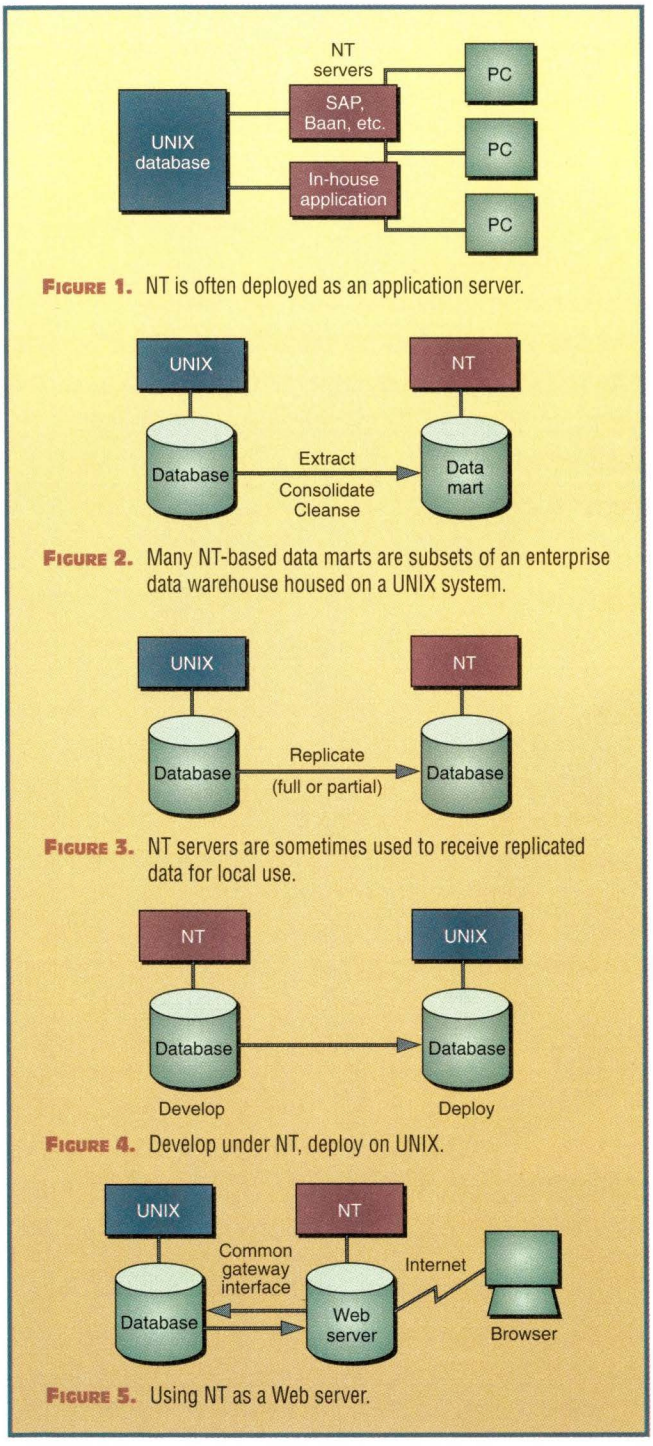



**Figure 1.** NT is often deployed as an application server.

**Figure 2.** Many NT-based data marts are subsets of an enterprise data warehouse housed on a UNIX system.

**Figure 3.** NT servers are sometimes used to receive replicated data for local use.

**Figure 4.** Develop under NT, deploy on UNIX.

**Figure 5.** Using NT as a Web server.

## Sample Scenarios

Still, NT databases are being built and deployed. Here are some typical applications:

- Three-tier client/server
- Data mart
- Data replication
- Development platform
- Web server

NT is probably most often deployed as an application server (see Figure 1) running against a "back-end" DBMS, which could be housed on anything from a mainframe to the same NT server running the application. Many sites, for example, run popular client/server packages from SAP America Inc., Baan Co. or PeopleSoft Inc. on an NT server, but keep the main database on a Sun server running Oracle. You can also run a report server application from Cognos Corp., Seagate Software (formerly Crystal Services Inc.), Business Objects Inc., IQ Software Corp. or Actuate Software Corp. running on an NT server but have the report server access heterogeneous data sources, including mainframe and UNIX-based DBMSs or data warehouses. Similarly, many departmental, home-grown applications are deployed from an NT server against databases housed on UNIX systems in the data center.

Another increasingly popular scenario is to spawn NT-based

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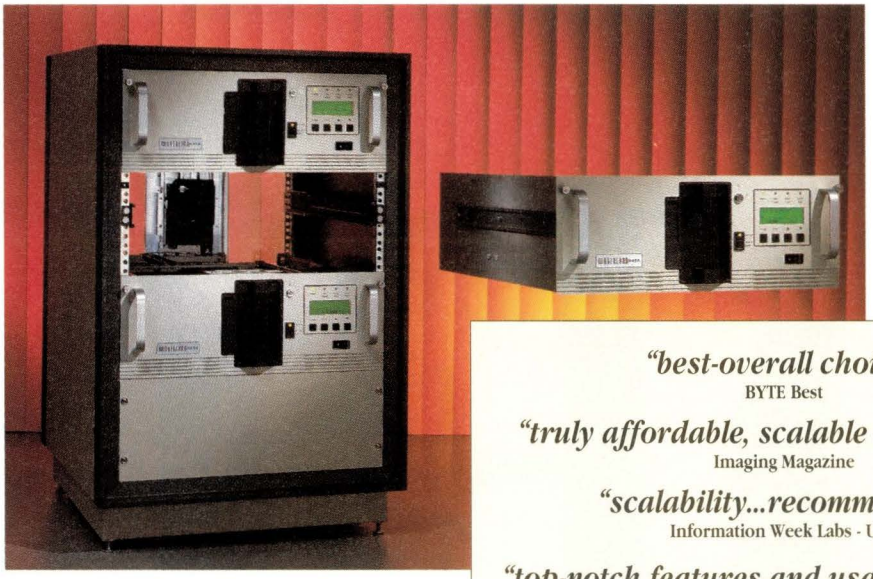

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data marts off enterprise data warehouses that are often 100-GB-plus behemoths housed on UNIX symmetrical multiprocessing (SMP) or massively parallel processing (MPP) servers (see Figure 2). But many vendors are actively marketing "quick start" standalone data marts–typically Windows NT-based bundles with some consulting that cost less than $100,000 (see Table 1). Others, such as Hewlett-Packard Co. and SAS Institute Inc., offer warehouse or mart management consoles on NT.

Data sharing using data replication (see Figure 3) is another popular scenario. For example, relevant portions of enterprise database data might be replicated homogeneously to an NT version of the same database in branch offices. However, given appropriate middleware or gateways, it's not hard to implement heterogeneous replication from a Solaris-based DBMS to an NT-based SQL Server, for example.

The fourth common use of an NT server is as a development platform (see Figure 4). Here, NT represents an inexpensive alternative to workstation development, especially for mobile workers. Imagine, for example, that you're developing stored procedures and other routines for what will ultimately be a UNIX-hosted Oracle or Informix database. Nothing prevents you from doing that on an NT version of Oracle or Informix–although, clearly, hardware-specific code that takes advantage of SMP or MPP systems probably couldn't be developed or tested on NT.

The final example of UNIX/NT database co-existence would be using NT as a Web server (see Figure 5) to deliver HTML reports or perhaps data that can be manipulated in a browser with Web-enabled online analytical processing (OLAP) client software, for example. One impressive example

**Table 1. Representative 'Quick Start' Data Mart Bundles for NT**

| Company | Package | Price ($) | URL |
|---|---|---|---|
| **Arbor Software Corp.** | ESSBASE | 37,000 | http://www.arborsoft.com |
| **Data General Corp.** | Business Data Warehouse Program (bundled collection of products) | Varies, contact vendor | http://www.dg.com |
| **Digital Equipment Corp.** | Digital Data Mart (uses Informatica's PowerMart) | 99,500 | http://www.digital.com |
| **IBM Corp.** | Visual Warehouse for Windows NT | 22,500 | http://www.software.ibm.com |
| **Informatica Corp.** | PowerMart | 50,000 | http://www.informatica.com |
| **Information Advantage Inc.** | DecisionSuite | 29,995 | http://www.infoadvan.com |
| **Information Builders Inc.** | SmartMart | 55,000 | http://www.ibi.com |
| **Informix Software Inc.** | Informix FastStart Data Mart (includes MetaCube) | 62,500 | http://www.informix.com |
| **Kenan Technologies** | Acumate ES | 25,000 | http://www.kenan.com |
| **Knosys Inc.** | DecisionView | 10,000 | http://www.knosysllp.com |
| **MicroStrategy Inc.** | DSS Server | 50,000 | http://www.strategy.com |
| **Oracle Corp.** | Data Mart Suite for NT, Data Mart Suite – Sales and Marketing | 39,500, 99,500 | http://www.oracle.com |
| **Prism Solutions Inc.** | Prism Scaleable Data Mart | 70,000 | http://www.prismsolutions.com |
| **QAD Inc.** | QAD Enterprise Data Warehouse (for MFG/PRO) | 100,000 | http://www.qad.com |
| **Red Brick Systems Inc.** | Red Brick Warehouse | 15,000 (initial license fee) | http://www.redbrick.com |
| **Sagent Technology Inc.** | Sagent Data Mart Solution | 50,000 | http://www.sagenttech.com |
| **Seagate Software/ Holistic Systems** | Holos | 75,000 | http://www.seagatesoftware.com/HOLOS |
| **Sequent Computer Systems Inc.** | CompleteWarehouse, (also Proof of Concept, Data Mining/Marketing, and Data Mining/Fraud Detection options) | 500,000 (hardware and software) | http://www.sequent.com |
| **Siemens Pyramid Information Systems** | Smart Warehouse | 25,000 | http://www.siemens-pyramid.com |
| **Software AG Americas Inc.** | Dmart and SourcePoint | 25,000 | http://www.sagus.com |
| **Sybase Inc.** | WarehouseNOW, formerly called QuickStart DataMart (uses Informatica's PowerMart) | 65,000 or QuickStart ReportMart 25,000 | http://www.sybase.com |
| **Virtual Integration Technology** | designMANAGER and deliveryMANAGER | 50,000/server | http://www.vit.com |
| **Vmark Software Inc.** | Software DataStage | 37,500 | http://www.vmark.com |

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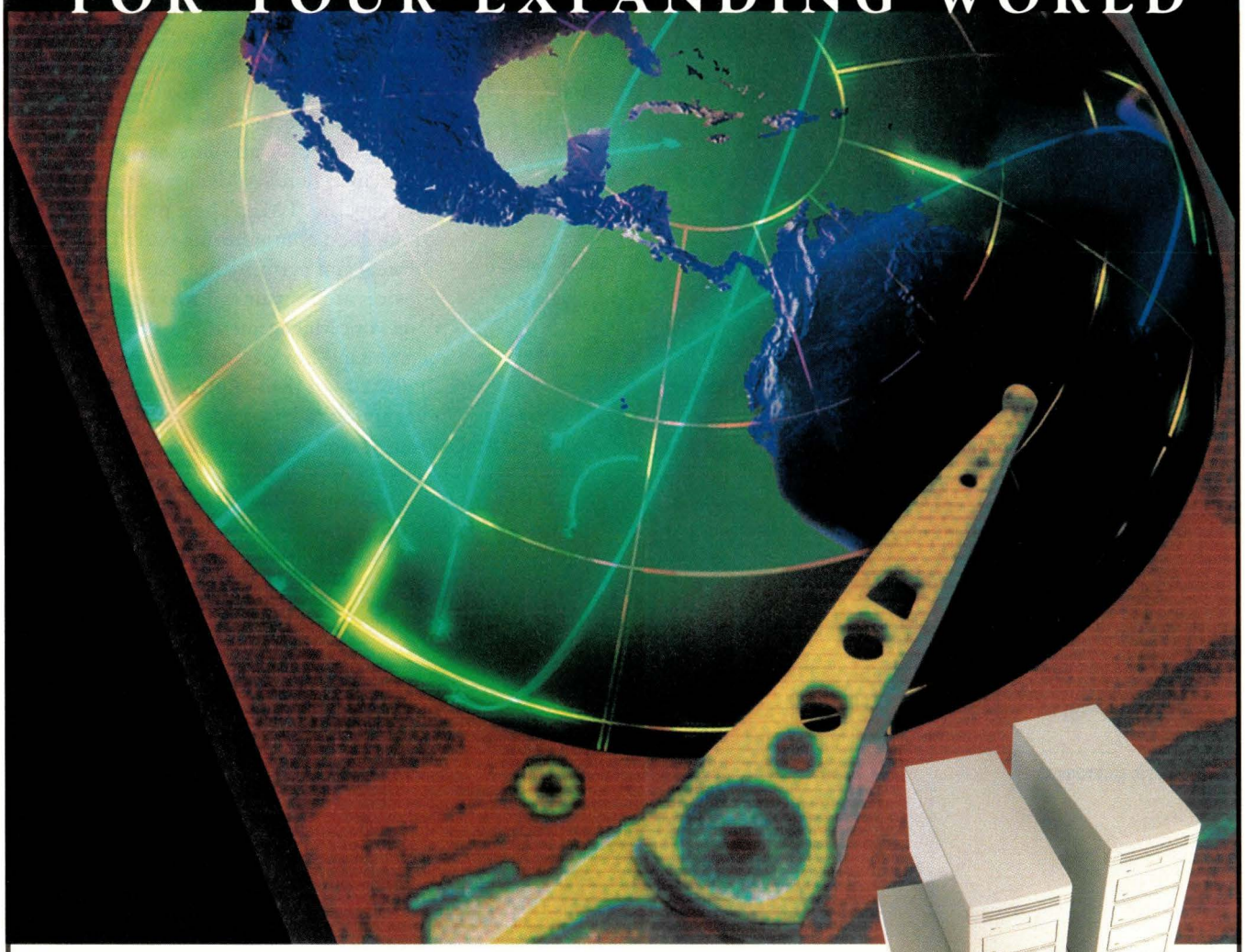

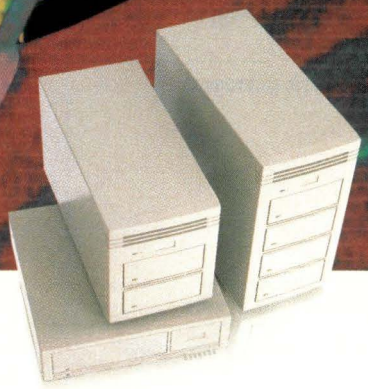

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is NASDAQ.COM, which runs on more than half a dozen quad-processor Compaq Computer Corp. and Dell Computer Corp. systems that handle the home page and quote engines, along with news and charting. Although the "main" NASDAQ databases are stored on UNIX, market news and historical data is transferred to the Internet using Microsoft SQL Server.

Sun has taken note of the trend toward NT Web servers, however, and is offering an extremely affordable "intranet in a box" five-user bundle of Solaris 2.6 for Intranets for $1,290.

**Sun has taken note of the trend toward NT Web servers and is offering an extremely affordable "intranet in a box" five-user bundle of Solaris 2.6 for Intranets.**

## Enterprise Tools Emerge

Until about a year ago, managing heterogeneous networks with multiple databases running under different operating systems was often painful and expensive. DBMS vendors supplied their customers with utilities and finally (following the lead of Microsoft with its easy-to-use Windows-based console for managing SQL Server) GUI consoles. But DBMS-supplied utilities weren't very good at managing applications based on DBMSs, so vendors such as BMC Software Inc. (Patrol) and Compuware Corp. (EcoSCOPE) moved in to fill the gap with specialized application monitoring tools.

*SunExpert* readers will realize that network and systems management tools have been dominated by UNIX-based platforms such as HP OpenView, IBM NetView and SystemView, Computer Associates International Inc. Unicenter, SunNet Manager and Tivoli Systems Inc. TME. These products are quite good at monitoring overall network devices and performance–especially if devices are instrumented to be Simple Network Management Protocol (SNMP)-compliant–but weren't developed to handle DBMSs and their applications. That's beginning to change, however, again, thanks to acquisitions. Tivoli is hard at work integrating recently acquired DBMS application monitor DBMX into TME 10, and HP is working to weave its UniPrise acquisition into HP OpenView.

**Table 2. Tools for Managing Heterogeneous, Distributed Networks**

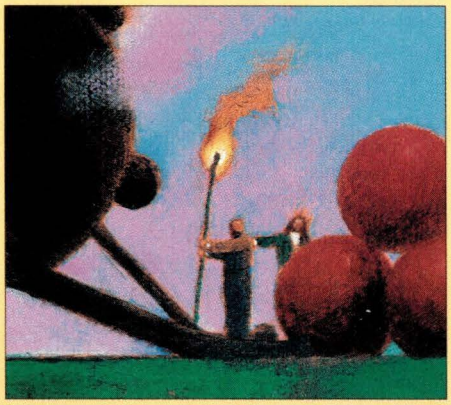
| Category | Representative Products | URL |
|---|---|---|
| Systems managers | Tivoli Management Environment (TME); Sterling SOLVE:Operations | http://www.tivoli.com, http://www.sterling.com |
| Network managers | HP OpenView; CiscoWorks; IBM NetView; Cabletron Spectrum; Bay Networks Optivity; Unisys NetWORKS; Sterling SOLVE:Netmaster | http://www.hp.com/go/openview, http://www.cisco.com, http://www.ibm.com, http://www.ctron.com, http://www.baynetworks.com, http://www.unisys.com, http://www.sterling.com |
| Network analyzers | Network General Sniffer | http://www.ngc.com |
| DBMS management tools | Platinum Enterprise DBA; SFI SQL Programmer; Embarcadero DB Artisan | http://www.platinum.com, http://www.sfi-software.com, http://www.embarcadero.com |
| Application and service level managers | Compuware EcoTOOLS; BMC Patrol; NetIQ AppManager; Platinum ProVision; Micromuse Netcool/SLR; Remedy Action Request System | http://www.compuware.com, http://www.bmc.com, http://www.netiq.com, http://www.platinum.com, http://www.micromuse.com, http://www.remedy.com |
| Manager of managers (MOM) | Boole & Babbage Command Post; Candle Command Center | http://www.boole.com, http://www.candle.com |
| LAN and NT network managers | Intel LANdesk; Microsoft SMS; Seagate Desktop Management Suite, ExecView and Nerve Center for NT; McAfee Saber LAN; Symantec (HP) Norton Administrator Suite; Bluecurve Dynameasure; Heroix RoboMon; NuView ManageX | http://www.intel.com, http://www.microsoft.com/sms, http://www.smg.seagatesoftware.com, http://www.mcafee.com, http://www.hp.com, http://www.bluecurve.com, http://www.heroix.com, http://www.nuview.com |

**Table 3. Enterprise Management Standards**

| Organization | IETF | DMTF/ DMI | DMTF/ CIM | Sun/ JavaSoft | OSI/ ISO x.700 | OMG/ CORBA | Ideal |
|---|---|---|---|---|---|---|---|
| **Protocol** | SNMP | RPC | Not defined, will probably use existing protocols. | RMI | CMIP | IIOP | IIOP |
| **Data model/ modeling language** | SMI | MIF | MOF | None* | GDMO | IDL | MOF |
| **Data store** | MIB | MIF | CIM schema | No standard yet | MIB | | CIM schema |
| **Management services (to manage objects)** | | | None | JMAPI | | OMA | Java |
| **Notes** | Trend from connectionless to connection-oriented. SNMPv3 may incorporate IT security. | Digital certificates may be used to provide security. Some implementations use MIF without using DMI. | CIM can accommodate and interoperate with other standards' instruments and stores. WBEM is an implementation of CIM. | *Will probably use CIM description for object schema. JMAPI, like WBEM, should be thought of as an interface standard rather than an implementation standard. | CMIP has effectively been replaced by SNMP. | Based on the CORBA object model. | |

**Key:**

CIM – Common Information Model
CMIP – Common Management Interchange Protocol
DMI – Desktop Management Information
DMTF – Desktop Management Task Force
GDMO – Guidelines for the Definition of Management Objects
IDL – Interface Definition Language
IETF – Internet Engineering Task Force
IIOP – Internet Inter-ORB Protocol
JMAPI – Java Management API
MIB – Management Information Protocol
MIF – Management Information Format
MOF – Management Object Format
OMA – Object Management Architecture
OMG/ CORBA – Object Management Group/ Common Object Request Broker Architecture
OSI/ ISO – Organization for Standard Interconnects/ International Standards Organization
RMI – Remote Management Interface
RPC – Remote Procedure Call
SMI – Structure of Management Information
SNMP – Simple Network Management Protocol
WBEM – Web-Based Enterprise Management



Still, managing distributed networks has never been a piece of cake, and even these high-end UNIX-based management systems pale in comparison with the rock-solid performance that mainframes offer. As one IT veteran observes, "With the mainframe, we schedule maintenance maybe once a year. With our UNIX systems, they may be down once a month. With NT, well…you don't want to know."

Tired of cobbling together point solutions (often euphemistically referred to as "best of breed"), customers started demanding single-console enterprise management solutions. The result, starting in early 1996, was a frenzy of merger and acquisition activity and a slew of strategic alignments. Computer Associates bought Cheyenne Software Inc. and acquired most of Digital's Polycenter. IBM bought Tivoli, which itself picked up DBMX and Digital's Polycenter Manager for NetView. Boole & Babbage Inc. acquired Maxm Systems Corp., Bay Networks Inc. acquired Xylogics Inc., Hewlett-Packard picked up the Norton line of network management tools from Symantec Corp., Ascend Communications Inc. acquired Cascade Communications Corp., and Cisco Systems Inc. bought StrataCom Inc., Netsys Technologies Inc. and a dozen other vendors. Thanks to acquisitions like these, traditional "network management" vendors added systems management functionality to their products, while systems management vendors enhanced their products not only with device-level monitoring associated with network managers, but also with application-level monitoring and service-level management.

The recent explosion of tools for monitoring and managing NT-centric networks and applications (see Table 2) has complicated the picture as dozens of vendors such as NuView Inc., NetIQ Corp. and Bluecurve Inc. have rushed to market with new products. But in addition to new tools for monitoring NT systems, existing management platforms that had only been available under UNIX have been ported to NT. Both Computer Associates Unicenter TNG and Tivoli TME 10, for example, have been completely ported to NT. That means users can manage heterogeneous networks from either a UNIX- or NT-based management console.

HP OpenView customers are still waiting for key operations and administration modules to be ported to NT, but the other OpenView modules, including HP Network Node Manager, are available on NT. As you might expect, Sun's Solstice Enterprise Manager, targeting data communications vendors and Fortune 1,000 commercial customers, doesn't run on NT and probably never will. Sun is also perceived as having lost momentum and leadership in the network management field. Ed Zander, president of Sun, acknowledges, "We didn't keep the kind of pace we should have. We still have work to do."

Does the proliferation of tools make managing heterogeneous networks any easier? In most cases, yes. But along with the increased automation have come increased demands, notably for Web-based management and service level agreement management.

## The Promise of Web-based Management

As you probably know, Web-based enterprise, network, system, application and database management is something that's attracting a lot of interest. Unfortunately, the Java

### Companies Mentioned in this Article

**Actuate Software Corp.**
999 Baker Way, Ste. 330
San Mateo, CA 94404
*http://www.actuate.com*
**Circle 150**

**Ascend Communications Inc.**
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Alameda, CA 94502
*http://www.ascend.com*
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**Baan Co.**
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Menlo Park, CA 94025
*http://www.baan.com*
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**IQ Software Corp.**
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6475 Christie Ave.
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**Tivoli Systems Inc.**
9442 Capital of Texas Hwy.
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Austin, TX 78759
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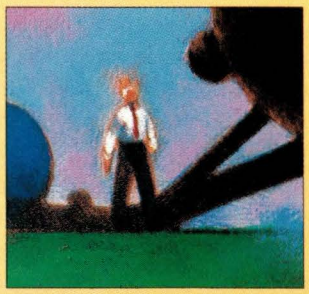

## UNIX and NT at the Bookstore

- *Integrating NT and UNIX*, Phil Lumish (1997, IDG Books, ISBN 0764531573, $49.99)
- *Migrating from UNIX to Windows NT*, Jack Tackett (1997, Ventana, ISBN 1566046904, $49.99)
- *NT and UNIX Intranet Secrets*, Sharon Crawford and Charlie Russel (1997, IDG Books, ISBN 0764530976, $49.99)
- *Porting UNIX Applications to Windows NT*, Andrew Lowe (1997, New Riders, ISBN 1578700043, $49.99)
- *Windows NT and UNIX Integration Guide*, David Gunter, Steven Burnett and Lola Gunter (1997, Osborne McGraw-Hill, ISBN 0078823951, $49.99)
- *Windows NT/95 for UNIX Professionals*, Donald Merusi (1997, Digital Press, ISBN 1555581811, $29.95)

Management API (JMAPI) is still evolving, and there are other existing initiatives and protocols that are also evolving toward Web support (see Table 3).

To some extent, Table 3 mixes apples and oranges (standards formulated by international standards organizations such as ISO and IETF with more parochial ones sponsored by Sun and Object Management Group), but it serves as a starting point for evaluating vendors' tools.

Many vendors seem to be heeding customers' requests for Java-enabled tools that let them perform the management function from a browser. Computer Associates, for example, announced at the IT Forum in September that it will begin beta testing a Java Web browser console, CA Unicenter TNG. Also at IT Forum, help desk vendor Remedy Corp. announced a Java client version of its Flashboards that allows customers to manage service levels.

## Service Level Agreements

Service level agreements (SLAs), which amount to a contract between IT and its internal customers or IT and its external network services providers, have been around for a long time, but they've recently begun to get an enormous amount of press. Part of this is because vendors see an opportunity to capitalize on the trend toward better monitoring of cost of ownership and fundamental quality of service. For database or decision support applications, an SLA might promise to deliver responses to certain types of queries within 10 seconds from the time the user presses the enter key, for example. SLAs may provide UNIX fans with ammunition for keeping applications on UNIX systems, but they can also represent a threat to internal IT: measure up or get outsourced.

## Interim Conclusion

How well UNIX and NT and their DBMSs coexist in a given organization will ultimately depend a lot on people like you who sponsor and build the applications. A case can be made for scenarios such as the ones outlined in this article, and good tools are emerging to help you manage your increasingly complex systems. It will behoove you to take heed of the important trends toward Web-based management and SLAs. Let us know your experiences.

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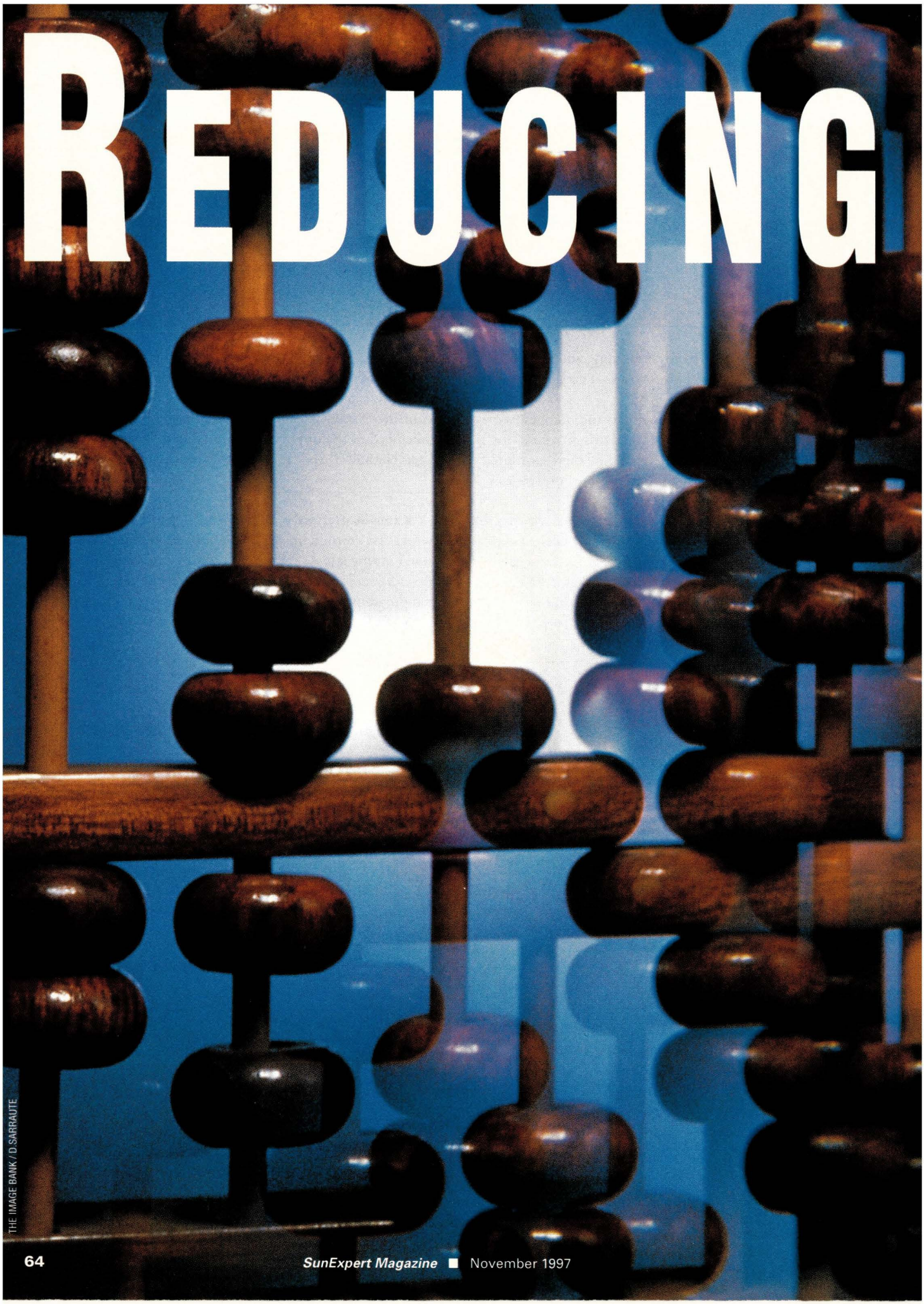

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# Your Network Costs

**Investigate requirements in advance and then reap the rewards of a carefully planned network.**

*by Allan Packer and Shanti Subramanyam*

The aphorism "the network is the computer," coined in the '80s by Sun Microsystems Inc., has finally come of age. Companies everywhere are scrambling to assess the impact of the Internet, intranets and the World Wide Web.

Yet even workloads with more mainstream appeal such as online transaction processing (OLTP) and decision support systems (DSS) can have significant network requirements. And they often prove difficult to quantify in advance.

Network bandwidth has an important bearing on application performance and, hence, user satisfaction. An understanding of the trade-offs in choosing a network strategy is vital to the success of application deployment. But it is equally crucial to anticipate the way application design and middleware will affect your network.

Let's pick an example. The client/server model of computing is now widely accepted. But what does client/server mean to you? If it conjures up visions of Powerbuilder applications running on PCs linked to a database server over a wide-area network, you'd better keep your checkbook handy next time your network supplier calls.

Typically, client/server in a database context implies applications sending SQL to the database server and receiving data back. This applies equally to Java applications or applets using JDBC, forms-based applications and COBOL applications using embedded SQL. Depending on the SQL statements, that could mean a lot of data. SQL queries auto-

matically generated by middleware may not be well optimized. And inquisitive users with powerful query software may not know, or care, how much data will be processed by their latest ad-hoc query.

If client/server makes you think instead of a large application server locally connected to a database server, with remote PCs or terminals merely acting as display devices, your network costs will probably be much lower. Here, the same SQL/data exchange may be taking place, but over a local-area network, which is usually much less expensive to implement.

## Understanding Your Workload

OLTP workloads are characterized by random data access and frequent updates. The transactions are designed to complete quickly, holding resources as briefly as possible. Typical applications range from airline reservations to inventory management. DSS applications are characterized by large numbers of sequential data reads and infrequent updates. Queries may consume prodigious resources and run for extended periods of time. Typical applications include financial forecasting and sales trend analysis.

In this article, we consider two different OLTP applications and calculate the network load for each. The first is a production forms-based application; the other uses a transaction monitor. Both rely on an application server networked to a database server over a LAN.

If you develop your database applications using a commercial forms package, then the sales rep probably waxed eloquent about reduced development time and usability benefits. How much was said about network costs, though? Forms software can make extravagant use of network resources compared with, say, transaction monitors. That may not matter in a LAN. But it could become significant over a WAN.

## An Experiment Using Live Data

What are the network costs per user when using a forms package? The following study was carried out using a popular financial application based on forms software. A production installation was used as the model (see Figure 1). Information about transaction throughput was gathered, and user data entry patterns observed. Finally, a remote terminal emulator was used to emulate typical users running applications against a copy of the live database. Think times were selected that replicated the throughput observed by real users.

**Figure 1. Hardware Configuration for Forms-Based Application**

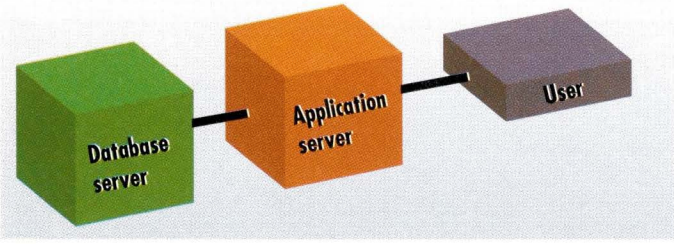



**Table 1. Transaction Type Packet Sizes**

| Transaction | Client->server (in bytes) | Server->client (in bytes) | KB/ transaction |
|---|---|---|---|
| Inquiry type 1 | 217 | 108 | 79.7 |
| Inquiry type 2 | 141 | 91 | 18.6 |
| Inquiry type 3 | 154 | 82 | 11.0 |
| Data entry type 1 | 186 | 88 | 76.4 |
| Data entry type 2 | 186 | 88 | 18.3 |
| Data entry type 3 | 275 | 112 | 48.7 |
| Report entry type 1 | 130 | 470 | 64.3 |
| Report entry type 2 | 117 | 124 | 53.8 |
| Report entry type 3 | 142 | 86 | 11.1 |

In order to measure the network requirements, the UNIX `snoop` utility was used on an Ethernet LAN to individually capture TCP packet statistics for each of nine transaction types, including inquiry, data entry and report submission. Once submitted, the reports were run on the server and did not generate network traffic.

Table 1 shows the average packet size (in bytes) for each transaction type, and the number of bytes required to complete a transaction.

Similar measurements were then taken under a 10-user load. Using the statistics for each transaction along with the number of transactions completed for each type, the expected number and size of packets was calculated and compared with the actual results. Having verified the method (the results were within 3%), it then seemed possible to predict the network load at any level of transaction volume.

## Answers Are Not Always What They Seem

Each user submitted 0.34 transactions per minute. The average data transmission rate for 10 users was 3.5 KB/s. Assuming an Ethernet segment (10 Mb/s) can sustain a practical maximum of 440 KB/s (35% loading), the observed rate suggested that a single Ethernet should be able to support more than 1,000 users.

Unfortunately, simplistic analyses like this usually end up with some kind of fundamental flaw. Experience showed that a sample of 300 users was more realistic using an average collision rate of 5% as a guide. So why the discrepancy? Primarily because, like any real workload, the traffic was bursty in nature. When several users were active concurrently, periods of intense packet activity lasting several seconds resulted. These were interspersed with relatively quiet periods.

Further investigation of the network traffic was carried out using a five-second moving average. The results showed considerable variation. Peaks of 25 KB/s were observed for 10 users. This corresponded to a peak load of 750 KB/s for 300 users–almost 60% utilization for Ethernet. One in 10 of the five-second moving averages showed traffic of 10 KB/s or more. On this basis, 300 users would consistently generate

**Figure 2. Five-Second Moving Average Packet Distribution for Forms-Based Application**

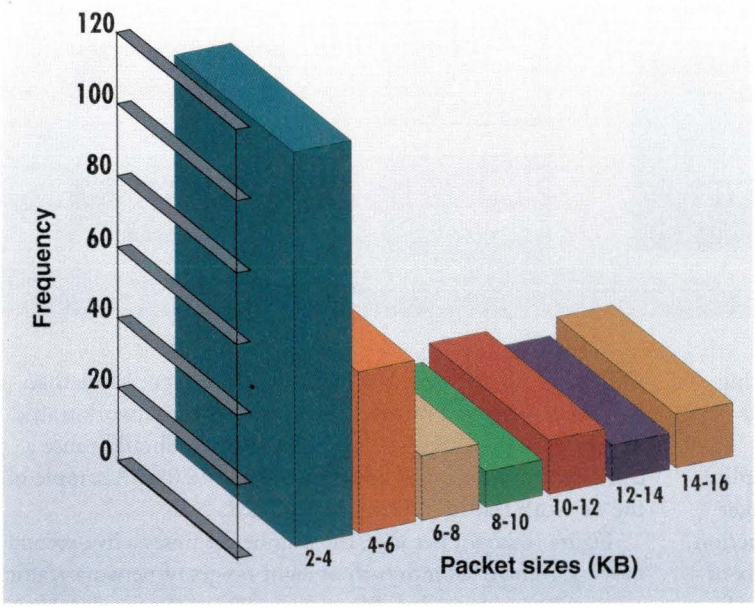
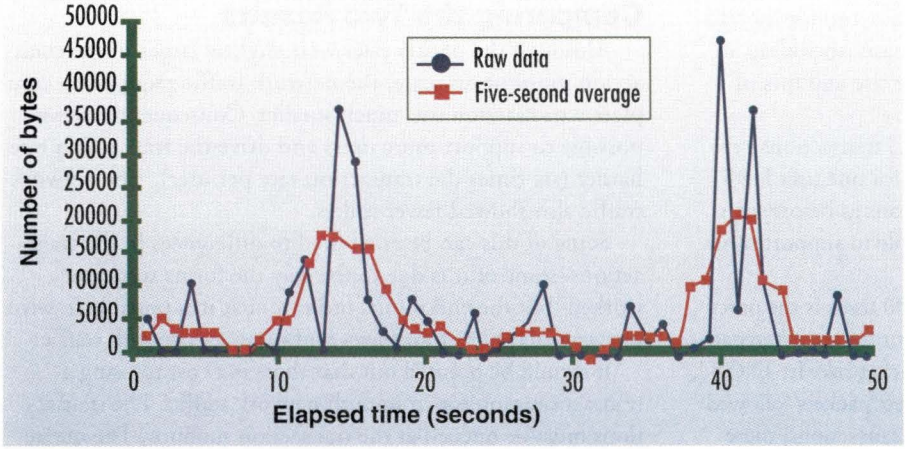



**Figure 3. Fifty-Second Network Traffic Snapshot for Forms-Based Application (10 users)**




a load exceeding 300 KB/s (24% Ethernet utilization). This was much more in keeping with observed behavior.

Figure 2 shows, per user, the number of times a five-second moving average fell into each of eight ranges of network traffic over a 60-minute period. For example, just over 100 of the five-second moving averages showed network traffic in the range of 2 KB to 4 KB. More than 80% of the moving averages showed less than 6 KB of traffic, but the remainder of the traffic was evenly spread over the other ranges.

For this application, the packets sent from the client system were typically larger than those returned by the server. The average client packet size was around 200 bytes, compared with around 100 bytes from the server. The actual packets varied quite a lot in size. Most of the server packets were 50 to 150 bytes in length, whereas 40% of the client packets were 300 to 500 bytes long, and another 30% were small (50 bytes or less). Figure 3 shows the bursty nature of the network traffic for 10 users.

This exercise highlights some of the difficulties associated with predicting network utilization. Allowances must be made for peaks and troughs in network usage. In this case, the peak load exceeded the average load by a factor of seven, and the moving average 90th percentile load exceeded the average by a factor of almost three.

Fortunately, there are a number of ways to reduce network load. All major database products, including those from Oracle Corp., Sybase Inc., Informix Software Inc., Progress Software Corp., IBM Corp.'s DB2 and others, support the use of Stored Procedures. These are commonly repeated sequences of user SQL that are stored within the database engine. When called, only the results for the whole sequence are returned. This generates significantly less network traffic than would be the case for executing each SQL statement individually.

An alternative is to use transaction monitors, such as BEA Systems Inc.'s Tuxedo, NCR Corp.'s TopEnd and Transarc Corp.'s Encina. Transaction monitors offer several ways of reducing network traffic.

A transaction monitor can be used as a multiplexer. Instead of users directly connecting to the database server, they connect to the transaction monitor. It queues requests for database server access and passes them to one or more user-written processes that directly connect to the database server. These processes carry out the interaction with the database server on behalf of the users. Data is then passed back to the transaction monitor, which in turn forwards it to the relevant user.

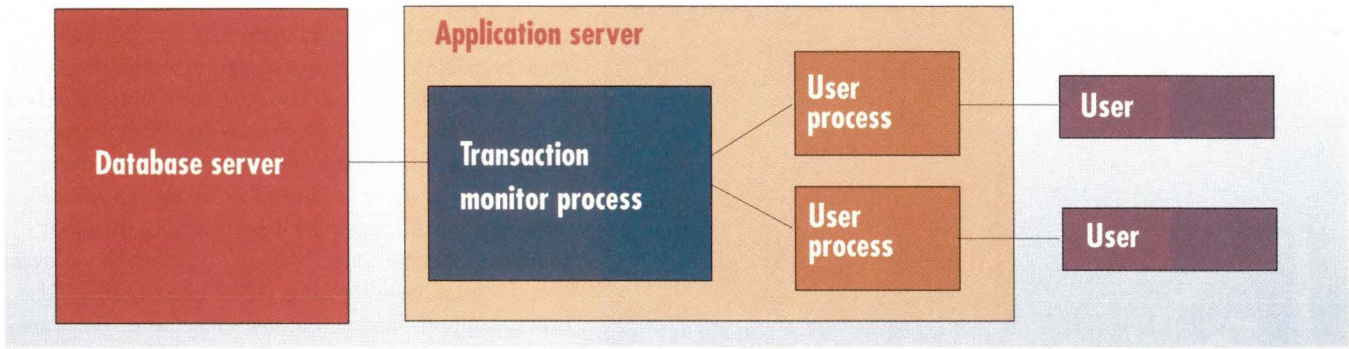
This approach has two benefits. First, it reduces the number of direct connections to the database server–that means less contention for server resources and, hence, better performance. Second, it smooths out the peaks and troughs in network usage, resulting in a more consistent network load.

## Case Study Using a Transaction Monitor

The second application we looked at was an implementation of TPC-C, a standard benchmark from the Transaction Processing Performance Council, which is the de facto standard measure of OLTP performance. The application represents a company with geographically distributed warehouses and districts. Customers call the company to place a new order or request the status of an existing order. This application is also used to enter payments from customers, process orders for delivery and examine stock levels to identify supply shortages. A typical client/server implementation is depicted in Figure 4.

Users run the TPC-C application from their workstations. When a transaction is submitted, it is routed through a transaction monitor to an application that connects to the DBMS

**Figure 4. Typical Client/Server Configuration**




server. The transaction monitor acts as a multiplexer, servicing many client processes. Thus, the actual number of network/database connections is far fewer than the number of users.

A similar analysis as was done for the forms-based application was done for the transaction monitor. Network packet information was first collected for each of the five transaction types individually. A full TPC-C run with the proper mix of transactions was then carried out. Knowing the number of transactions that completed, the expected number and size of packets was calculated and verified against the packet statistics actually observed.

Table 2 shows the average packet size (in bytes) for the various transaction types on a per transaction basis, including an "average" TPC-C transaction (based on the size and mix of each type of transaction).

Because each user performs 2.66 TPC-C transactions per minute, the average data transmission rate for one user is 95 bytes per second. Using the same assumptions as before, this suggests that a single Ethernet should be able to support more than 4,000 users.

However, our experience shows that 1,400 users is the practical limit. Variations in packet activity account for the discrepancy in predictions based purely on average packet size. In TPC-C, the new order transaction generates the largest packets followed by order status. Due to the random mix of transactions, there are periods when higher percentages of these transactions are clustered together, causing greater network activity.

Computing the five-second moving average, we found peaks of more than 20 KB/s for 100 users. This corresponds to a peak load of 280 KB/s for 1,400 users–22% Ethernet utilization. In this case, the load was more even. More than half the five-second moving averages showed network traffic of greater than 10 KB/s. Hence, 1,400 users should cause a consistent utilization of between 10% and 20%. A sample of the network traffic is shown in Figure 5.

Figure 6 shows, per user, the number of times a five-second moving average fell into each of eight ranges of network traffic over a 60-minute period. More than 60% of the moving averages showed between 8 KB and 12 KB of traffic, and more than 90% were between 6 KB and 14 KB.

**Table 2. Transaction Type Packet Sizes**

| Transaction | Client->server (in bytes) | Server->client (in bytes) | KB/transaction |
|---|---|---|---|
| New order | 181 | 296 | 3.8 |
| Payment | 134 | 219 | 1.2 |
| Order status | 219 | 406 | 1.7 |
| Delivery | 71 | 95 | 0.3 |
| Stock level | 47 | 90 | 0.3 |
| TPC-C | 167 | 264 | 2.1 |

## Comparing the Two Results

Although the packet sizes were slightly larger in the transaction monitor test case, the network traffic required to complete a transaction was much smaller. Consequently, it was possible to support more users and drive the transaction rate harder (six times the transaction rate per user). The network traffic also showed fewer spikes.

Some of this can be attributed to differences in the transactions–some of it is due to the way the forms software worked–but the end results indicate that it is possible to write software that both minimizes and balances network traffic.

It should be pointed out that there is a cost to using a transaction monitor to smooth network traffic: The transactions must be queued at the transaction monitor. The queue time will depend on the number of users queuing concurrently and the network bandwidth as well as the time taken to process the transaction at the server.

A transaction monitor can also be used as a sophisticated message handler. Instead of sending SQL and receiving data, messages are sent containing the information necessary to carry out each type of database access. As a simple example, instead of an SQL statement such as `select customer_name from customer_table where customer_id = 12345`, a message containing a message type and the customer ID could be sent, with the transaction monitor managing the network connections transparently.

This approach allows messages to be designed that contain no more data than is actually necessary to complete a transaction. Substantial savings in network requirements can be achieved in this way, perhaps at the cost of some flexibility.

## What's the Catch?

As any cynic will tell you, there's no such thing as a free lunch. Popular commercial forms software tends not to have simple hooks into transaction monitors. So you may find yourself forced to choose between them. The reduced development costs associated with forms software could compensate for the additional ongoing network costs, however, especially if WANs are not involved.

OLTP workloads usually involve a large number of users carrying out many relatively small SQL statements, which in turn each give rise to a small number of disk accesses. By contrast, decision support workloads tend to be query-intensive and access a large amount of data via a small number of SQL statements. Both can consume a lot of CPU and disk bandwidth. But they have very different network requirements.

Because OLTP typically gives rise to many SQL statements, the network is a key component for client/server implementations. Decision support usage, however, involves little network traffic during the execution of a query. Network requirements will largely depend on the amount of data displayed by the query. It is possible to have a query that consumes vast amounts of CPU and disk I/O and yet returns a tiny amount of data. For example, "Of the stock items bought every month by our top 20 customers, which is the most profitable?" might require scanning large amounts of data but would only return a single result.

Conversely, a query might require little processing yet generate large amounts of data. An example might be, "Which items are currently stocked in warehouse 1?"

Although network traffic may often be insignificant for decision support applications, there are exceptions. An example is the case where query tools depend on large amounts of data first flowing from the server to an intermediate system or even directly to the desktop for processing.

When planning a network, transaction throughput is not always a good guide to network requirements. A detailed understanding of the kind of transactions the network will be expected to support is crucial.

Ethernet, for so long the workhorse of local-area networks, has given way to Fast Ethernet, increasing the bandwidth from 10 to 100 Mb/s. Having upgraded a network from Ethernet to Fast Ethernet, it was a relief to see the collision rate drop from 25% to less than 3%. Fast Ethernet (100BaseT) is fully compatible with standard Ethernet. The two can coexist and exchange data transparently. And both can be used over inexpensive twisted-pair cables.

Many companies, however, could not afford to wait for Fast Ethernet and implemented LANs using the more expensive FDDI instead. Users are continually confronted by this kind of trade-off in the rapidly changing world of network technology. Even Fast Ethernet is now being superseded by Gigabit Ethernet. Can I afford to ignore the latest and greatest? Should I anticipate new standards or wait to see which of them fall by the wayside? Where should I be on the technology curve–implement now, or wait until costs come down as the technology matures?

**Figure 5. Fifty-Second Network Traffic Snapshot for Transaction Monitor Application (100 users)**

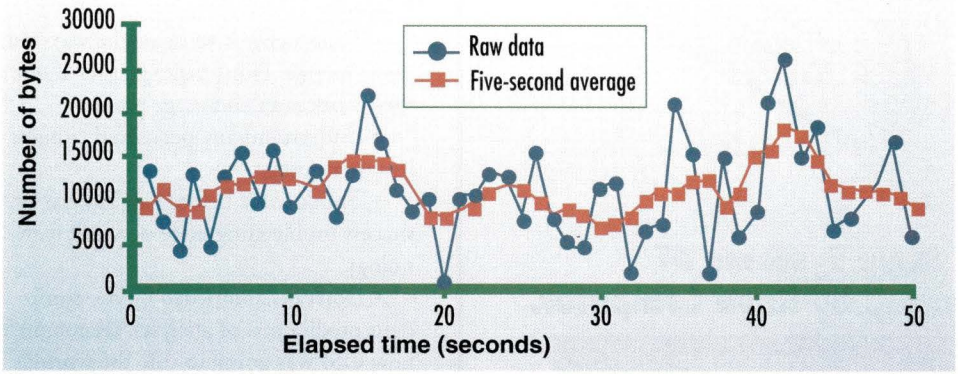
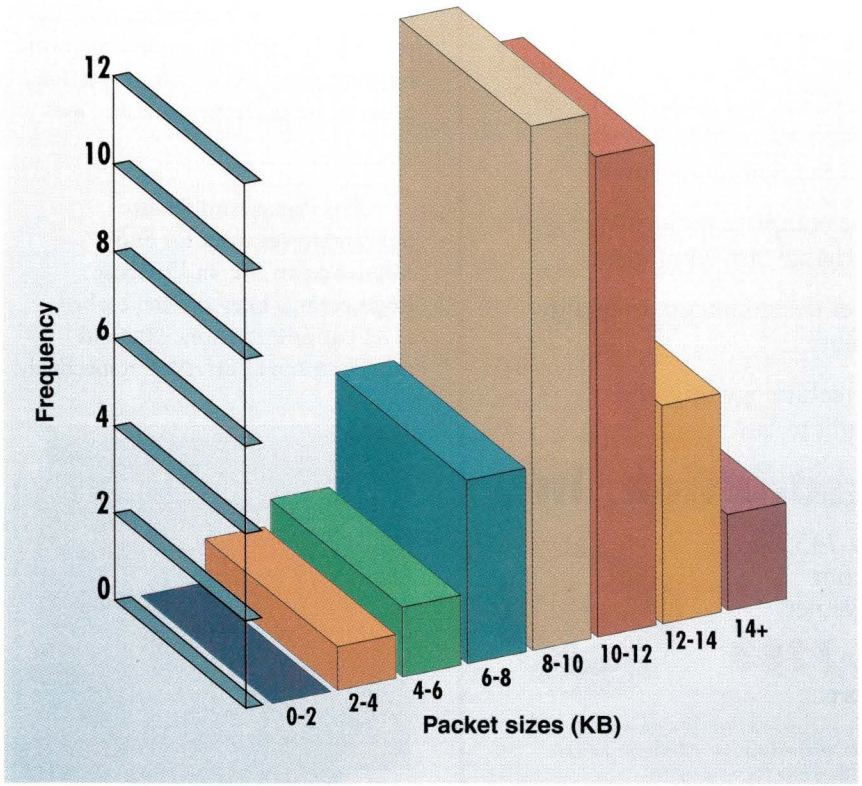



**Figure 6. Five-Second Moving Average Packet Distribution for Transaction Monitor Application**



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ATM is a good example of an emerging standard offering high bandwidth over a WAN. Costs are still relatively high. If you can afford to wait, you may be glad later.

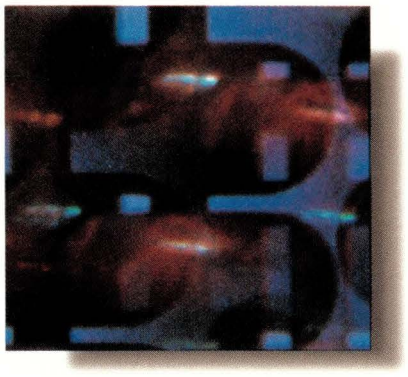
### Preparing for the Unexpected

The best way to plan a network with the lowest risk is to carry out a pilot study. If you it do well enough on a small scale, you should find it possible to extrapolate for a larger number of users. Here's a few tips:

- Use real applications and the target network technology rather than approximations.
- Thoroughly investigate the way your users operate. Don't make guesses about their work rates and usage profiles.
- Understand any peaks and troughs in system usage.
- Think twice before gambling your success on bleeding-edge network technology.
- Don't be stampeded by the confident predictions of analysts. (Remember how OSI was going to rule the world?)
- Don't be restricted by conventional wisdom if presented with a more effective and efficient strategy.

Accurately anticipating network requirements is a demanding task. The payback of a carefully planned network, however, can make the effort of a thorough investigation worthwhile. ➸

**Allan Packer** and **Shanti Subramanyam** work for Sun Microsystems Inc. in Database Engineering. They can be reached at `allanp@Eng.Sun.COM` and `shanti@Eng.Sun.COM`, respectively.



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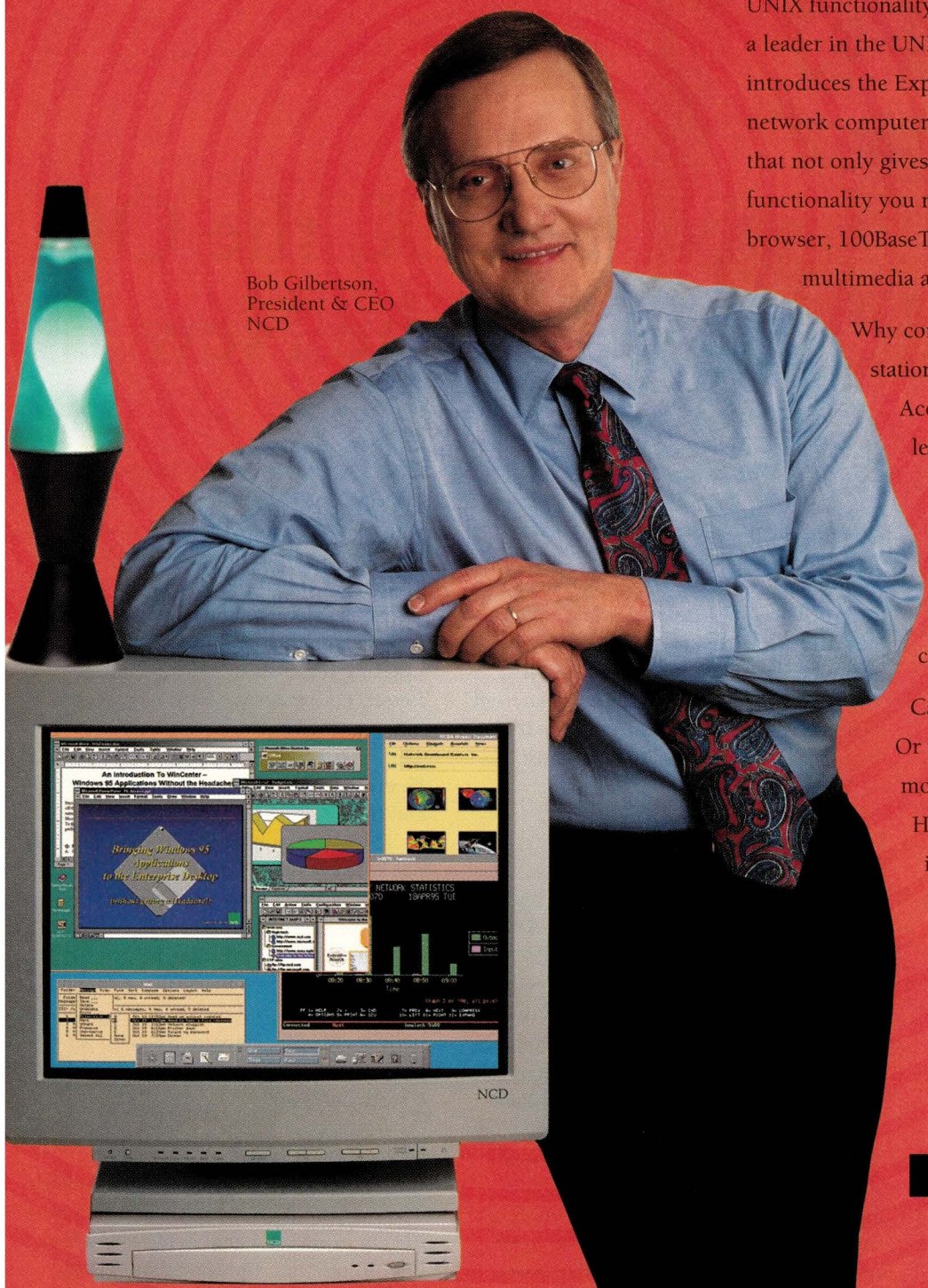


Bob Gilbertson,
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**Circle No. 57**

# Q&AIX

by Jim Fox

# LaTeX, the Old and the New

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

**Q:** We have many manuals formatted with LaTeX, the old version. Some of them can be processed with the new LaTeX (LaTeX2e) and some cannot, even though LaTeX2e is supposed to be compatible with the old LaTeX. Can the new LaTeX be fixed to handle all of our manuals? Should we attempt to convert them to LaTeX2e, or would we be better off converting to another formatter? Are there tools available to do these conversions? AA

Myron Mendelson
Acova Digital Inc.

**A:** The answers to your questions are no, yes, no and no. Let's review the history of TeX to see why LaTeX2e was necessary–and why you should use it–and why another formatter would be a lesser formatter.

For many years, TeX (pronounced like "tech") and LaTeX, a macro package for TeX, have been the standard of computerized text processing in academia and research laboratories. TeX is in the public domain, therefore free. It typesets mathematics better than all other text formatters; it works with non-English languages; and it produces publishing-quality documents. TeX not only runs on every common computer system–mainframes, workstations, PCs, Windows, DOS, NT and Macintoshes–but it runs exactly the same on all those machines. You can proof your documents using your 300-dpi laser printer and send the TeX source to a real typesetter for publishing.

You "program" a TeX document by inserting commands in the document source. For instance, `\begin{chapter}` indicates the beginning of a new chapter. The "command" `$` starts a math equation. Figure 1 shows an example of TeX input and the resultant output.

This programming paradigm is definitely not WYSIWYG (what you see is what you get), but it does give you power and portability not found in other word processors. You'll get automatic floating figures and tables, mathematics, the ability to write in other languages, and the ability to generate indices and bibliographies. You also get to use your favorite text editor on whatever system you're on.

## Why LaTeX2e?

TeX has something of a split personality. The program itself, `tex`, has not been modified in many years and, in fact, its author, Don Knuth, has stipulated that nobody

A *wizard's apprentice*
AA *super user*
AAA *wizard*

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## TODAY'S NEWS...


- Aspen Finalist in Ernst & Young Entrepreneur of the Year Award PG 2
- IBM®RS/6000™ Is Chess Champion PG 2
- Data Protection Available from ADSM PG 3
- Aspen Offers High Availability Benefits with HACMP PG 5
- Detroit is Newest Aspen Office PG 5


## IBM®AIX® 3.2.x Users Need to Upgrade to 4.x

By Bill Stevens

After December 31, 1997, IBM will no longer support older AIX versions 3.2.x. According to Stephan Moen, Vice-President of Information Technology, Aspen is ready to upgrade all AIX 3.2.x users to the latest version of AIX 4.x. "This is just one of the many system integration services that Aspen offers," commented Moen.

As the system integrator to the AIX user community, Aspen Consulting is a full service firm handling all aspects of the RS/6000 and AIX. Aspen consultants are experts working with IBM RS/6000™SP™, Storage Systems, HACMP, Tivoli®,

SEE UPGRADE, PAGE 5

# Martian Pathfinder Mission A Success

## *IBM® RS/6000™ Capabilities Make It All Possible*

By Linda Smith
DAILY TIMES NEWS SERVICE

This month's proper soft landing on develop- captured th and testing. It would no rol, AIX the comput municate the IBM RS ace-dust technology ss beam on board th hnology Pathfinder. metime

The new ,000 IBM budget, usi 00's are in off the shelf in over businesses h 00 com- Developed f l and tech- in less than customers the vehicle v AIX, the to carry cam UNIX the Sojourne operating meteorologic environ- communicate computer back to earth er. The withstand tak mission landing on un e up to deploy its scie 0 IBM direct the expe commer- the mission to stomers using AIX, the closest in comp IX based operating system. The computer

The flight is based on a vers IBM's RS/6000 technology and the first commercially based processor to travel into deep space. Since software development was critical to the success of the mission, using known and successful technology was key to saving money and time to allow

SEE PATHFINDER, BACK PAGE


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**Figure 1. TeX Input and Output**

```
\(n! \approx \sqrt{2\pi n}\left({n\over e}\right)^n\)
```

⇓

$$n! \approx \sqrt{2\pi n}\left(\frac{n}{e}\right)^n$$

shall ever make any changes. It is very reliable and stable. However, the macro packages that customize TeX and give it a particular look and feel–LaTeX is one–have changed substantially in recent years.

The problem was the uncontrolled proliferation of these macro packages. Each was somewhat useful but generally incompatible with the others. For example, if you wanted to make slides, you might use SLITeX. If you sent something to the American Mathematical Society, you had to use AMSTeX, or LAMSTeX. If you wanted to use different fonts, you were really out of luck because none of the packages allowed easy control over font selection.

Out of this confusion, LaTeX2e was born. (It is partway to LaTeX3, which is the actual project, thus the odd name, *LaTeX two epsilon*.) With LaTeX2e, all macro packages work together. Fonts are easy to control–including PostScript fonts–and there are many more formatting tools that make life easier. It is a much cleaner and more convenient system. Nowadays, the name LaTeX refers only to the new version.

For the new system, the LaTeX macros had to be completely rewritten. Anticipating your own conversion troubles, the authors of new LaTeX built in a *compatibility mode* that was supposed to handle documents written in old LaTeX. It does–as long as your documents or local macro packages haven't made any changes to the internal LaTeX macros. I'll guess you've probably done just that, and that's why you're having problems now.

You have two choices for your manuals: Keep an old version of LaTeX around just to format the old documents, or migrate them all to the new LaTeX2e format. Even if the former option works for now, it will become more and more restrictive as the documents are revised. It ought not be your permanent solution.

The difficulty of migrating your documents to LaTeX2e is directly dependent upon the extent of those nonstandard changes to the macros. I suspect you'll find many of your local modifications no longer necessary; others you'll find easier to implement. I know of no tools to do this conversion for you, but for the most part this is an easy task. Sometimes, you only have to convert the first line from `documentstyle` to `documentclass`. The different beginning is a cue that you want to use the new macros.

## Getting TeX Stuff

If you don't yet have a good copy of the new LaTeX, or if you'd like to get the latest macro packages, here are some key places to check:

- **TeX Users Group** – Many TeX-related products and services, including books and classes, are available through the TeX Users Group. Contact by phone (209) 561-0112, by fax (209) 561-4584 or by email `tug-office@mail.tug.org`.
- **TeX newsgroup** – The TeX newsgroup, `comp.text.tex`, is active, and you're sure to find answers to all your questions there.
- **CTAN sites** – Sources for TeX and all the macros, associated tools and support programs are available from several Comprehensive TeX Archive Network (CTAN) sites around the world. The mother of all these is the archive in England. It can be reached in a variety of ways:

| | |
|---|---|
| **ftp** | `ftp.tex.ac.uk/tex-archive` |
| **gopher** | `gopher.tex.ac.uk` |
| **NFS** | `nfs.tex.ac.uk:/public/ctan/tex-archive` |
| **http** | `www.tex.ac.uk` |
| **Email** | `ctan-uk@tex.ac.uk` |

The Web site, including the CTAN archive, is searchable.

If you decide to get the whole distribution, it builds quite easily. Read the `README`s, run `configure` and run `make`. The defaults are pretty good. You want to build at least `tex` and `latex`, the program and principal macros; `dvips`, used to make PostScript output, and `xdvi`, to show output to an X terminal.

---

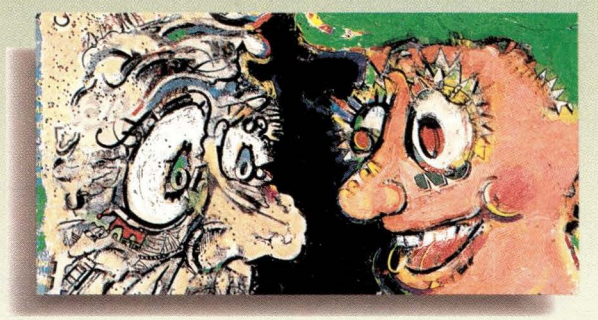
If I have to come up with a flyer for the PTA, I might revert to something with a manual and easy, if inefficient, interface like Word-for-Windows, but if I'm helping someone format a book or a doctoral thesis, I'll reach for the new, improved LaTeX every time. ⊸

## LaTeX Sources

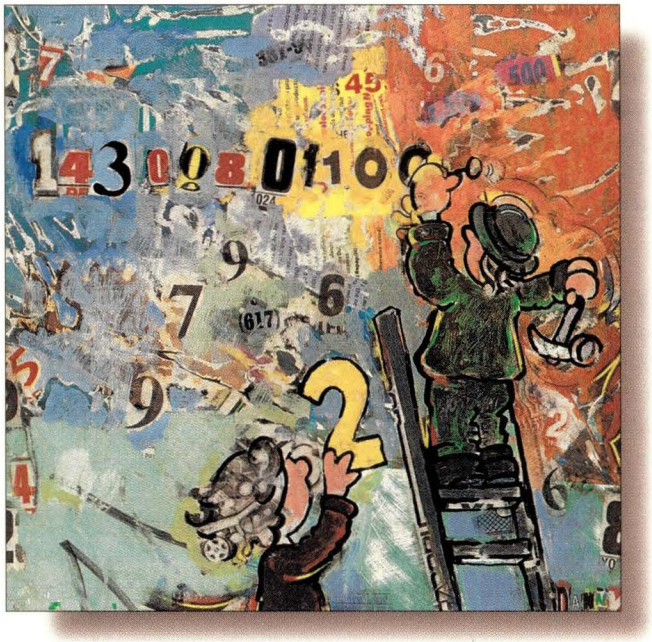
Here are a couple of books to help make your move to the new LaTeX a little easier:

- *LaTeX, 2nd Edition,* Leslie Lamport, Addison-Wesley, 1994, ISBN 0-201-52983-1.
- *The LaTeX Companion,* Michel Goossens, Frank Mittelbach and Alexander Samarin, Addison-Wesley, 1993, ISBN 0-201-54199-8.

The *LaTeX Companion* assumes you have read and understood Lamport's introductory book, so both books are necessary.



by John S. Quarterman



# Renumbering

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

For many years, I've recommended that people avoid renumbering IP networks. That is, avoid having to change the Internet Protocol addresses for your hosts, servers and routers.

## How to Avoid Renumbering

In the old days (before around 1994), I'd recommend registering a network number and sticking to that number. This was to counter a common tendency for companies to just pick a number and use it internally regardless of whether it was in use elsewhere. For example, Sun Microsystems shipped machines still configured for its own internal company IP network number, and lots of customers didn't bother to change it. Companies could get away with this because many of them had internal IP networks (which are now trendily called intranets) that were not connected to the Internet. As soon as they connected, however, they had to renumber.

More recently, I've recommended using one of the network numbers that are reserved for internal use, such as net 10 (the old ARPANET Class A network number). Users inside the company can still reach the Internet through the use of proxy servers for popular services such as the World Wide Web. However, outside crackers can't even see the internal structure of the company's intranet, and they have a hard time getting through a properly constructed firewall gateway. The firewall itself has to have an IP host number on a publicly registered network, but it's only a single machine or a small cluster of machines on a secure subnet, so if renumbering is needed, only those few machines have to change. Machines on the internal network know the proxy servers by interface addresses on the internal network, so they are not subject to renumbering.

The appearance of network numbers reserved for internal private use was driven by a need to conserve IP address space, which is fast being used up. Address space actually isn't the most pressing conservation issue: routing table entries are. To conserve routing table entries, a typical Internet service provider (ISP) these days prefers to route only customer IP addresses that are drawn from blocks of addresses registered to that ISP. Thus, the wide-area IP carriers can handle routing to the ISPs, letting the ISPs handle routing to their customers, and everybody's routing tables are kept small. A practical consequence of this technique is that a customer who changes ISPs usually

has to change IP addresses. That's the main current cause of IP address renumbering.

After years of recommending that everyone should avoid renumbering, it's ironic that now Matrix Information and Directory Services Inc. (MIDS) has to renumber. Basically, we're splitting Texas Internet Consulting (TIC) and MIDS, which are two companies that have used the same network number with the domains `tic.com` and `mids.org`, into separate IP networks. We're also switching IP connection methods at the same time. The result is a need to renumber. I took notes as we did it, as a case study in the process of renumbering. This particular case was a bit more complicated than simple renumbering, because we also changed the domain names of some hosts. I'll note where that made a difference.

Here are some of the most essential steps. They are phrased in terms of UNIX systems. The precise filenames to change vary from one UNIX variant to another, but the general filename types are the same.

## Static Host Addresses

In these days of dynamic lookup of IP addresses for domain names through the Domain Name System (DNS), you might think there aren't any static maps left to modify. For most hosts, that is the case. But for the local host, there is still the matter of bootstrapping. The operating system has to set up its local interfaces and at least some routing before it can start using DNS. So renumbering means changing some static addresses:

- `/etc/nodename` – This is apparently System V convention for the name of the local host if there is no network interface. If you didn't change your domain name, you can leave this one alone.
- `/etc/hostname.le0` – This is a common convention for a network address hostname. If you didn't change your domain name, you can leave this one alone. The location and name of this file tend to vary. For example, under Red Hat Linux, it's `/etc/sysconfig/network-scripts/ifcfg-eth0`.
- `/etc/hosts` – This file contains host-to-IP address mappings. You need to change the IP address for the local machine's hostname.
- `/etc/defaultroute` – This file determines the default route for reaching machines outside the local network. You will almost certainly need to change it. I suppose you could have this file use a symbolic name that you define in `/etc/hosts`, but there's not much benefit in doing that. This information may be elsewhere; for example, under Red Hat Linux it's the `GATEWAY` parameter in `/etc/sysconfig/network`.

## Domain Name System

DNS is essential for Internet access and often for internal intranet access:

- `/etc/resolv.conf` – This file determines where the local machine will look for DNS nameservers. The IP addresses in it need to be updated.
- `/etc/named.boot` – If the local machine is running a nameserver, you may need to change this file to determine where that nameserver looks for DNS information about the local domain. This is particularly necessary if the local machine is running a caching nameserver, which is usually a good idea.
- `/var/named` – The `/etc/named.boot` file says where the rest of the DNS parameter files are. Usually, they are in a directory such as `/var/named`. If the local host's nameserver is doing more than caching, that is, if it is acting as a primary server for the local domain, you will need to update the IP addresses for hosts on the affected network.

## Network Information Service

DNS isn't the only popular network name service protocol. Many local networks use a protocol invented by Sun, originally called YP and now called NIS, for Network Information Service:

- `/etc/defaultdomain` – If you're simply changing your IP addresses, you do not need to change this file, which specifies the NIS domain. Even if you're changing your DNS domain, you don't have to change this file, because the NIS domain and the DNS domain are two different things. You only need to change this file if you are changing the NIS domain. Of course, because it is typical for the NIS domain to be set to the same text string as the DNS domain, usually if you change the DNS domain you do in fact change the NIS domain and, thus, this file as well.
- `/var/yp/bindings` – Even if you do not change the NIS domain, you will need to change the IP addresses of the NIS domain nameservers, which are found in a directory such as `/var/yp/bindings`. You will need to use commands such as these to do so:

```
ypinit -c
ypinit -m
```

The exact commands and syntax vary with the version of NIS and the UNIX platform, so further details are left to the reader.

## Applications

You can't do much of anything on the new network number until you have adjusted the static host files, DNS and NIS, as above. Once you've done that, you can proceed to applications. Or, if you're brave, you can change the application parameter files at the same time. And if you're only renumbering and not changing your domain name, you may not have to change many application parameter files.

## Network File System

If you're using the Network File System (NFS), you probably won't need to change much because NFS normally uses domain names, not IP addresses, in its parameter files. Of course, if you are also changing your domain name, you will need to change the files that control the exporting and importing of DNS file systems. Most systems administrators know where those files are, usually something like `/etc/fstab` or `/etc/vfstab` for import, and `/etc/exports` or `/etc/dfs/dfstab` for export.

A slightly more obscure case involves a mixture of NIS and NFS:

- `/var/yp/mapinput/auto.direct` – If you're using automount file systems, you will need to change this file if you have changed domain names.
- `/var/yp/mapinput/netgroup` – If you're using netgroups and you have changed domain names, you will also need to change this file.

It's common to export groups of directories to netgroups of clients, which is one case where NIS and NFS mix. Or you may need to change one or the other file separately. In both cases, you will need to do `yppush` or the equivalent.

## Electronic Mail

Electronic mail is still the most widely used network application protocol above the file system level and outside the workgroup.

- **Server** – If you're only changing IP addresses, you probably won't have to change any electronic mail parameters, depending on your setup. But if you're changing your domain name, you will need to change some mail parameters. If you are running `sendmail`, the likely files are `/etc/sendmail.cf` and `/etc/aliases`.
- **Client** – Even if you are not changing your domain name, you may have your `sendmail` set up to forward mail to another server, which may have changed if you've changed ISPs. The file for `sendmail` is `/etc/sendmail.cf`. Each mail user agent also has its own parameter file, for example, `/util/mh/mtstailor` for MH. This is a good argument for running your own local mail server.

## Authentication

- **rlogin** – If you've changed domain names and you want `rlogin` and `rsh` to work, you will probably need to change `/etc/hosts.equiv`, and each user may need to change their own `$HOME/.rhosts` file.
- **tcpd** – If you've changed your domain name, you will need to update `/etc/hosts.allow` and `/etc/hosts.deny` for `tcpd`, or TCP Wrappers.
- **ssh** – If you're using `ssh`, the Secure Shell, you will need to update some things even if you've only changed IP addresses. The main item is `/etc/ssh_host_key`. This is usually done with something like the following one-line command:

```
sudo ssh-keygen -b 1024 -f
   /etc/ssh_host_key -N ''
```

Each user may have to fiddle with their own `$HOME/.shosts` and `$HOME/.ssh/` files. To regenerate a personal `ssh` key, use `ssh-keygen` with no arguments.

Your print servers may also require a little tweaking. The System V print server, for example, often has IP addresses wired in in too many places, which may include `/etc/lp/Systems` and `/etc/lp/printers/*/configuration`. If the print servers are using DNS symbolic names such as `printserver.domain`, you will need to update the IP addresses for those names in `/var/named` or the equivalent.

## What's Left?

If you've changed domain names, remember that `tcsh` may have hostnames wired into `/etc/csh.cshrc`, and the various Bourne shell lookalikes may have the same in `/etc/.profile`. Even if you change all the above files, don't be surprised if there's some further gotcha that I haven't mentioned. It's not uncommon for application protocols to wire in IP addresses for efficiency. If you're running a USENET news server, for example, such servers often do a hostname-to-IP address lookup when they start up, so you'll need to tell the news server to reinitialize itself.

Most organizations have some Macintoshes or IBM-compatible PCs. These will all need their local IP addresses, DNS server addresses and default routes changed. A UNIX column is not the place to go into detail about that, however.

Renumbering is a tedious task. If you also have to change some domain names, it's even more tedious. In general, it is a good idea to try rebooting after changing all the likely parameters. You want each system stable enough that it will come back up correctly after a power failure or other reboot. The only way to tell for sure is to try it.

All this renumbering tedium is a good argument for using a proxy gateway and one of the private IP network numbers internally. That would avoid most causes of renumbering. But if you do have to renumber, we've just reviewed the major points that are involved. ➸

Circle No. 36

by Jim DeRoest

# Millennium Madness

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

I find it hard to believe that there is anyone left out there who isn't aware of the Year 2000 problem closing in on most of the world's information processing shops. Articles on Year 2000 issues (just like this one) are rampant. Conferences, consulting firms and Web pages are springing up everywhere. There are even magazines and books dedicated to the topic. What I find easy to believe is that there are many of us who haven't seriously begun formulating plans to address the problem. Even with all the publicity, there are going to be many sites caught off guard when the bell tolls midnight December 31, 1999.

Many of us in the UNIX world have given the problem only a moment of our attention. Year 2000 catastrophes are only going to hit those giant glass house enterprises. You know, the ones with all the dusty deck COBOL programs and big iron operating systems. We UNIX geeks can sit back and rest on our laurels until 2038, right? More about what 2038 means to UNIX later. Maybe you're thinking you can skirt most of these problems because you're running the latest hardware and software that has been stamped as Year 2000 compliant. You don't internetwork or trade data with other sites, and you don't have any legacy data sets hiding in your file systems. But are you willing to bet your business or your job on it? You might be doing just that!

## How Did We Get Here?

How many times a day do you jot down "97" when you really mean "1997"? We've all become far too comfortable using two digits to represent a year. The forms you fill out and checks you write often require only a two-digit year. Back in the days of punched 80-column Hollerith cards, it made good business sense to save a few cards by compressing dates into as small a space as possible. Unfortunately, these old applications have lived on far beyond their intended design specifications. The fascinating part is that with all the attention directed at scaling issues in computing, something as simple as this is still lurking in many of our operating system and application designs.

For years, we've been crunching, trading and storing data based on a two-digit year format. We've used two-digit dates to sort, hash, Julian (pun intended), compare and check intervals in a wide array of applications and subsystems–all to save a few key-

strokes and a couple of bytes of storage space. This is where the problem really begins to get ugly. Assuming we can find and fix all of the software bugs in the time we have left, all of this legacy data will likely be around to haunt us for decades to come.

The problem gets even uglier. Consider the time-based interactions that take place in the highly heterogeneous, automated networked environment we live and work in. A few misbehaving PCs with outdated BIOSs can easily compromise network synchronization and transaction time stamps. On January 1, 2000, environmental systems with embedded time processes will begin locking doors, turning off lights and heat all because they're confused as to what day it is. Automated aging checks might begin expiring things such as passwords and backups. Suddenly, that dump you did on the morning of January 1, 2000, turns out to be 100 years old. Just think of all the incrementals required to fully restore a 100-year-old dump!

## UNIX and the Year 2038

It turns out that most UNIX systems will span the millennium change without many glitches showing up. This is because most of the time handling within the operating system is based on the UNIX Epoch 00:00:00 January 1, 1970 UTC (Universal Time Coordinate). Time is calculated as the number of seconds since the Epoch and is stored as a 32-bit integer type `time_t`. Other structures, such as `tm` and `timeval`, break this number down into microseconds, seconds, minutes, hours, days, months and years along with associated time zones. Most commands and applications are pretty safe as long as they use kernel and library routines to manipulate time data. The gotcha is that as a 32-bit integer, this value will roll over in the year 2038. Just increase it to 64 bits, right? No problem. Let the vendors fix it. I'll retire before 2038 anyway!

Unfortunately, many of us have code that manipulates time values without using standard library calls. There are also exceptions that crop up in some of the older commands. For example, some implementations of the UNIX `date` command only accept a two-digit year when setting system time. Ouch! Take a look at Table 1 to see if the UNIX version you're running has been certified Year 2000-compliant by its vendor. Note that this is information I've gleaned from the vendor's Web pages. I advise you to verify the information by visiting those pages or contacting the vendor directly (see Table 2).

**Table 1. UNIX Vendor Compliance**

| | |
|---|---|
| **IBM AIX** | Versions 4.2.x and 4.1.5 are compliant. Fixes are available for 3.2.5 and other 4.1.x releases. |
| **Digital UNIX** | Version 4.0D is compliant. Fixes are available for previous releases. |
| **HP-UX** | Updates for 10.x available since February 1997. 9.x users must upgrade to 10.x. |
| **SCO UNIX** | See Web site for required fixes per version and release. |
| **Sun** | Solaris 2.6 is compliant. See Web site for version details. |

## Legalities

What's your next move? Are you going to start fixing the software, rewrite or replace subsystems, or sit back and do nothing? Before you decide on the latter, consider that there are legal ramifications for ignoring the problem. These may include penalties, lawsuits and liabilities for corporate officers. Federal Securities Laws and State Fiduciary Duty Laws define the concept of "due diligence." The bottom line here is that those responsible for the well-being of the business and its interests must exercise due care in carrying out its functions.

Your company could be liable, if by ignoring Year 2000 issues you were unable to make payrolls, issue invoices, pay taxes or meet inventory commitments. These requirements are especially true for regulated businesses. You might incur civil claims due to errors in personnel data that are covered by the Data Protection Act of 1984. If you would like to learn more about your legal responsibilities regarding Year 2000 issues, I recommend taking a look at some of the articles listed on the Year 2000 Information Center home page (see Table 2).

## Plan of Attack

Now that I've convinced you to look into the problem to protect your "assets," where do you begin? To meet legal obligations, you will need to formulate and carry out a Year 2000-compliance plan. Build a paper trail to assist in auditing and formally documenting the process. Remember, you're going to have to do this while continuing to run a day-to-day operation. If it appears that you will need help, consider obtaining outside assistance.

First, make someone responsible for formulating a plan and directing the project. Survey the hardware, software and infrastructure that are critical to your operation–this should include information and resources that you share with other sites. Make an inventory of the available tools and information that may assist you in meeting your goals. For example, Digital Equipment Corp. (DEC) is including a tool called y2ksniff in its 4.0D release of Digital UNIX that can audit time relationships in software.

Armed with support information and tools, begin to audit your subsystems to determine if they are compliant. For problem subsystems, estimate the scope of the problem and what it will take to make them compliant. This should include a test suite for validating fixes once they have been installed. There are a number of test suite recommendations available on the Web pages listed in Table 2. Once you have determined the extent of the work that must be completed, make certain that you leave yourself plenty of room for testing. Most analysts

have adopted December 31, 1998, as a deadline so as to leave sufficient time for testing once you have implemented what you believe to be a compliant environment.

## UNIX Tips

IBM Corp., DEC and Sun Microsystems Inc. have some excellent tips on addressing Year 2000 issues. For example, you might implement a date partitioning algorithm that assumes a leading date value of "19" for years in the range "69" to "99" and "20" for years "00" through "68." Note that there is a one-year variance to support time zone offsets because the UNIX Epoch is based on UTC. This algorithm is Open Group UNIX98 compliant and is implemented in Digital UNIX 4.0D.

As suggested earlier, make sure that locally developed software uses system and library routines such as `time()`, `ctime()` and `localtime()` when manipulating time values. A common coding technique is to use the `tm` structure variable `tm_year` to represent the significant two digits of the year. The value of `tm_year` is the number of years since 1900 and will reach the value of 100 in the year 2000. A quick fix here would be to add the value `1900` before using `tm_year`. You'll find a number of suggestions like these on the Web pages listed in Table 2. I'd also recommend checking the various `comp.unix` newsgroups for information specific to particular vendor architectures.

## Create a Test System

It's going to be difficult to adequately test updates on your production system. Create a test system that is representative of your environment. Isolate this system from your network so as not to compromise any time-synchronized transactions. Make a backup copy of your test system before proceeding–this will allow you to restore the default environment to facilitate testing multiple application configurations. Also, make certain that any time modifications will not invalidate software licenses that are critical for the test. You will want to check all the boundary dates and times involved to evaluate how the system will react as time advances across a given boundary. Remember that 2000 is also a leap year, so include those dates in your test set. Sample dates should include:

Midnight 12/31/1998
Midnight 12/31/1999
Midnight 12/31/2000

Midnight 02/28/2000
Midnight 02/29/2000
Midnight 03/01/2000

When performing each test, first reboot the system into single-user mode. Set the system time to just before the boundary condition. Mount the file systems to update super block time stamps. Now, start the subsystems you will be testing.

The time for musing about the possible problems and consequences over a beer after work is long past. You've only got a couple of years left to audit and fix thousands of lines of code. Everybody's got a favorite cost estimate for the time and effort it's going to take to fix the problem. You know best what impact it will have on your company. Let's just say, it could be large. Very large. The clock's ticking. It's time to get to work. ⊸

### Table 2. Year 2000 References

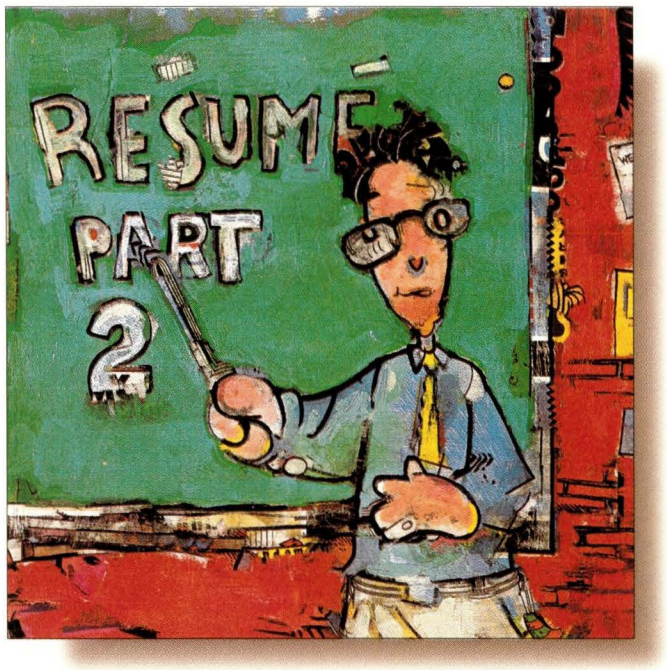
**Vendors**

| | |
|---|---|
| IBM Corp. | `http://www.software.hosting.ibm.com/year2000/#1` |
| | `http://www.ibm.com/IBM/year2000/` |
| Digital Equipment Corp. | `http://www.software.digital.com/year2000/` |
| Hewlett-Packard Co. | `http://www.hp.com/gsy/year2000/index.html` |
| The Santa Cruz Operation Inc. | `http://www.sco.com/technology/y2k/` |
| Sun Microsystems Inc. | `http://www.sun.com/y2000/index.html` |
| Microsoft Corp. | `http://www.microsoft.com/CIO/year.asp` |
| | `http://www.microsoft.com/msoffice/officenews/960916/year2000.htm` |
| Apple Computer Inc. | `http://www.devworld.apple.com/dev/technotes/tn/tn1049.html` |

**General Help Sites**

| | |
|---|---|
| The Year 2000 Information Center | `http://www.year2000.com` |
| Washington State Year 2000 Information Resource Center | `http://www.wa.gov/dis/2000/y2000.htm` |
| Minnesota Year 2000 Information Clearinghouse | `http://www.state.mn.us/ebranch/admin/ipo/2000/2000.html` |
| Florida State Y2K Task Force | `http://mail.irm.state.fl.us/yr2kvend.html` |
| Year 2000 FAQs | `http://www.usbr.gov/y2k/faq/y2kfaqi.htm` |

by Jeffreys Copeland and Haemer




# Your Résumé, Part 2

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Last month, we started developing a `troff` macro package for résumés. We left off just as we were getting to the definitions of useful fancy text strings. We also promised the setup for a Web version of the résumé, by (ab)using `nroff` to generate HTML output.

## Fancy Strings and Setup

The last set of definitions we need in the macros are for some strings we'll use, which we provide in separate `troff` and `nroff` renditions. We start with the name of a popular typesetting system, TeX.

```
.\" set up some fancy strings
.ie t .ds TX T\h'-.1667m'\v'.25m'E\
\v'-.25m'\h'-.125m'X
.el   .ds TX TeX
```

Then, the name of the font generation tool that goes with it. We explicitly set this in Helvetica: We would normally set it in the TeX `manfnt`, but this is the closest font that we're guaranteed to have.

```
.ie t .ds MF \fH\s-1METAFONT\s0\fP
.el   .ds MF METAFONT
```

We use small caps when we can, to match Adobe's practice.

```
.ie t .ds Ps P\s-2OST\s0S\s-2CRIPT\s0
.el   .ds Ps PostScript
```

Then, the name of a company where we used to work, again rendered to match the practice at that company.

```
.ds IN \s-1INTERACTIVE\s0
```

Last, we make special strings for the names of our favorite typesetting tools because we'll be using them a lot.

```
.ds Nr \f2nroff\fP
.ds Tr \f2troff\fP
```

The very last thing in the macro package is setup for the actual page size, tab stops and the like:

```
.ll 7i
.lt 7i
.ev 1
.ll 7i
.lt 7i
.ev
.if t .po .75i
.if n .po 5m
```

We begin by setting up the page and title length in both the main and page heading environment. We set the page offset to center the text on the page, or, in nroff, to give us a left margin. We define a string for the tab character, which we're sure to need. We can use hard tabs in running text, but it's convenient to be able to see them. Because we can't use troff's.\t character in text, this string makes the tabs visible:

```
.ds T \t
```

We begin with a ragged right margin, no hyphenation and 4½ lines (that is, 54 points) down the page.

```
.na
.nh
.sp |4.5v
```

Because of the typical font load in a PostScript printer, we make the type slightly bigger and leave a little extra space between the words. (These lines used to be enclosed in an if directive that checked the printer name, available in troff in the .T string, but we found that, in practice, we only used PostScript printers.)

```
.\" the following 3 lines are
.\"   setup for PostScript printers
.ps 11
.vs 12.375p
.ss 15
```

We want to use the tilde for unbreakable spaces, and we set up the tab stops based on the point size we use.

```
.tr ~
.ta 1.1i*\n(.su/10u +.5i +.5i +.5i +.5i
```

If we've set the H number register, we want to produce the HTML version of the résumé, and we invoke an addendum to the macros in the file html.mac:

```
.if n .if \nH .so html.mac
.if t .if \nH .ab ^G^G^G============== \
can't do html in troff!!!!
```

OK, we could have defined the main résumé macros in a way that included the HTML stuff in parallel using ifs, but it's cleaner and makes for easier reading to just supplement the original definitions with a separate macro file.

## The HTML Version

We'll discuss the special-case HTML macros before we discuss the text of the résumé, because there are some odd things in the text required for the multiple output versions. What we're doing here is using a formatter to generate input for another formatter: We're taking our résumé source and pushing it through nroff to generate HTML, which will be formatted by the interpreter in a browser. Because HTML gets formatted on the fly based on the size of the window into which it's being displayed, and because we only have limited formatting directives, some of the elements of our very fancy troff version will be lost.

```
.\" reset the page offset
.po 0
```

The only special setup we need for the HTML version is to reset the page offset. This isn't strictly necessary, but it makes the HTML easier to read and debug. However, we must have

```
.\" font change macros
.de i
<I>\\$1</I>
..
.de b
<B>\\$1</B>
..
.de c
.br
.ie \w@\\$3@ <A HREF="\\$3">
.el <A HREF="\\$1">
.br
<TT>\\$1</TT></A>\\$2
..
```

These override the font-change macros we built in the typesetting version. Notice that we're allowing a third argument to the c macro. In general, we use Courier in the résumé for references to addresses, for example, our email address, or as a pointer to a personal Web page.

This third argument allows us to add an active link in the HTML version. For example,

```
.c jsh@usenix.org ";" mailto:jsh@usenix.org
```

will generate the HTML

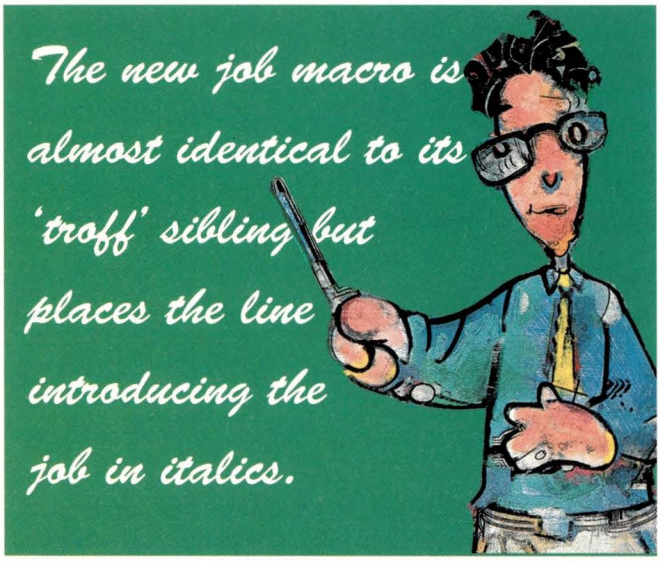
```
<A HREF="mailto:jsh@usenix.org">
<TT>jsh@usenix.org</TT></A>;
```

We also need some macros for paragraphs:

```
.\" html versions of paragraphing
.de BR
<BR>
..
.de PP
<BR>
..
.de IP \" indented paragraph
<BR>    
..
.de HP \" hanging paragraph
<P>
..
```

We add the BR macro, which will be ignored when we generate

the troff version–except that it will generate a warning message from groff. We'll use BR between lines in centered text, because HTML won't let us center a block paragraph. The other paragraph macros are pretty simple translations, except that IP uses the nonbreaking space character,  , which may not be recognized by all browsers. David Siegel (http://www.dsiegel.com) recommends using GIF files containing white space of a specified width as a workaround for this.




Our HTML-generating rendition of the bullet list macros makes an interesting study. In our résumé, we use three levels of list, and each item is tagged with one of the list item macros. For troff output, each one of those macros begins by doing a hard set of the indent and outputting the tag.

In the HTML version, we use the native HTML unordered list construct to generate the outline. However, as in the troff mm macros, we need to bracket the unordered lists with a begin/end directive pair. For HTML, these are <UL> and </UL>.

We invent an internal list end macro, LE, which keeps track of how many levels deep we are in the list (with the LT number register), and outputs an appropriate number of <UL>'s and </UL>'s when we change levels in the outline.

```
.\" special nested bullet lists
.de BU \" bullet list item for summary
.LE 1
<LI>
..
.de DA \" dashed list item for summary
.LE 2
<LI>
..
.de SB \" item line for summary
.LE 3
<LI>
..
.de LE \" list begin/end
.nr *d \\$1-\\n(LT
.if \\n(*d=-1 </UL>
.if \\n(*d=-2 </UL></UL>
.if \\n(*d=2 <UL><UL>
.if \\n(*d=1 <UL>
.nr LT \\$1
..
```

## HTML Pages and Sections

We also need to override some of the page breaking macros and directives we have relied on in the troff version:

```
.\" page break handling
.rm BP
.de bp
..
```

We totally remove the top-of-page handling–actually, this is a redundant exercise because HTML is generated by nroff, for which we've set the page length to one line, so the top of page handling is never done. We also override the native nroff page-break directive, bp, because we don't need to do real page breaks when we're formatting for HTML.

We also need HTML output versions of the main structural elements of the résumé.

```
.\" resume structural markup
.de SC \" begin section
<HR><FONT SIZE=+1><I>\\$1</I></FONT><BR>
..
```

A section is marked by a horizontal rule, and an italic label in a slightly larger point size.

```
.de NJ \" new job
.tr #-
<P>
<I> [[\\$1]]
.if \w@\\$2@ \\$2.
.ie \w@\\$4@ \\$3, \\$4:</I>
.el \\$3:</I>
.tr --
..
```

The new job macro is almost identical to its troff sibling but places the line introducing the job in italics. It does not rely on tab stops or other setup; it merely drops the arguments given to NJ into the output in order.

We should have a special version of the top-of-first-page title block with our name and address information:

```
.de PH \" 1st page title block
<HTML>
<TITLE>\\*(Jf's Resume</TITLE>
<BODY>
<CENTER>
<FONT SIZE=+1>
<B><I>\\*(JF</I></B>
```

```
</FONT>
.BR
\\*(A1
.BR
\\*(A2
.BR
\\*(A3
.BR
.c \\*(J@ mailto:\\*(J@
</CENTER>
..
```

We also need to override the troff three-part title directive, because its output would be meaningless when the HTML is (re)formatted by the browser. We just enclose its arguments in an HTML comment, though we could also ignore them.

```
.\" replace the nroff tl directive
.de tl
<! -- \\$1 -->
..
```

In the troff version, we had an end macro that generated a page footer on the last page containing the date we printed the résumé. Here, we'll add it in small type at the bottom of the HTML output. But more important, we have to close the HTML body:

```
.\" html resume end macro
.de EM
<P><FONT SIZE=1>(\\*(PD)</FONT><P>
</BODY></HTML>
..
```

Whew! That covers two different versions of the macros, which support some major differences in their output with only minor differences in the text we input. Now it's time to look at that text.

## The Résumé Text

We begin the text with the string definitions for name and address we talked about earlier:

```
.ds JF \s+2J\s0EFFREY \s+2L C\s0OPELAND
.ds Jf Jeffrey L Copeland
.ds J@ copeland@alumni.caltech.edu
.ds A1 1085 Albion Road
.ds A2 Boulder, Colorado 80303
.ds A3 303-499-8924
```

Notice that we've got two versions of the full name: one with small caps, one with lowercase. We'll immediately turn around and invoke the first page header macro:

```
.PH
```

We can proceed from there with the executive summary:

```
.\"  summary
.sp .66i
.in 1i
.in +3m
```

We've dropped two-thirds of an inch down the page before beginning the summary list itself. As we discussed earlier, we'll assume some base left margin indent, which we've also set up. From there, we can start dropping in bullet items:

```
.BU
Technical skills:
.DA
Very experienced UNIX/C developer
.SB
Developer of systems and applications software
.....
.BU
Good communications skills
.DA
Monthly columnist for
.i SunExpert
magazine
```

At the end of our bullet list, we need to close out the unordered list in the HTML output, reset that page offset and set up the résumé proper: In the nroff version, we draw a line; in troff, we start a new page; and in HTML, we rely on the first subsection header to draw a horizontal rule.

```
.if \nH .LE 0
.in 0
.if t .bp
.if n .if !\nH \l'\n(.lu'
```

In the case of troff only, we need to do some fancy setup at the top of the page:

```
.if t \{\
.sp -2v
.ce 1
\*(JC
.sp .3v
.if !\nA .tl |\s10\*(A1, \*(A2|\
|\fC\*(J@\f1, \*(A3\s0|
\l'\n(.lu'
.\}
```

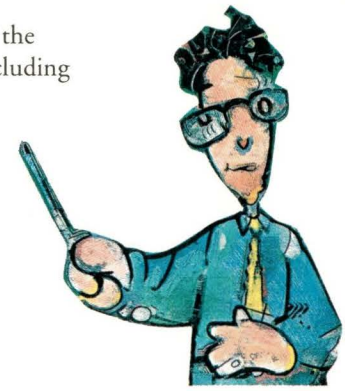
We begin by going back two lines, because the top of page macro has dropped us too far down the page–this probably means that our top-of-page processing isn't sufficiently general. After centering our name, we reiterate our addresses, physical, electronic and telephonic; though we can ask for those to be omitted by turning on the A number register. Last, we draw a horizontal rule.

At this point–nearly at the end of this second column on the subject–we can begin supplying text to the résumé.

```
.SC Objective
.HP
A job as the Chief Executive Officer
of a Fortune 500 company,
like Disney, AT&T, or Apple,
that will supply me with a
megabuck severance package.
```

Of course, we'd also like to supply some information about the jobs we've had:

```
.SC Experience
.NJ "11/94#8/97" \
 "Senior Member of the Technical Staff" \
 "QMS, Inc" "Boulder, Colorado"
.PP
.MG
Interim manager of languages group,
from December 1995 to August 1996.
.IP
.VE
QMS's representative to the Printer
Working Group,
a printer industry consortium
and standards-making body.
See PWG web pages, at
.c http://www.pwg.org/.
```



Notice that we've used a couple of the tricks we outlined above: We're including a paragraph about management responsibility only in the management version of the résumé. We're also allowing a pointer to an external Web page from our HTML version.

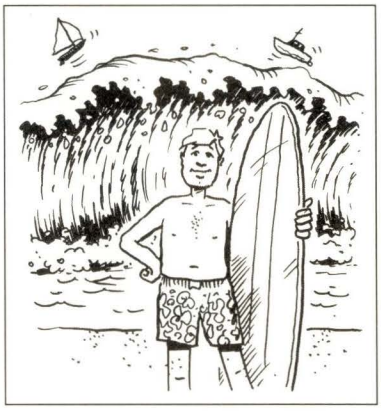
We could go on in the same vein for a while, but you've seen the basic structure and how to use it. If you're interested in seeing a full résumé using these macros, we've included an example with the software bundle for this column.

## Now, Go Get a Job!

That's it. You've got the basic tools to produce a fancy résumé in several different forms. The macro package, along with all the software we write for this column, is available at `http://alumni.caltech.edu/~copeland/work.html`. Use it in good health. We'd love to hear from you if you think of improvements to these macros.

Until next month, happy trails. ⊸


Internet and IT Costs Rising?



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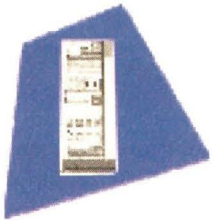

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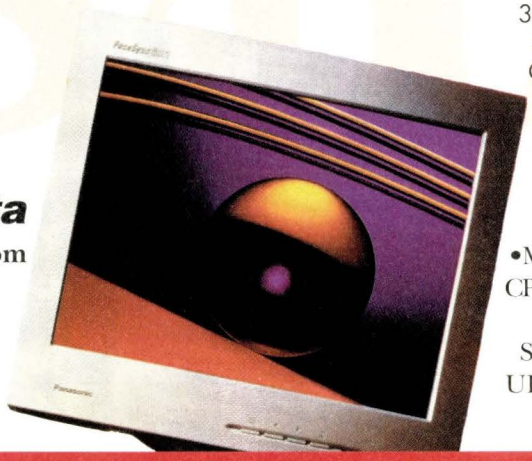

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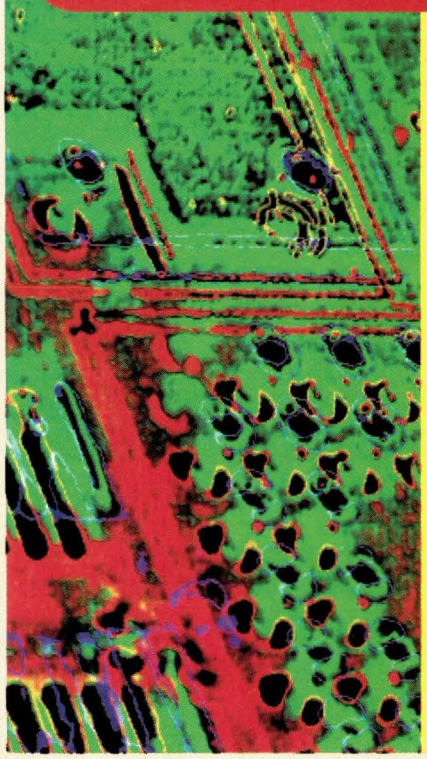

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# NEW PRODUCTS

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

## Tool to Integrate Old, New Apps

Technology Advancement Group (TAG), a newly formed division of Pro\ Sim Corp., has introduced TAGtools, which is designed to help systems administrators and developers integrate and support a mixture of old and new applications. TAGtools is said to replace the PinQuick (PQ) Toolkit but continues to provide the same capabilities with new performance and usability enhancements.

Maturing UNIX text applications can be merged with new graphical ones using a uniform user interface, the company says. In addition, TAGtools can execute in both graphical (X Window) and text modes simultaneously, depending on available terminal equipment. TAGtools is implemented in, and comes with a copy of the Tcl/Tk scripting language.

Developers can use a component of TAGtools, called TAGbuilders, that offers bar menus and forms for use with interactive applications. Also, TAGbuilders comes with menus that drive applications developed with TAGtools, Tcl/Tk or most other languages, the company says.

Several utilities come with TAGtools, including a disk utility, which is designed to scan directory trees for large files and directories; administrative tools, which offer windowing access to the `ps`, `kill` and `crontab` commands; Personal Archiver, for creating and restoring archives on tape or disk; Email, which is a demonstration program; Printer, a System V Line Printer front end; UNIX Commands, which makes file directory manipulations more windows-like; UNIX Help, a form for accessing UNIX man pages; and PathFinder, a visual tool to set the path to a file.

TAGtools is available for most UNIX variants, including Solaris, AIX, HP-UX and SCO UNIX. Pricing starts at $595.

**Technology Advancement Group**
800 W. Sam Houston Pkwy. S.
Ste. 101
Houston, TX 77042
*http://prosim.com*
**Circle 101**

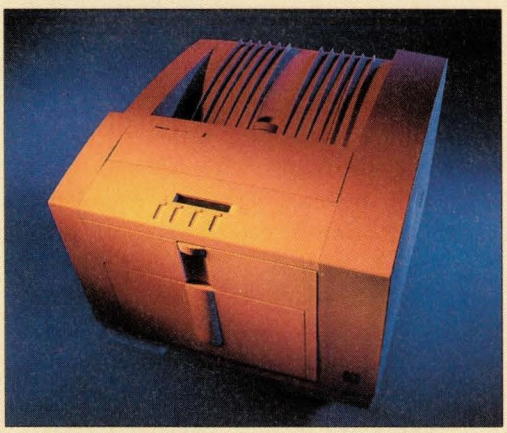
## Island Suite Web-Enabled

Island Software has announced that Version 6.0 of its Island Productivity Suite has been Web-enabled. The Island Productivity Series Version 6.0 is an integrated desktop publishing and multimedia design suite that includes word processing, raster graphics editing and presentation features, spreadsheets, text retrieval and screen customization, the company says.

Some of the Web-related features include a URL Access to Documents feature, which is said to give users the ability to access Web sites and import documents directly from IslandWrite. Also, IslandWrite users can retain

## Printer Specializes in Science, Engineering

Tektronix has announced the Phaser 380 color printer, specifically designed for scientific, engineering and specialized manufacturing applications. The Phaser 380 offers a 12.7- by 18-inch print area, 600-dpi resolution and prints solid-ink colors on most paper surfaces, the company says.



Specifically, Tektronix has positioned the new printer for a variety of applications, including mechanical design, solids modeling, finite element modeling and analysis, mapping/geographical information systems, technical data analysis and architectural rendering. To accomplish this, Phaser 380 includes Adobe Systems Inc. PostScript image processing and carries options for network connections, additional RAM and fonts, enhanced print and management features, and copying capabilities, Tektronix says.

Phaser 380 can reportedly produce $3\frac{1}{2}$ letter-size and 2 tabloid-size pages per minute by using a drum-offset architecture. According to Tektronix, the image is transferred from the drum and fused to the paper in a single step. Also, the new printer uses Tektronix's ColorStix solid inks that are clean, nontoxic and easy to reload even while a print job is in process, the company says.

As an option, Tektronix offers PhaserPrint software, which enables fast raster file and screen printing from UNIX-based workstations. Users can print Sun raster format, SGI RGB, HP Starbase, xwd and GIF files. In addition, PhaserLink software allows users to manage the printer through a Web browser and TCP/IP network connection.

The Phaser 380 color printer costs $7,995.

**Tektronix Inc.**
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**Circle 100**

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hyperlinks embedded in HTML documents that are imported from the Web. In addition, IslandPaint and IslandPresents now offer support for JPEGs, GIFs and transparent GIFs.

The new features are designed to allow IslandWrite, Draw & Paint users to edit and present images for Web output. Users are also provided with a feature called File Structure Conversion to HTML, which allows IslandInTEXT users to organize documents using a file cabinet/folder metaphor and to convert the document structure to HTML.

Island Productivity Series Version 6.0 is available on HP-UX 10.10, AIX 4.1, SunOS 4.1.3. and Solaris 2.3+, and includes IslandOffice; IslandWrite, Draw & Paint; IslandPresents; IslandCalc; IslandInTEXT; and IslandBuild. The suite costs $1,695.

**Island Software Corp.**
715 Sutter St.
Folsom, CA 95630
*http://www.islandsoft.com*
**Circle 102**

## SCSI RAID Controller Out

The company that brought the PrestigePlus controller to market has announced the Regency SCSI RAID controller. Syred Data Systems says its RAID controller is designed specifically for use with demanding database and multimedia applications.

The Regency SCSI RAID controller supports RAID levels 0, 1, 0+1, 3, 4, 5, and is powered by a 40-MHz 1960CF Intel processor with bidirectional cache. It comes with eight Wide Ultra SCSI channels, two of which are dedicated to the host, and supports SCSI-1, Fast SCSI, Wide SCSI, Ultra SCSI and Wide Ultra SCSI.

Multiple database servers operating at different RAID levels can use the same array because Regency features two dedicated channels to the host, the company says. This dual-host feature allows multiple Regency controllers to be connected in series, expanding the array's capacity to more than a terabyte. RAID levels 3 and 4 are reportedly ideal for the large file sizes common to multimedia, video storage, transmission and streaming applications.

Simple Network Management Protocol (SNMP) compatibility allows the controller to be connected directly to an Ethernet network via its Ethernet plug. Also included is a Multiple Floatable Disk feature, which allows the system to allocate two spare drives to one array rather than to an individual set or one spare drive to two arrays.

The Regency controller includes hot-swapping, background rebuilding and bad sector reassignment capabilities. It uses bus mastering, bursting, multithreaded I/O and tag queuing to deliver up to 40 MB/s on each channel. It can have one to 15 disks per channel.

The Regency SCSI RAID controller supports SunOS, Solaris, VMS, SCO UNIX, NetWare, DOS, Windows 95/NT/3.1 and Mac OS. It is offered to systems integrators and OEMs for $4,500.

**Syred Data Systems**
272 Lanes Mill Road
Howell, NJ 07731
*http://www.syred.com*
**Circle 103**

## Fourth-Generation Fibre Channel Switch

Ancor Communications has introduced its GigWorks MK II Fibre Channel (FC) switch. The product is designed to meet the needs of OEMs, systems integrators and network managers who deal with performance issues and scalability in storage, compute clusters and high-performance LAN applications. The switch offers 1.062-GB/s performance plus eight arbitrated loop ports on a 16-port chassis, and is reported to offer optimal speed and scalability, including the ability to connect storage or client seats on a loop.

At the heart of GigWorks MK II is a new Application-Specific Integrated

Circuit (ASIC) developed by Ancor, which is designed for optimal performance in Class 3-2-1 and Intermix Fibre Channel communications. Ancor says that placing communications functionality on the chip, rather than relying on software to manage different classes of service, gives the GigWorks MK II a highly efficient, cost-effective architecture with a switch latency of approximately 500 nanoseconds–reportedly, less than one-third the latency of competing Fibre Channel switches.

The switch complies with the current Fibre Channel 4.3 standard and interoperates with other FC 4.3-based products. It is also FC-arbitrated loop 4.5-compliant, scalable to 192 ports with a 16-port chassis and cross-connect architecture, and is offered in a variety of configurations, including fully loaded with short-wave optics or copper media modules (GigWorks MK II is also available without optics). The GigWorks MK II has been designed with built-in hot-pluggable ports and redundant, hot-swappable power supplies and fans, the company says.

List price for the GigWorks MK II FC switch is $2,495 per port or $1,995 per port without optics.

**Ancor Communications Inc.**
6130 Blue Circle Drive
Minnetonka, MN 55343
*http://www.ancor.com*
**Circle 104**

## Ultra SCSI Storage Subsystems Out

Digital Equipment has announced a new line of storage subsystems based on Ultra SCSI technology called StorageWorks. StorageWorks is reportedly targeted at storage-intensive, mission-critical applications such as data warehousing, video imaging and Year 2000 conversions. It also offers customers a migration path to Fibre Channel storage technology, the company says.

StorageWorks comprises four storage subsystems: the Enterprise Storage Array (ESA) 10000, the RAID Array 7000 departmental server, the RAID Array 3000 subsystem for Windows NT and the RAID Array 230/Plus solution. StorageWorks also includes new storage management software, and 2-, 4- and

9-GB Ultra SCSI disk drives. All four units support all levels of RAID. When wishing to upgrade to Fibre Channel, administrators can simply swap in a Fibre Channel board, maintaining the same cabinetry, the company says.

The ESA 10000 stores from 200 GB to multiple terabytes. Two modules are available: One is optimized for mail, messaging and Year 2000 applications, and transaction-based applications such as those from Baan Co., PeopleSoft Inc. and SAP AG Americas Inc.; the other is designed for higher bandwidth applications such as decision support, data mining, data warehousing and online analytical processing (OLAP). The ESA 10000 delivers up to 24,000 I/Os per second and a data transfer rate of 56 MB/s for an average of $0.43/MB.

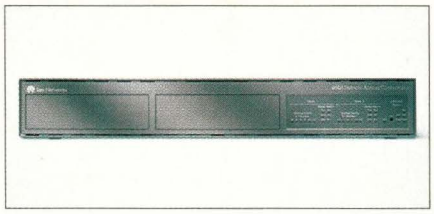
The RAID Array 7000 has a storage capacity of 655 GB, with 12,000 I/Os per second and a data transfer rate of 28 MB/s. The RAID 3000 Array, offered for Windows NT server environments, supplies between 64 GB and 128 GB, 4,400 I/Os per second and a 28 MB/s data transfer rate. The RAID Array 230/Plus, for customers who require high performance but do not need failover or clustering, delivers 3,000 I/Os per second and a data transfer rate of 19 MB/s.

All StorageWorks Ultra SCSI products support Digital UNIX, OpenVMS, Solaris, HP-UX, AIX, IRIX, Windows NT and Novell NetWare. Pricing starts at $55,382 for the ESA 10000; at $24,939 for the RAID Array 7000; at $7,999 for the RAID Array 3000; and at $2,420 for the RAID Array 230/Plus.

**Digital Equipment Corp.**
14 Main St.
Maynard, MA 01754
*http://www.digital.com*
**Circle 105**

## Compact, Stackable RAC

Bay Networks has expanded its Adaptive Networking strategy with the announcement of its Model 8000 Remote Access Concentrator (RAC). The product is a compact, stackable RAC featuring a choice of 56-KB/s access options, extensive call and modem management, and software upgradability using Digital Signal Processing (BayDSP) digital modem technology. It is intended for Internet service providers (ISPs) and carriers who need point of presence (POP) enterprise dial access.



Model 8000 RAC offers a choice of 3Com Corp. x2 or Lucent Technologies Inc./Rockwell International K56flex modem technology. It allows remote users to dial into the corporate network at any time from any place. Network traffic is routed whether users need TCP/IP, IPX, AppleTalk or a combination of protocols. ISP customers can access the Internet by dialing into the 8000 RAC using analog or digital modems or ISDN connections, the company says. In addition, the 8000 RAC is fully supported by Bay Networks' BaySecure Access Control RADIUS, an industry-standard RADIUS (Remote Authentication Dial-In User Service) server incorporating user authentication, authorization and accounting solutions for enterprise and service provider environments.

The Model 8000 RAC provides connectivity for two Primary Rate Interface (PRI) or Channelized T1/E1 lines with support for up to 48 industry-standard v.34 33.6-KB/s digital modems and 56 KB/s technology for North American

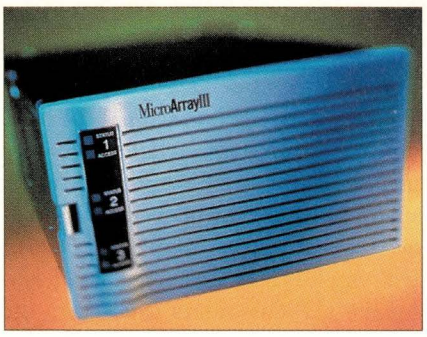
T1 applications or up to 62 modems for international networks with built-in redundancy. Also featured is a multiprocessor architecture that ensures high performance with three 32-bit CPUs, optional hardware compression and multilink Point-to-Point Protocol (PPP) support.

The Model 8000 RAC costs $19,995 for two PRIs or Channelized T1 interfaces and 48 modems, or $25,999 for two PRIs or Channelized E1 interfaces and 62 modems.

**Bay Networks Inc.**
8 Federal St.
Billerica, MA 01821
*http://www.baynetworks.com*
**Circle 106**

## Low-Cost RAID Subsystem Out

Aiwa America has come out with the latest generation of its MicroArray product family. The MicroArray III combines three $3^1/_2$-inch Imbedded Drive Electronic (IDE) drives and a built-in RAID controller into a disk array subsystem that fits into a standard $5^1/_2$-inch full-height drive bay.




The product is a platform-independent RAID subsystem that aims to fill the void between larger, more costly external RAID subsystems and server-dependent, bus-based RAID subsystems.

The MicroArray III provides scalable RAID capacities from 10 GB, using three 5.1-GB drives, to more than 100 GB, by daisy-chaining several systems together, the company says. The Ultra SCSI interfaces allows transfer rates up to 40 MB/s.

The subsystem provides data redundancy and hot-swappable drives. User-selectable RAID levels 0, 1, 3 and 5 are supported. It uses a cableless design, a backplane Printed Circuit Board (PCB) and a single RAID controller board with a Wide Ultra SCSI host interface.

In addition, its array engine incorporates a 40-MHz RISC microprocessor with 512 KB of Flash ROM and 4 MB of DRAM, and has a 32-bit bus capable of 80-MB/s internal data transfer rates. To further enhance performance, 4 MB of parity-protected cache with user-definable and adaptive features is used, the company says.

The MicroArray III comes with Aiwa's ArrayView monitoring software, which incorporates features such as remote monitoring and paging as well as audible and visual alarms. Pricing starts at $4,500, depending on configuration. It is packaged with comprehensive documentation on CD-ROM along with a step-by-step installation video.

**Aiwa America Inc.**
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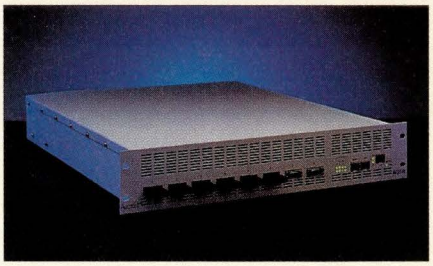
Irvine, CA 92612
*http://www.aiwa.com*
**Circle 107**

## Fabric Supports Arbitrated Loop, Point-to-Point

A new Fibre Channel switch from Arcxel Technologies, the AGS/8 Fibre Channel Fabric, is reportedly the first fabric switch to support both arbitrated loop and point-to-point network topologies. The AGS/8 can also support either direct fabric-attach or loop devices without having to perform a hardware upgrade, Arcxel says. This means that users can configure the switch with either RAID or just a bunch of disks (JBOD) systems.

According to the company, the AGS/8 transmits data at 1.063 Gb/s at full duplex. It employs a nonblocking architecture for a combined throughput of 16 Gb/s. Routing and switching capabilities are hardware-based for a total fabric latency of less than two microseconds, the company says. The fabric handles all three classes of Fibre Channel service, as well as Intermix, which is defined as Class 1 service where unused bandwidth is shared with Class 1 and Class 3 traffic. The units can also be cascaded to provide increased ports.

Arcxel says the AGS/8 was designed with reliability in mind. The AGS/8



employs a single printed circuit board to minimize the number of connectors. It uses highly reliable DC power modules and includes an additional standby cooling feature. Optionally, the switch can be equipped with a second power supply that provides load-sharing and automatic failover. Should a unit fail, the AGS/8 reports its status via the Arcxel private enterprise MIB (management information base), which displays the status, generates SNMP trap messages and updates log files.

Administrators can also set up, configure and monitor the AGS/8 via a Web browser. Fibre management can be performed in-band through Fibre Channel, or out-of-band through Serial Line Internet Protocol (SLIP) and Ethernet.

**Arcxel Technologies Inc.**
2691 Richter Ave., Ste. 106
Irvine, CA 92606
*http://www.arcxel.com*
**Circle 108**

## Tool for Building Java Apps

A new visual tool for creating Java object models–data structures, the relationships between them and the underlying Java code–has been introduced by Tendril Software. Through a point-and-click interface, StructureBuilder 1.0 for Java frees programmers from rote programming tasks and gives them more time to focus on solving business problems with their programs, Tendril says.

When programmers design applications based on object-oriented programming languages such as Java, they typically draw an object model–that is, the program's objects are drawn as boxes with lines between them to determine the relationships or structure of the objects. However, over the course of the programming project, these objects change, and programmers frequently forget to update the program's model.

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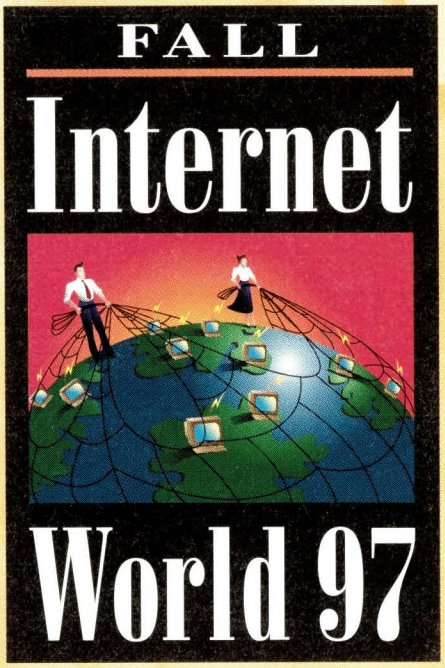


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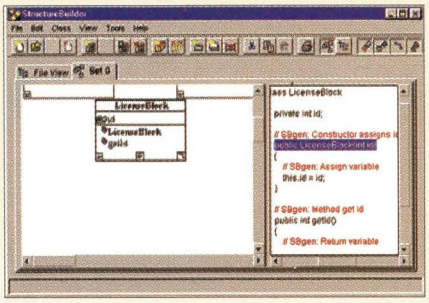

This can result in bugs because of poor communication, or in poor program documentation, the company says.

StructureBuilder 1.0 reportedly generates a model directly from the source code, which can be easily updated with any code changes. Tendril says StructureBuilder is also less rigid than similar tools embedded within integrated development environments (IDEs). It can function either as a stand-alone application or as a part of several leading Java IDEs, including Symantec Corp.'s VisualCafe, Microsoft Corp.'s AFC and J++ programs, Sun Microsystems Inc.'s Java WorkShop and IBM Corp.'s VisualAge. In addition, StructureBuilder 1.0 can be used to automatically generate code.

StructureBuilder 1.0 is based on Sun's Java Developer's Kit 1.1 and is available for $495 from the company's Web site.

**Tendril Software Inc.**
319 Littleton Road, Ste. 105
Westford, MA 01866
*http://www.tendril.com*
**Circle 109**

## Centralized Storage Management Solution

CommVault Systems has announced Vault98, an application software suite designed for complex, heterogeneous networks consisting of large files and database servers. Vault98 offers file system and database backup and recovery, disaster recovery, hierarchical storage management (HSM), archiving and data migration, the company says.

Backups may be full or incremental and may include both data and metadata, such as file attributes and access rights, that are native to the client's file system. Also, backups can be automatically performed based on predefined schedules or may be manually initiated from any client on the network.

The Vault98 architecture reportedly uses a virtual machine concept of parallel paths established between a client and the Vault98 server to enable multiple backups to operate on any given client, or simultaneously across multiple clients. In addition, the product is said to employ a special crash-resistant, backup architecture where a backup can be interrupted due to system or network failure and restarted from the point of interruption without loss of data. Data compression is available on either the client or server side.

Vault98 file system backup and recovery software operates on a dedicated Sun Microsystems Inc. server and is capable of backing up a wide range of clients, including more than a dozen variants of UNIX, as well as OS/2, Windows 95/NT, Vines and NetWare. In addition, Vault98 backs up and restores a broad range of databases in online and off-line modes, including those from Oracle Corp., Informix Software Inc. and Sybase Inc.

Vault98 is fully compliant with Year 2000 standards, and CommVault ensures its storage software will properly recognize file dates before and after December 31, 1999.

Pricing is based on size and performance, plus additional charges for the number and type of clients to be backed up. Basic software packages start around $30,000.

**CommVault Systems Inc.**
2 Crescent Place
Oceanport, NJ 07757
*http://www.commvault.com*
**Circle 110**

## Updates, Enhancements, Additions...

■ Rhapsody, from i-Logix, has been upgraded to Version 1.1. Rhapsody is an object-oriented design and implementation tool targeted at embedded systems software designers. New features include integrated configuration management capabilities, using Rational Software Corp.'s ClearCase, Intersolv Inc.'s PVCS, and code management utilities RCS and SCCS. It also features a new open, ASCII-based object repository and now supports floating licenses. Pricing for Rhapsody starts at $2,495. **i-Logix Inc.,** Three Riverside Drive, Andover, MA 01810, *http://www.ilogix.com.* **Circle 111**

■ ICL has integrated the CORBA-standard Transaction Service with its DAIS object request broker (ORB). DAIS Transaction Service, offered as part of the DAIS suite, is said to act as a transaction manager, coordinating transactions and receiving instructions to either save all changes if a system's action is successful or abort all changes if notification of a failure is received. In addition, DAIS Transaction Service conforms to an X/Open XA specification, which allows transactions to be coordinated with relational databases and other products that support the XA specification. It supports Oracle Corp. and other databases conforming to the XA interface on Solaris and Windows NT and costs $350 per client. **ICL Inc.,** 11490 Commerce Park Drive, Reston, VA 20191, *http://www.iclinc.com.* **Circle 112**

■ Black & White Software has upgraded Orb/Enable, its productivity tool set for Iona Technologies' Orbix, a CORBA-compliant object request broker (ORB). Orb/Enable 2.2 offers C++ and Java code generation from compiled Interface Description Language (IDL) descriptions, graphical viewing of CORBA interface repository contents, native Windows and UNIX support and automatic server deployment. Orb/Enable 2.2 includes a set of graphical utilities that are invoked from the command line. Once they're started, Orb/Enable connects to the Orbix CORBA environment so users can visually manipulate CORBA repositories and servers. Orb/Enable 2.2 costs $1,500 per user for UNIX and $995 per user for Windows platforms. **Black & White Software Inc.,** 1901 S. Bascom Ave., Ste. 700, Campbell, CA 95008, *http://www.blackwhite.com.* **Circle 113**

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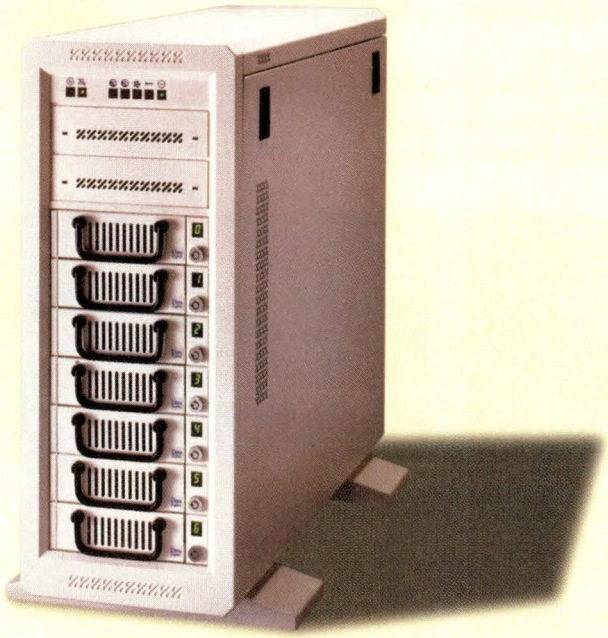

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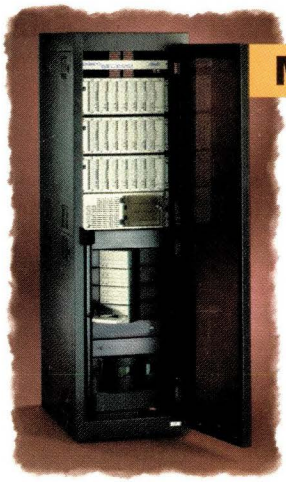

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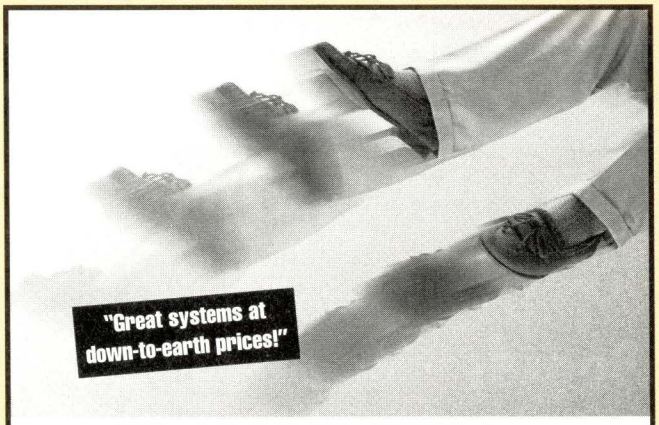


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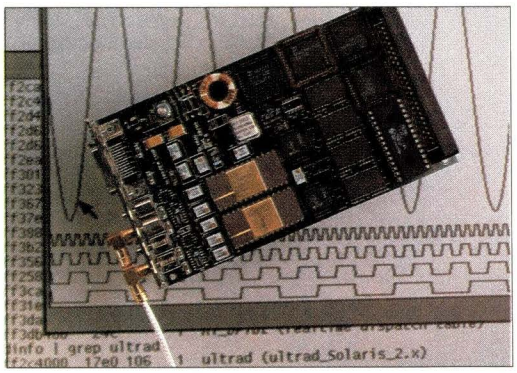

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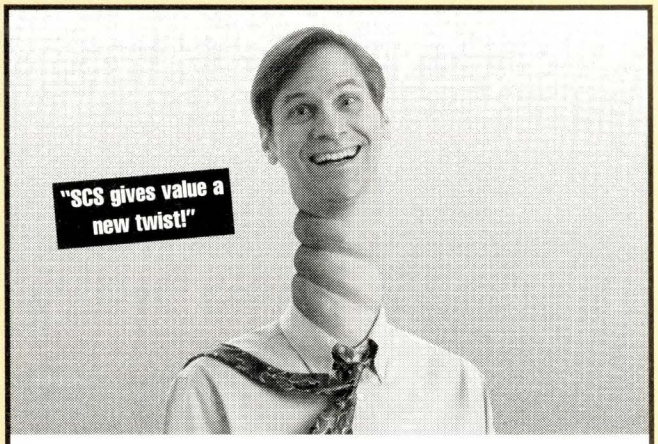


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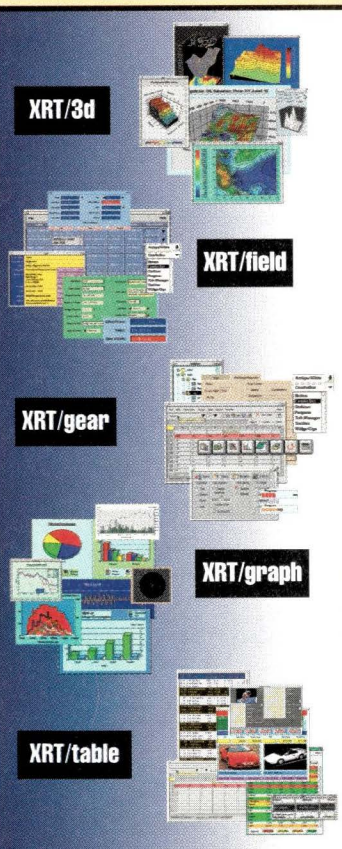


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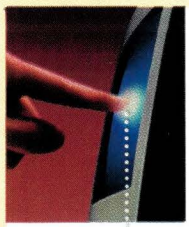

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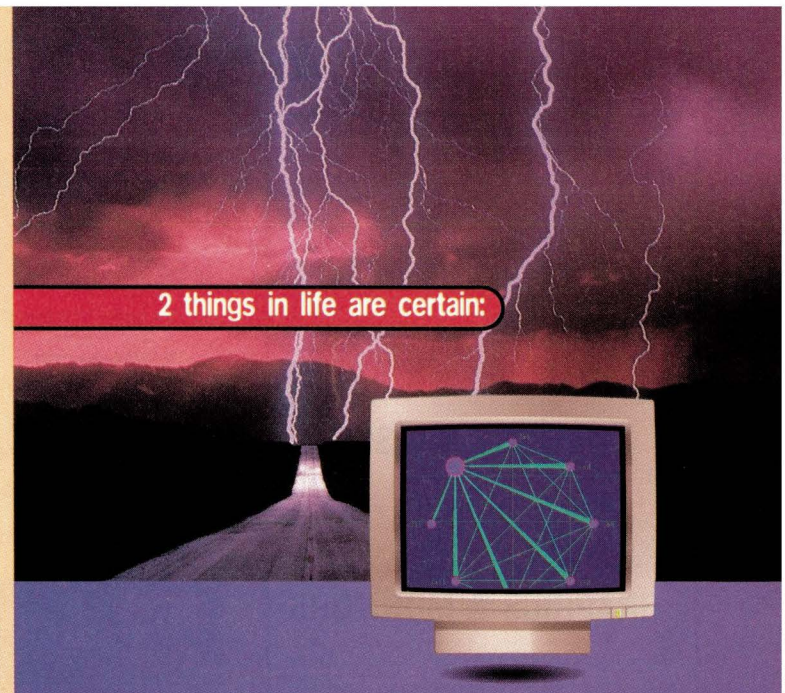


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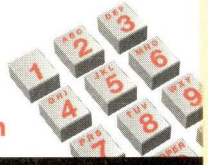

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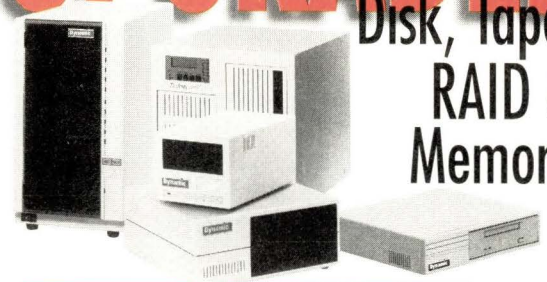

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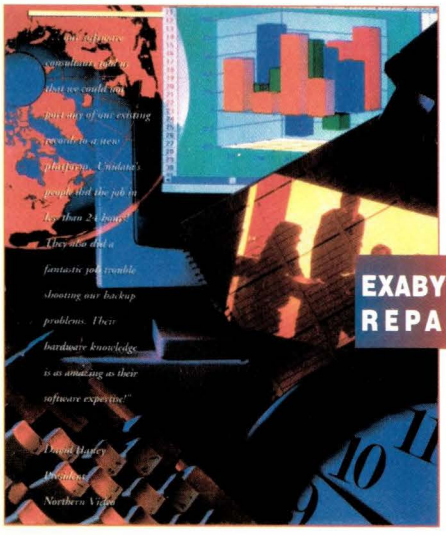

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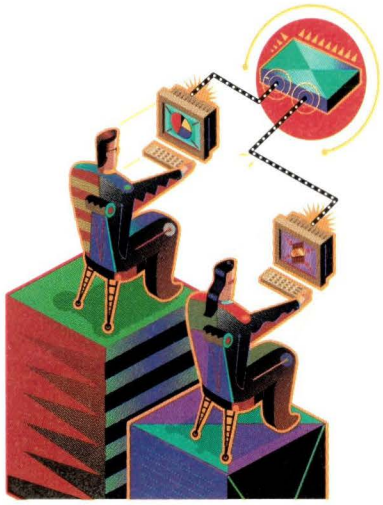

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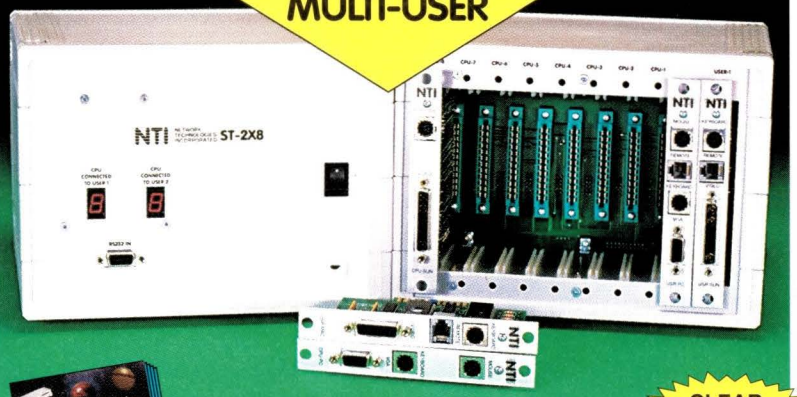


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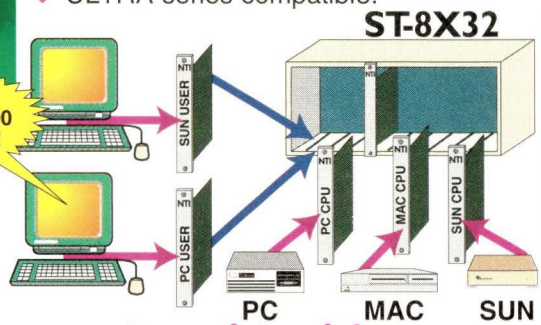


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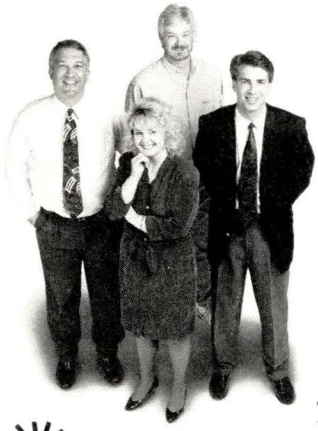

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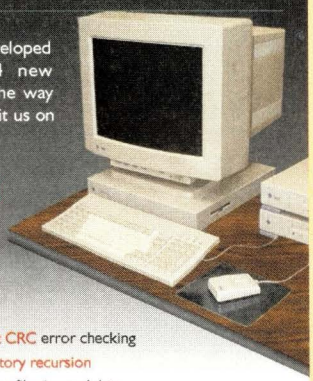

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