MARCH 1998 Vol. 9 No. 3 $5.50

SUNEXPERT

The Server/Workstation Magazine

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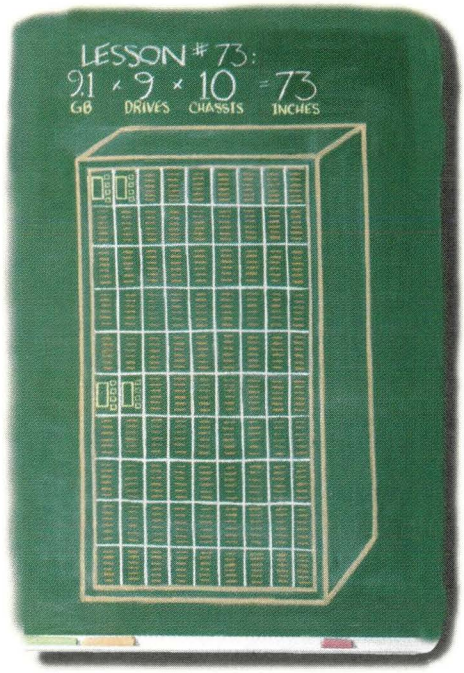
TAKING ON NEW ROLES

Review: OpenNT

UNIX Basics: Stop the Spam!

Artecon's New RAID Math



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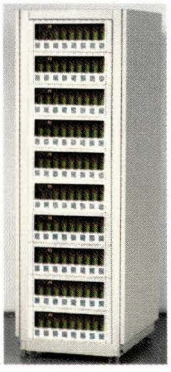

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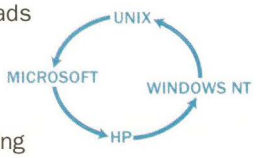

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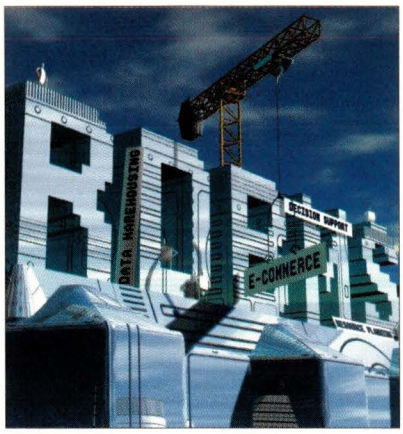

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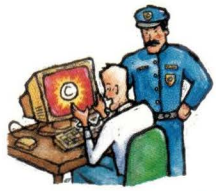

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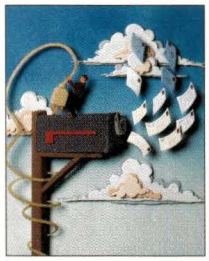

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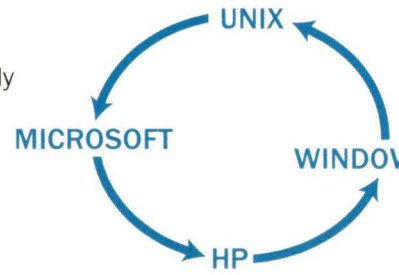
The Interoperability Training Kit is a self-paced training course that explains the architectural similarities and differences of Microsoft® Windows NT® and UNIX, making integration not only feasible but resoundingly 

practical. This kit will keep you current with the latest Windows NT terminology and functionality. At the same time, it makes clear how Windows NT and UNIX work together to bring technical and enterprise computing to your PC at a greatly reduced total-cost-of-ownership.

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EDITORIAL

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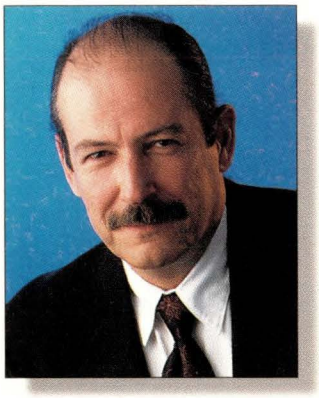

You Be the Judge

What are database vendors to do as they face both slowing sales growth and narrowing profit margins? That's the basic question of this month's cover story by Karen Watterson. It turns out that they are doing a lot. Oracle, Informix, Sybase and even IBM are changing, looking for new ways to sell their wares. The focus seems to have shifted from all-purpose database software to applications software, middleware and systems specially targeted for e-commerce and decision support applications. As a result, according to Karen, "Today's relational databases are being tasked to do more and more. No longer simply heads-down online transaction processing (OLTP) systems, they're being harnessed to provide data warehousing, support e-commerce and offer better integration with both legacy data and enterprise financial and resource planning systems." With the advent of thin clients and the Network Computer–if it ever takes off–and the emphasis on Web-enabled data access, including new applications spawned by Java, more and more stress will be placed on application servers, chief among them the database and middle-tier servers. If you're developing, designing or administering in this environment, you'll want to read "Databases: Taking on New Roles," Page 58.

Also in this issue, *SunExpert* revisits the topic of UNIX/NT integration on the desktop–this time, in the guise of an NT system wearing UNIX-like or POSIX-compliant garb. Technical Editor Ian Westmacott takes Softway's OpenNT for a thorough test drive. He finds quite a bit to like but a few snags. Although many flavors of UNIX run on the Intel architecture with success, in some cases–especially those involving developers moving to NT or porting UNIX applications to NT–that isn't enough. For them, OpenNT extends the Windows NT POSIX subsystem to include full POSIX 1003.1 (system calls) and POSIX 1003.2 (commands and utilities) compliance. OpenNT provides ANSI C interfaces, BSD sockets (mapped to Winsock), SVID interprocess communication (IPC), X11R6.3 server, a telnet server and standard TCP/IP clients. For details, see "OpenNT: More Than Just UNIX and NT," Page 65.

Doug Pryor

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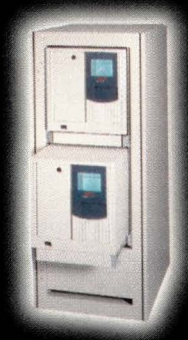

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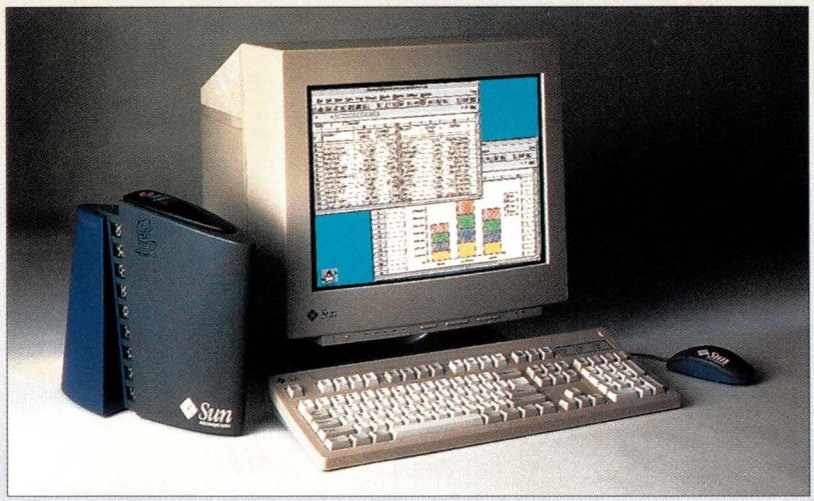
NCs and Growing Pains

April showers bring May flowers–and, hopefully, some long-awaited good news for NC proponents. By the end of March, the first full commercial release of Sun Microsystems Inc.'s JavaStation should finally be under way. Prospective buyers of Sun's NC have been waiting a year and a half for the finished product. Sun, which originated the concept of the Network Computer, first introduced its own NC product in October 1996. Sun has twice pushed back the full commercial release of the JavaStation, which has, so far, been available only in a developer's version to select beta sites.



'A long time in the lab,' the commercial release of Sun's JavaStation is due out by the end of March.

"Clearly, Sun's efforts have been a long time in the lab, and a disappointment in the marketplace," observes Peter Kastner, chief of research at The Aberdeen Group, a research firm based in Cambridge, MA. "In this case, no news has been bad news."

But Sun hopes to reclaim its leadership role by finally rolling out the commercial JavaStation. It will offer a speedier execution time than the beta version, thanks to the addition of a just-in-time (JIT) compiler, according to Ted Murguia, group manager for JavaStation product marketing. A JIT compiler can speed program execution by two to three times over a Java interpreter.

Like the beta release, the new version sports a MicroSPARC chip, although a different model–the IIep–which adds a PCI Controller and bus interface. Eventually, Sun plans to equip its NC with a Java chip, based on Sun Microelectronics Inc.'s picoJava core design, but has not yet decided when, Murguia says.

Remote usage of the JavaStation will become easier, thanks to an additional 4 MB of optional flash RAM and support of the point-to-point protocol (PPP) for dial-up access via a modem. "You turn the machine on, it dials up the number and sets the PPP connection. Then it checks its own software to see if it has the latest version and, if it does, boots from flash memory. It's a very fast process," says Murguia. Without flash memory, a JavaStation must download the operating system and main applications each time it is booted. Other changes include an increase in the machine's base RAM–16 MB instead of 8 MB–and support for Java Developer's Kit (JDK) 1.1 and Fast Ethernet.

But the question remains: Is there anything that makes this JavaStation stand out? Not really, says Eileen O'Brien, director of the NC Program for International Data Corp. (IDC), Framingham, MA. "It sounds like they're bringing their original product up to par with what other vendors are offering. I don't as yet see it as having anything very different or outstanding." But, she adds, Sun's first goal is simply to get a product out into the marketplace. "Now that they do have something that's on par with other NCs, I would encourage them to market and sell it."

At press time, no price or date for the official release had been set, but a spokeswoman for Sun says the product will definitely be ready to go by the end of this quarter with a price tag no higher than the current $742 for a base configuration.

The real battle for Sun will be convincing customers that they need a Java-specific NC, rather than a terminal emulator for accessing Windows and legacy applications. So-called Windows terminals, which use Citrix Systems Inc.'s WinFrame software to access Windows NT applications running on a server, have proved increasingly popular with users who like the idea of a thin client, but not necessarily a Java NC. A large part of the reason is the continued lack of Java-based business applications.

"The deployment of Network Computers hasn't been Java-based. It's been mostly Windows terminals that can also run Java," says Colin Mahony, analyst for the Yankee Group, a Boston, MA-based research firm. "Very few have been pure Java."

Sun's JavaStation can double as either a Windows or green-screen terminal. But the increasing number of thin-client options–whether marketed as Java NCs,

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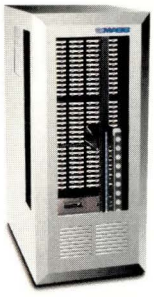

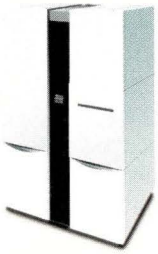

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Circle No. 6

Windows terminals, NetPCs or just stripped-down $900 PCs–available to corporate customers will make things more difficult for Sun, says Ron Rappaport, analyst for Zona Research Inc., Redwood City, CA. "The state of the market today is considerably more competitive than at any of Sun's past proposed rollout dates for the JavaStation."

The industry is also inclined to be more skeptical about consumer demand for NCs. While proponents have been predicting a massive rush to NCs in the past, it's clear that NCs won't be replacing PCs and workstations–or even terminals–overnight. IDC, for instance, is predicting that just 300,000 NCs will ship this year, down from its earlier forecast of 500,000.

Even Sun's NC teammate Oracle Corp. may be feeling a bit more reserved about Network Computers. Last month, a report appeared in an industry trade journal that Oracle was backing away from its commitment to Network Computers. That would be a major shift for Oracle, which has spent the past year introducing its Network Computing Architecture (NCA) for NC systems and only recently announced the release of a Java-based version of its suite of enterprise applications. Oracle also owns Network Computer Inc., a privately held company that sells the NC Network in the Box, a package containing NCI's server software and third-party server and NC hardware.

Oracle spokespeople vehemently deny the report, but they confirm that Oracle Chief Executive Officer Larry Ellison intends to spend more time promoting the company's traditional database applications. Ellison had been devoting considerable effort to plugging Network Computers. Lower-than-expected earnings, due to sluggish sales of software licenses, are the main reason that Oracle must focus more attention on the sales of its bread-and-butter products.

Dan Berkowitz, Oracle's director of public relations, stresses that the company does not plan to lessen support for network computing. "We're going full steam ahead with all our NC initiatives, including Network Computer Inc.," asserts Berkowitz, pointing to the company's recent purchase of a 60-second, $2.6 million TV ad that aired during this year's Super Bowl touting network computing.–*sjh*

NC Standards Get a Remake

Another Network Computer product that should be ready to roll in April is the NC Reference Profile Version 2. In January, the Open Group's NC committee met at Sun's headquarters in Menlo Park, CA, to hammer out additions to the NC Reference Profile. The committee, which includes representatives from Sun Microsystems Inc., IBM Corp. and Oracle Corp., has been working on the design for Version 2 of the NC profile since last October. The first version of the NC profile made its debut in 1996.

Some of the additions include support for HTML 4.0 and JavaScript, as well as support for Virtual Reality Modeling Language (VRML) and Secure Sockets Layer (SSL) Version 3. NCs that meet the new specs will also have to support the Dynamic Host Configuration Protocol (DHCP) for assigning IP addresses to stations in a network, and CORBA 2.1 Object Request Broker (ORB) with Internet Inter-ORB Protocol (IIOP) Version 1, the CORBA message protocol used on the Internet. NC Reference Profile Version 2 will also include support for an email client (the prior version supported only the *mailto:* command for responding to email address links on Web sites).

The final specifications are due to be published in April, with testing and branding for products that wish to carry the NC Reference Profile logo scheduled to be available in the fourth quarter of 1998. Also in January, another committee, the Network Computer Management Group, met in Cupertino, CA, to address interoperability between NCs and servers from different vendors. Gordon Yamamoto, manager of Internet technology development for the Solaris Server Group at SunSoft Inc., Sun's Solaris software division, says the committee of more than 50 people from 25 companies expects to submit an initial specification to The Open Group by the end of March. The group will address five key areas: booting over a network, configuration management, instrumentation, print management and security.–*sjh*

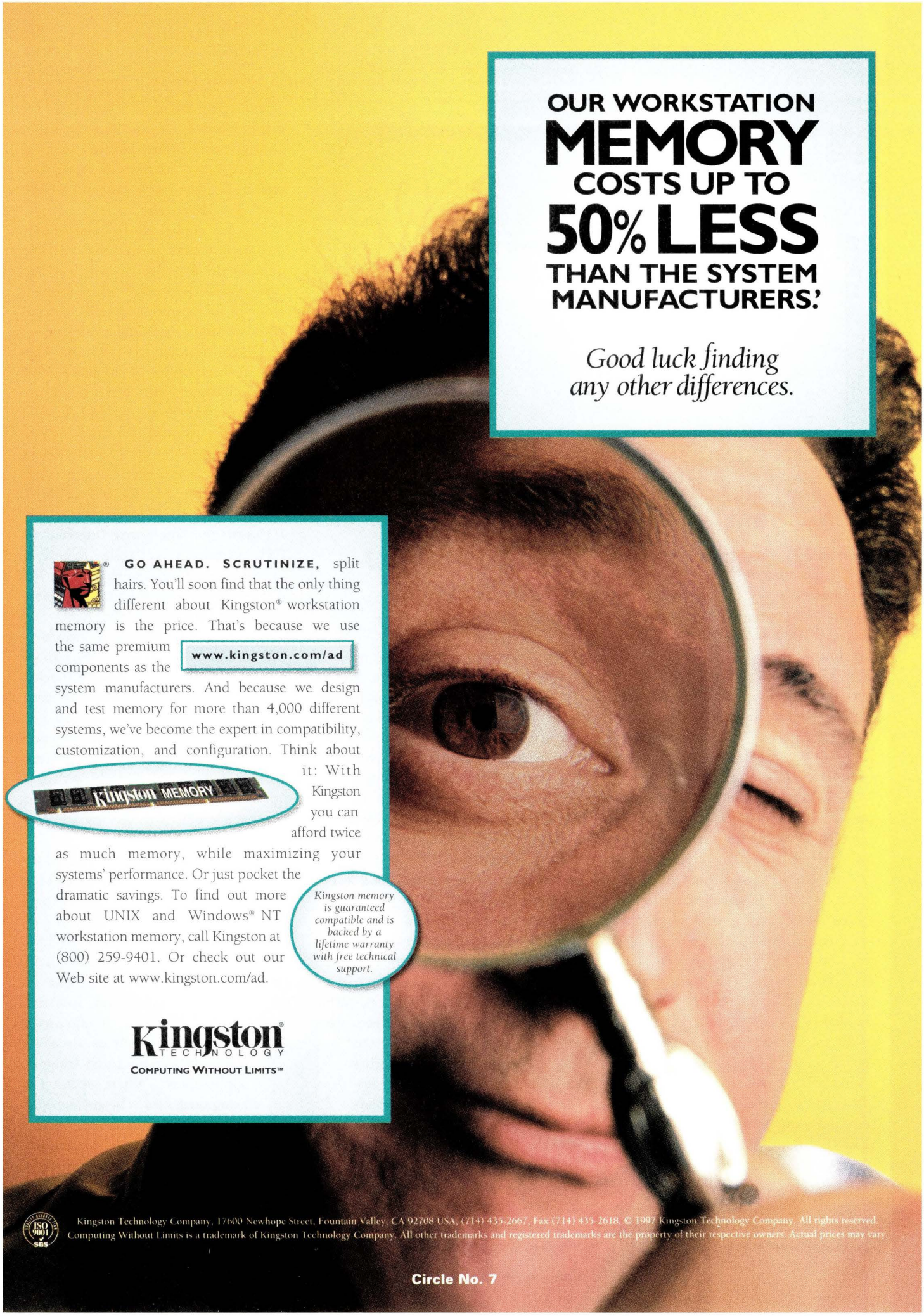
Sun DB Punch from IBM

IBM has expanded the platform support for DB2 Universal Database Enterprise-Extended Edition (EEE) to include clustered Sun Microsystems Inc. Solaris and Microsoft Corp. Windows NT servers and massively parallel processors (MPPs). Until now, IBM's AIX was the only operating system able to take advantage of the parallel support with DB2 Universal Database EEE. "The interest in Sun platforms for Internet-based work is huge," says Jeff Jones, program manager for data management marketing at IBM's software solutions division. "We very much would like to see RS/6000s used by that crowd, but we can't dispute the interest in both Windows NT and in Sun servers."

The move is seen by analysts as a positive step for Big Blue, as it attempts to challenge database market leader Oracle Corp. "For IBM to be creditable as an independent database vendor, which is really what their goal is, they must have their DB2 products on non-IBM products," says Judith R. Davis, an independent industry consultant based in Marion, MA. "NT and UNIX are the core platforms for databases today."

Jones says, "We very much expect that we can jump up and give Oracle a real run for it."

The use of a common application programming interface between DB2 Parallel Edition, DB2 Common Server and DB2 Enterprise-Extended Edition will help DB2 in becoming available on non-IBM products. This allows the systems management and front-end tools to be written as a single API. "This means all of the third-party tools [vendors] and ISVs [independent software vendors] have an easier way to bring tools to the Enterprise-Extended Edition," says Stephen Brodst, managing partner at Strategic Technologies &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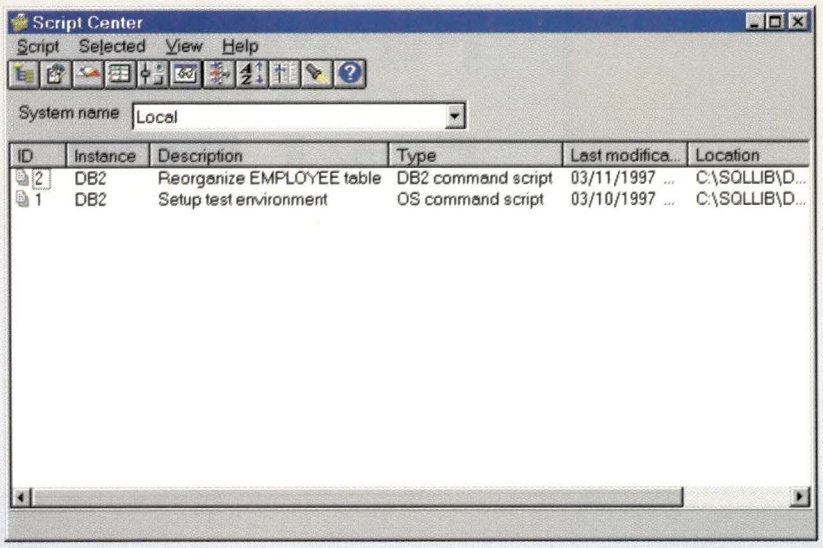


Script Center, a new feature of IBM's DB2 Universal Database, lets users create, save, execute and schedule command scripts.

Systems, a Boston, MA-based consulting firm. "This is major."

Brodst says he is also impressed that the Starburst optimizer is now available as part of Enterprise-Extended Edition. Previously, it was only available with DB2 Common Server. The Starburst optimizer, developed at IBM's Almaden Research Center, reportedly offers query rewrite capability. "This means the database will be able to handle a lot more complex queries," Brodst says.

As well as the ability to divide complex queries into multiple parts–which can then be run on numerous servers, or hundreds of processors, simultaneously–DB2 Universal Database EEE is designed so that functions such as insert, update and delete can operate in parallel. Furthermore, it can perform data scans, joins, sorts, load balancing, table reorganization, data load, index creation, indexed access, backup and restore simultaneously.

To specifically service the Internet "crowd," DB2 Universal Database EEE comes with applications like IBM's Net.Data for Web development and supports Java and Java Database Connectivity (JDBC). Other features include an object-relational database engine, replication support, extended GUI administration tools, Lotus Development Corp. Domino Go Webserver, Lotus Approach and Host Connectivity.–*ptc*

Java Developers Get a Scripting Language

In February, SunScript, the research group at Sun Labs responsible for the Tcl (for Tool Command Language, pronounced "tickle") scripting language, released Version 1.0 of both its Jacl and Tcl Blend projects. Jacl, which stands for Java Command Language, is a 100% Java implementation of Tcl 8.0. Tcl Blend is a Tcl Extension that allows developers to dynamically load the Java Virtual Machine (JVM) into the Tcl interpreter, or, vice versa, load a Tcl interpreter into the JVM.

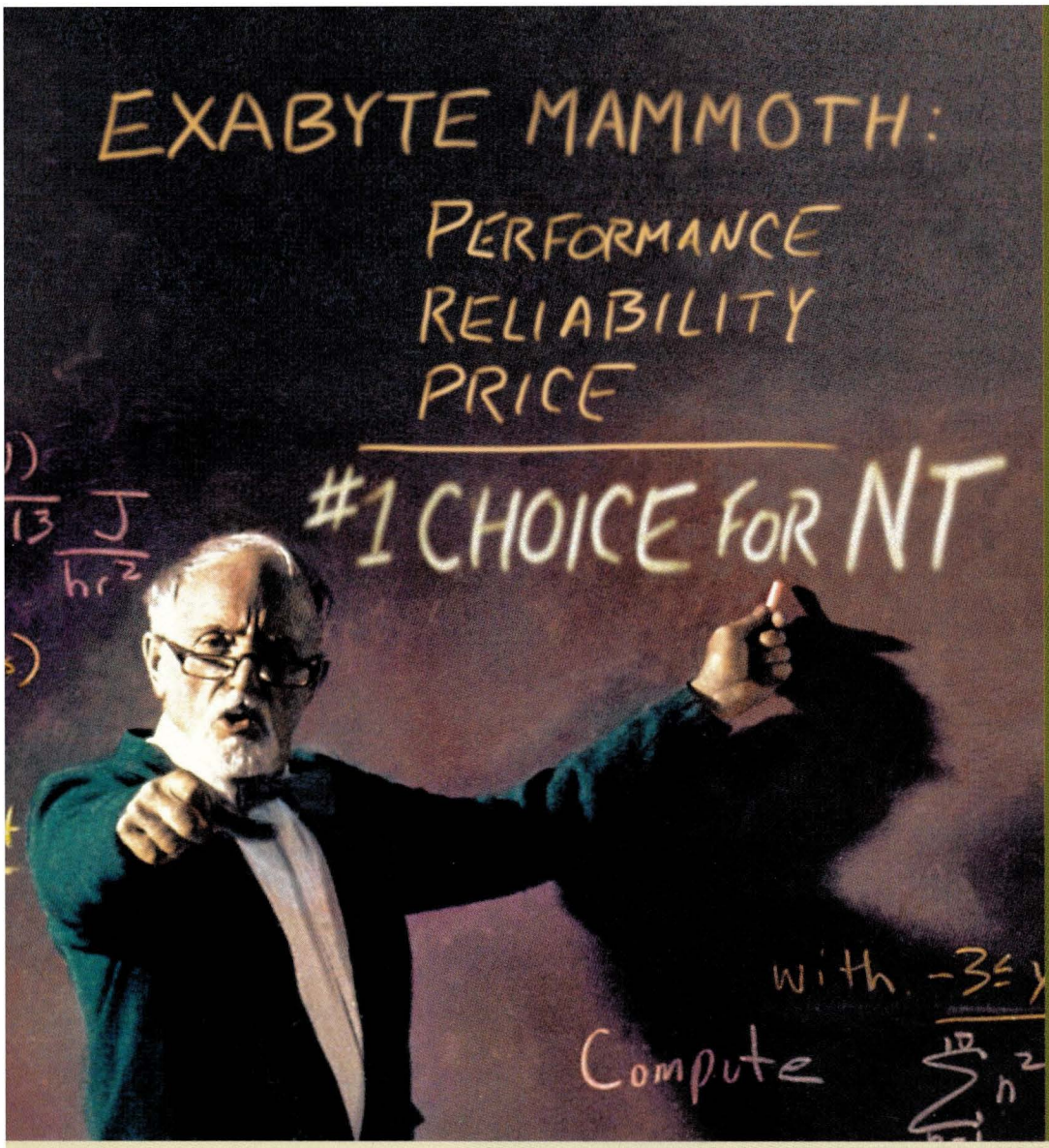
SunScript's motives for developing Jacl and Tcl Blend are twofold. The idea behind Jacl, says Ray Johnson, manager of the Tcl/Java project, is to provide Java developers with a powerful scripting language. Tcl developers, who number in the 300,000 to 500,000 range, use the scripting language for everything from simple shell scripting to cross-platform application assembly and, with the Tk toolkit, GUI development. Tcl Blend's role, on the other hand, is to give developers a means to gradually transition their existing code base to Java. "With Tcl Blend," explains Johnson, "you can put a Tcl veneer over your existing libraries." Then, you load the JVM in Tcl Blend and can begin adding new libraries written in Java. Eventually, says Johnson, the goal is to replace Tcl Blend with Jacl, and achieve 100% Pure Java status.

Tcl has traditionally been implemented in C and, as such, was available only on the platforms to which it had been ported. Admittedly, this included many of the operating systems in common use today, including most varieties of UNIX, Windows NT/95 and Mac OS. In recent years, about one half of the Tcl downloads have been for Windows, says Johnson. Jacl, on the other hand, should run on any platform that supports the Java Devloper's Kit (JDK) 1.1 or higher. To date, it has been tested on Solaris and on Sun's Windows NT JDK (Microsoft's JDK 1.1 omits the Java Native Interface, or JNI, on which Jacl relies heavily). Further operating system support for JDK 1.1 is contingent upon the operating system vendors, not SunScript.

Tcl developers hoping to switch to Jacl should be forewarned: Not all of the functionality found in Tcl 8.0 exists in Jacl yet. Notable exceptions are support for namespaces, sockets and Tk. Also, according to Usenet sources, code written in Jacl is not "applet-able," that is, it does not run directly within a browser. This, explains Johnson, has to do with a conflict between the Java and Tcl security models.

While not being able to run Jacl within the browser may appear to be a glaring problem, Johnson insists that, thus far, Jacl developers have yet to express any real interest in using Jacl for applet development. "Tcl isn't small–about 650 KB–which makes it way too big for developing Internet applications." However, it remains a good choice for anyone developing desktop-bound and intranet applications. "Where we see Tcl being used a lot is by anyone who is responsible for creating their own tools, but isn't a full-blown programming shop." Examples include systems administrators, engineers and financial analysts.

Both Jacl and Tcl Blend are available for download from SunScript's Web site



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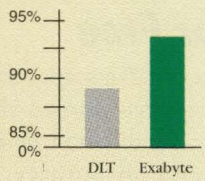
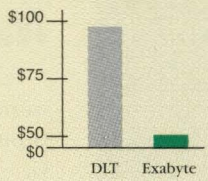
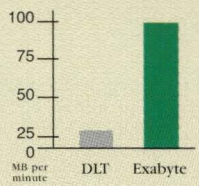


Annual Reliability Rate



Cost per Megabyte



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at `http://sunscript.sun.com`. There are no plans to charge for either tool. Other research projects under SunScript's umbrella include Safe Tcl/Tk, a Web browser plug-in that allows users to run Tcl/Tk applications from within a browser. The plug-in made its first appearance two summers ago and is now in Version 2.0, released in January.–*ab*

PersonalJava Ships

Sun Microsystems Inc. has released the PersonalJava platform 1.0 reference implementation to licensees. Sun expects this to result in Java-based devices such as Web-browsing phones before the end of 1998. PersonalJava, a subset of the Java software platform, was built specifically for network-connectable consumer devices such as mobile hand-held computers and set-top boxes.

More than 12 companies have licensed the platform since its release in January, including Acorn Group PLC, Wind River Systems Inc. and Lucent Technologies Inc. Manufacturers see Sun's commitment to embedded systems as a great benefit to their customers by allowing them to easily integrate Web access to their products.

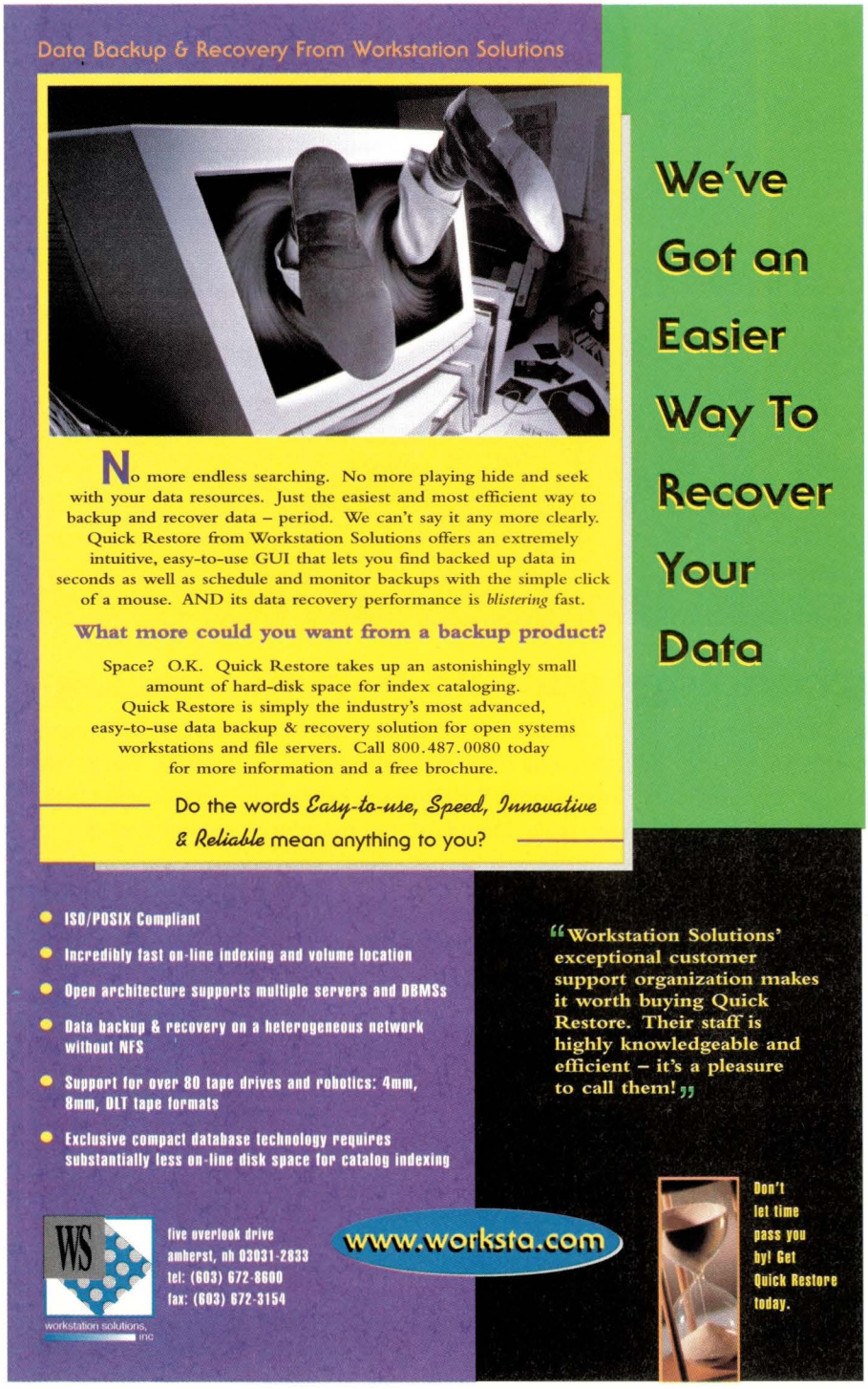
"PersonalJava addresses one of the biggest issues in embedded systems–memory footprint. The PJava API is much more tailored toward embedded aplications with the requirement of personalized user interfaces like set-top boxes or smart phones. As PJava requires a real-time operating system [RTOS] to operate, the combination of Wind River's leading RTOS VxWorks and PJava make an ideal platform for quickly developing and reliably deploying PJava in a broad range of applications," says Joerg Berhtoldt, product manager for Wind River's Embedded Internet, Alameda, CA.

A beta release of Personal WebAccess 1.0, also by Sun, offers a customizable Web browser for devices that run PersonalJava. The compact browser–at 750 KB–is written entirely in Java and supports HTML 3.2, frames, tables, cookies, Java applets and HTTP 1.1. The browser can be easily integrated with other components or applications such as calendar and email applications. Licensing options include binary redistribution and source code licensing.

A complete version of the PersonalJava specification is posted on Sun's Web site at `http://java.sun.com/products/personaljava`. Information on Personal WebAccess 1.0 can also be found at that site.–*mm*

Netscape Makes Navigator Free

The executives of Netscape Communications Corp. had hinted their browser software would soon be free to customers, and on January 22, 1998, it was made official. The com-



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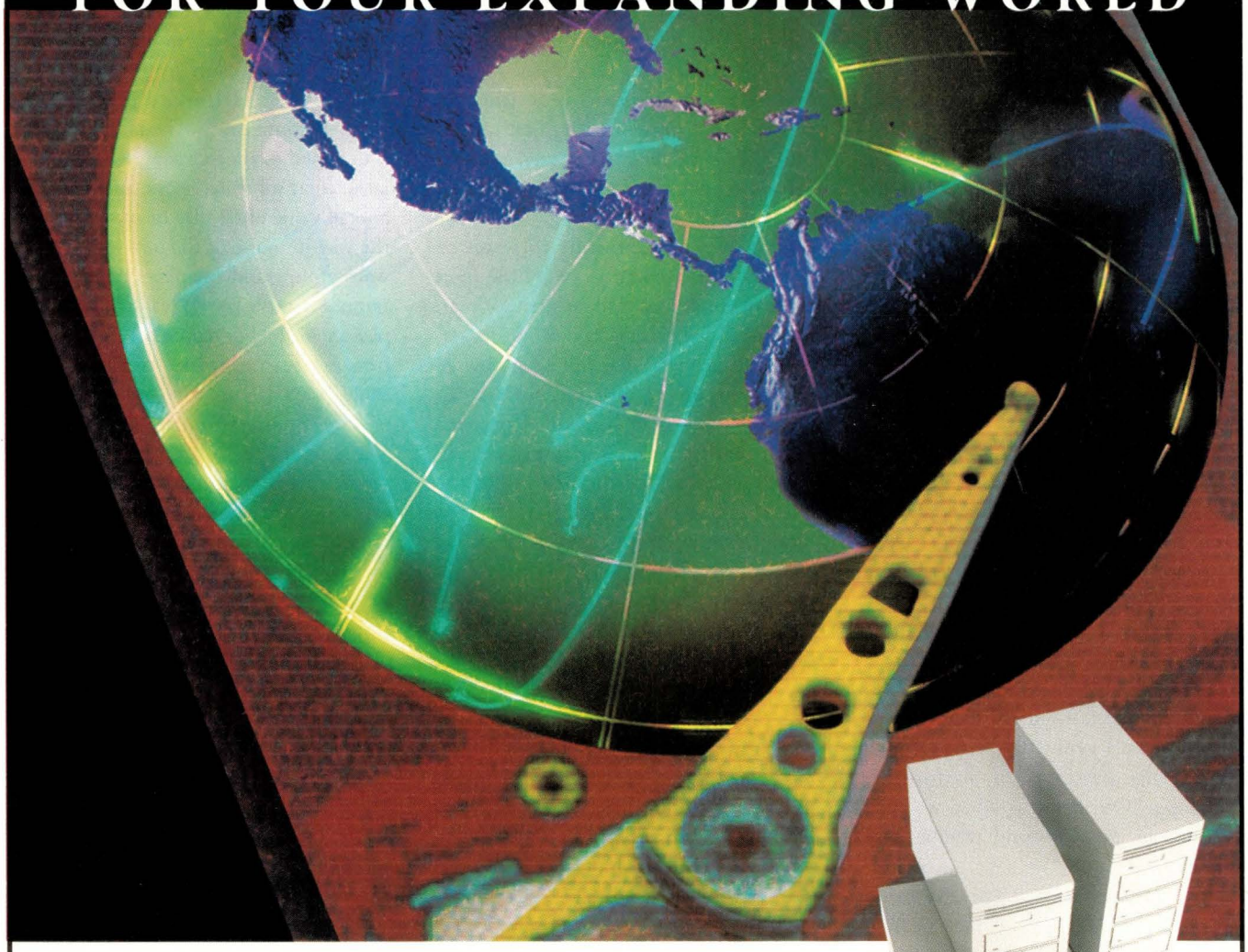

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pany announced that not only would its popular Web clients, Navigator and Communicator, be free to users, but so would the source code for Version 5.0 of the Communicator suite. The change in pricing matches Microsoft's policy of not charging for its browser, Internet Explorer (IE).

Navigator has been steadily losing market share to IE, but by many accounts still ranks as the most popular browser used on the Web (the latest figures from market research firm Zona Research Inc., Redwood City, CA, for September 1997, showed Navigator with 62% to IE's 36% market share). What surprised Netscape observers most was the decision to give third-party developers the source code for Communicator 5.0 developer release, expected by the end of first-quarter 1998. The only stipulation is that developers would have to post their modifications to a Netscape-run developers' site. This would allow the company to use enhancements in its own reference release of the product.

"We have significant leadership in the client [market] share, and we want to retain and grow that," says Marty Cagan, vice president of platforms at Netscape. "Our belief is when we compete on an equal ground pricing-wise, we win."

In other news, Netscape still hopes to release its 100% Pure Java browser in the first half of this year. Specifically, the company has tentatively planned to have the browser, commonly referred to in the press as Javagator but called Maui in Netscape circles, available in beta release this month, and then in final code by the end of June. "Those are the dates for now," says Edith Gong, group product manager at Netscape. "That's the plan. It may change as we're working on the product, but that's where we are at this time."

One possible hitch in Netscape's delivery plan for the Java browser is the restructuring the company is going through due to recently reported financial difficulties. Netscape reported a net loss of $88.3 million for the fourth quarter of 1997. The company has begun layoffs and closing certain facilities (reports are of 300 planned layoffs). One of the people to be handed a pink slip is a software engineer who was working on the Maui project. The former Netscape employee believes if the project was ongoing, there would be no need to look for a new job. Both Netscape and Sun Microsystems Inc., co-developer in this endeavor, strongly deny that the layoffs will shelve the Java browser, and they intend to deliver it this year. "We are committed to it," says Gong. "It's a project that we will continue to resource. We're probably going to be a little more creative in the resourcing of it. We are going to deliver that product."

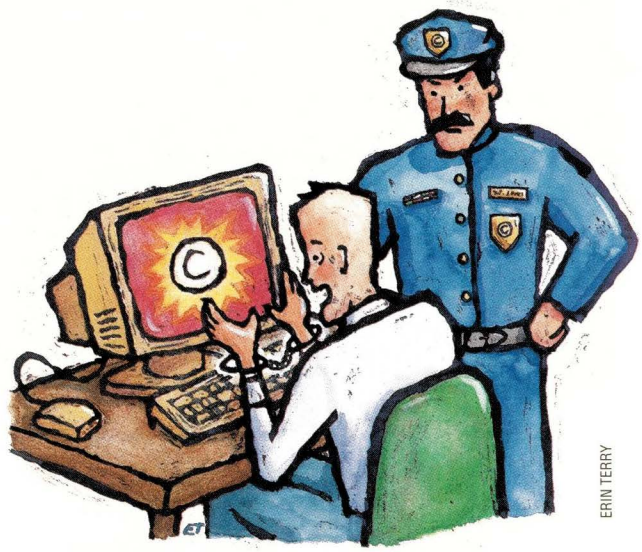
Netscape says Maui will be a browser-only component targeted toward the fledgling Java-based Network Computer (NC) market. Netscape hopes that its Java browser will be the first product to use the company's next-generation rendering and layout engine that will come in the form of a JavaBean. This new technology, code-named Gemini, will also be used in future versions of Communicator, the company says. Netscape has reportedly decided to stop developing Java Virtual Machines for all the platforms that Navigator runs on. Instead, an open API will be created for Communicator 5.0.

When Javagator was originally announced in August 1997, Netscape stated that it planned to release the product by the beginning of 1998. The company says that there are no major problems with its development, and that the original announcement only outlined the company's hopes for delivery.

"To be 100% honest, I thought Java was supposed to speed up application development," quips Zona's Ron Rappaport, regarding Netscape's failure to deliver the browser before the beginning of the year. "There could be any number of reasons [for the delay], but in order to step up support for Java-based NCs, this product should roll out ASAP."–*ptc*

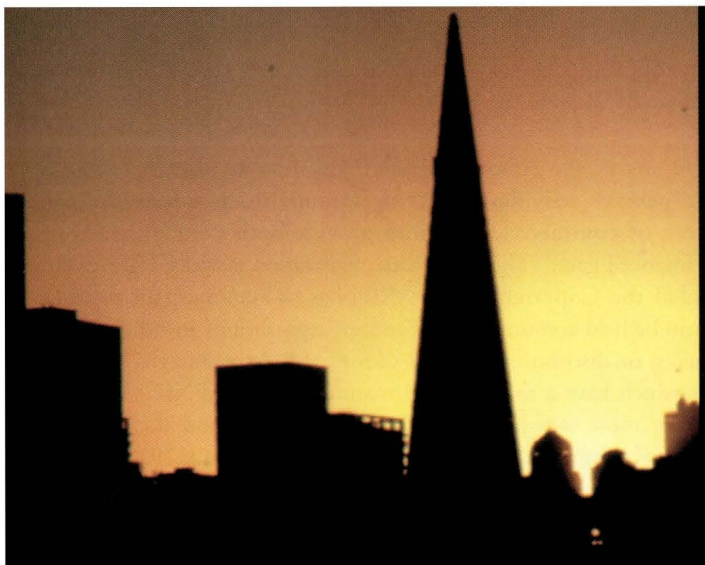
Internet Copyright Law Signed

On December 17, President Clinton signed into law the "No Electronic Theft (NET) Act," resulting in cheers and groans from different parts of the Internet community. The new legislation is designed to protect copyrighted material–such as software, music and text–with a retail value of $1,000 or more. Leading the way in praise of the new law are software groups and members of the entertainment industry. "President Clinton's passage of the bill represents the start of a new era for electronic commerce and trade," says Robert Hollyman, president of the Business Software Alliance, Washington, D.C., an organization representing software manufacturers' interests. "We applaud his leadership on the critical issue of copyright protection."



ERIN TERRY

The NET Act is also seen in a positive light by Internet service providers (ISPs). Under this law, ISPs would not be penalized for copyright infringement of others' property by their customers, and added protection could create an environment that encourages providing content on the Internet. "[NET] doesn't impact us too much because we're hosting for people that it would impact," says Bill Southworth, chief executive officer and chairman of HarvardNet Inc., an ISP based in Harvard, MA. "Potentially, it will make it safer for people to do a greater degree of publishing, so it could have an indirect effect on us."



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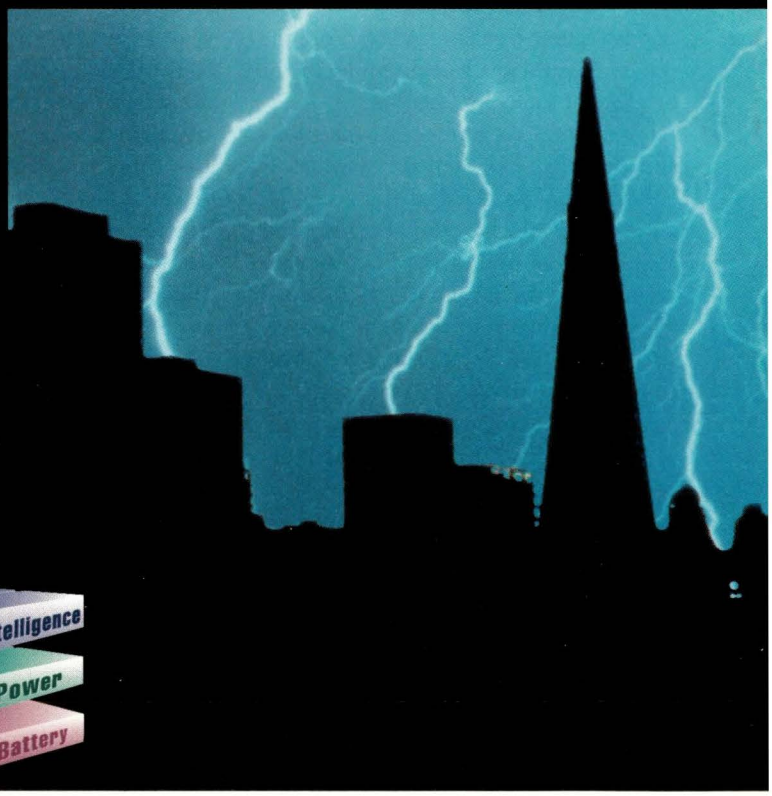

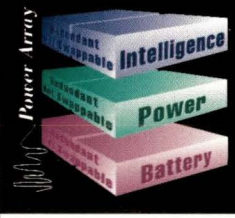

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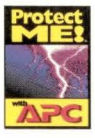

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Circle No. 10

Not everyone is happy with the legislation. The Association for Computing Machinery (ACM), a New York-based group of scientists and computing professionals who support the free exchange of information and ideas across the Internet, say the law was hurried through the legislative process. The group believes the act would make it illegal to transfer information protected under the U.S. "fair use" doctrine and restrict scientists from making their research available on the Internet for use by colleagues and students. Also, the organization feels the penalties are too severe and the law is not specific enough in determining the level of copyright infringement. "We feel the penalties are quite draconian," says Barbara Simons, chair of ACM. "And the way to determine a federal misdemeanor or a federal felony is rather 'iffy.'"

"This raises a number of questions and concerns, not the least of which is enforcement," says David Anderson, an attorney with the law firm of Christy and Viener in New York. "It appears we have been handed simply another overly broad federal criminal statute which the government will be free to employ against those relatively small percentage of offenders it deems worthy to prosecute."

Under NET, a person who willfully infringes on copyrighted material worth at least $1,000 could be subject to criminal prosecution even if they do not profit from their actions. For making one or more copies of material with a total retail value of at least $1,000 but less than $2,500, the violator could be imprisoned for up to one year and fined up to $100,000. For copies with a retail value of $2,500 or more, the violator could be imprisoned for up to three years and fined up to $250,000. A second offense could lead to a prison term of up to six years.

NET was created to close a loophole in the law that allowed the distribution of copyrighted material by people who weren't profiting from it. The most often cited case is that of David LaMacchia, who as a Massachusetts Institute of Technology graduate student set up an electronic bulletin board where he disseminated copyrighted software without consent, free of charge. LaMacchia was prosecuted but not found guilty. The main reason was the law at the time required proof that a person's activities were for the "purpose of commercial advantage or private financial gain." The NET Act has amended the Copyright Act so that a person can be held accountable for the reproducing or distributing of copyrighted works which have a total retail value of $1,000 or more, not just for infringing on a copyright for financial or commercial gain.–*ptc*

IP Numbers Game

If you want to register a new domain name, it's still a bargain at about $100 for two years. But if you need a new block of IP addresses, it's going to cost you a few grand. That's because Network Solutions Inc., Herndon, VA, the public company that formerly oversaw both the assigning of IP addresses and domain names, has bowed out of the address registration business. Instead, a new, nonprofit organization, the American Registry for Internet Numbers (ARIN), will take on the task of doling out blocks of IP addresses to Internet service providers (ISPs) and corporations for fees ranging anywhere from $2,500 to $10,000. Previously, IP addresses were assigned free of charge. The fees will be used to fund the operation of the registry and may be reduced if ARIN produces a budget surplus.

Dave McClure, executive director of the Association of Online Professionals, Alexandria, VA, doesn't think the fees are excessive: "Certainly, $2,500 for a block of 8,000 individual addresses is not unreasonable."

The minimum number of host addresses that ARIN will sell is a block of 8,192 (the equivalent of 32 Class C addresses), so customers who need only a few IP addresses–such as a small businesses or ISPs–must still purchase them from a larger provider. It will be up to that provider to decide whether or not to pass along the ARIN fees.

ARIN, based in Chantilly, VA, has been in the planning stage for nearly three years, according to Dave Graves, director of business affairs for Network Solutions. "The Internet community started to question whether there was any real operational need to have the same entity provide both domain name and address registration services," Graves says.

ARIN has two counterparts that handle address registrations in other parts of the globe: the Asia Pacific Network Information Center (APNIC) in Tokyo, established in 1993, and the European registry service, Réseaux IP Européens (RIPE) in Amsterdam, which opened its doors in 1989. Like ARIN, both are nonprofit, member-run organizations.

The Internet is undergoing a major makeover, with the opening of a new IP address registry for North and South America, and the unveiling in January of the U.S. Department of Commerce's plan to overhaul the domain-name registration process. Representatives from ARIN, APNIC and RIPE will all serve on the board of the new, not-for-profit organization to oversee the registration of IP addresses and domain names.

While ARIN's mandate to assign IP addresses won't be affected by the new plan, the fate of Network Solutions will. Under the proposal, two types of top-level domain-name registration entities will be established–*registries* charged with maintaining the database for each top-level domain, and *registrars*, which will provide registration services to end users. Network Solutions will retain its position as the registry of the `.net`, `.com` and `.org` domains, while new registries will be created for each additional top-level domain that is proposed. However, Network Solutions will lose its exclusive right to be the registrar of the `.net`, `.com` and `.org` domains and will have to compete with other registrars for business–presumably by offering lower prices and value-added services.–*sjh*

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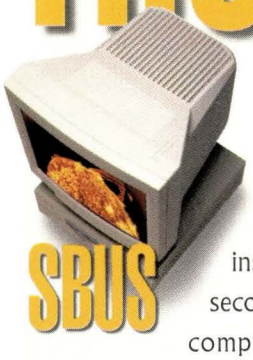

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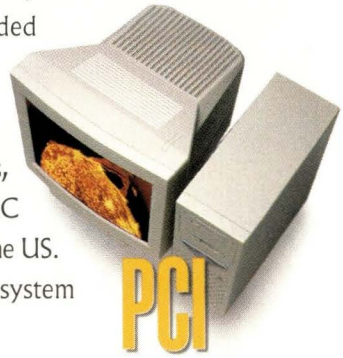

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Circle No. 11

quency. According to David Ferris of Ferris Research, a market research firm in San Francisco, CA, about 50% of organizations today are now migrating to a new messaging platform.

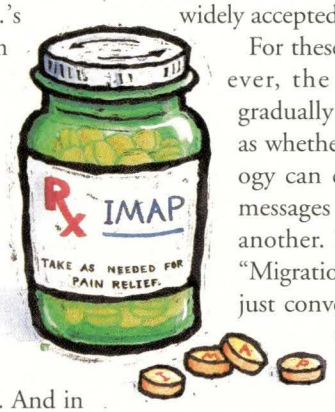
This harried state of affairs is nothing new, says Ferris, "it's been true for the last 10 years." The reason? "Companies are constantly merging with other companies that use different products, and they are constantly updating to newer technology."

These days, when an organization decides to adopt a new email system, it tends to lean toward one that also includes groupware capabilities, says Bruce Robertson, program director of the Meta Group's Global Networking Strategies Service, Stamford, CT. "People are looking for more than just mail," Robertson says. They also want features such as calendaring, discussion groups and directories. Examples of these sorts of groupware systems include Lotus Development Corp.'s Notes, Netscape Communications Corp.'s Internet Mail Server and Microsoft Corp.'s Exchange.

Meanwhile, says Robertson, organizations tend to leave behind LAN-based systems such as Microsoft (MS) Mail and Lotus cc:Mail, and host-based systems such as IBM Corp.'s Professional Office System (PROFS) and OfficeVision/VM.

Catering to the Sun Microsystems Inc. crowd is Madison, WI-based Wingra Technologies Inc., a supplier of gateways and directory synchronization products. Missive, the company's Internet backbone email switch, has been shipping on the Solaris platform since June 1997. And in January, the company announced migration services to companies adopting either Sun Internet Mail Server or Netscape Messaging Server, and leaving behind MS Mail and cc:Mail.

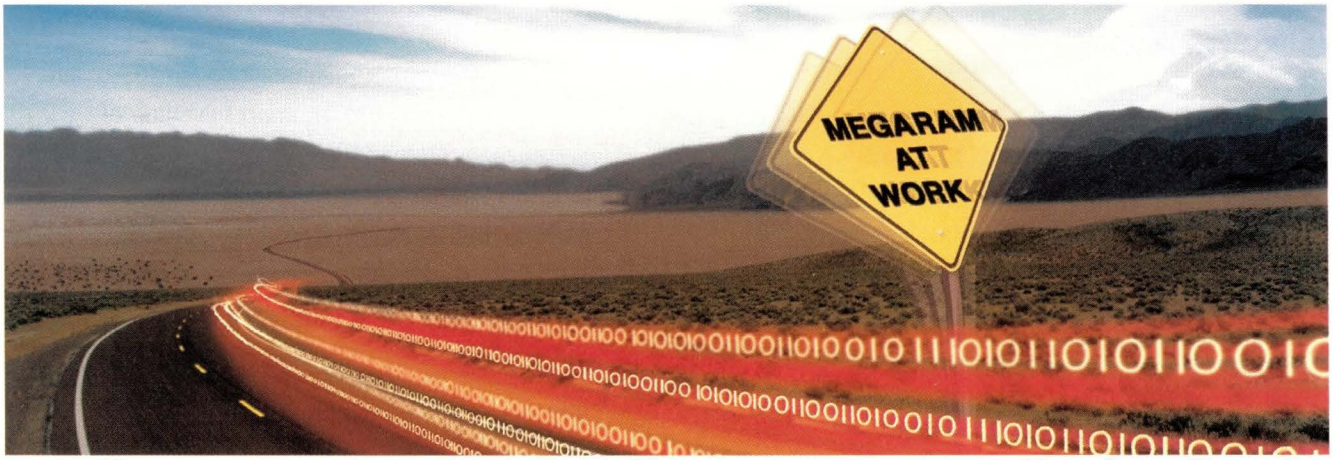
According to Dave Nelson, product marketing manager at Wingra, a lot of companies want to move from several messaging platforms to a single, standards-based system. The Sun and Netscape offerings appeal to them because they are both based on IMAP4, or the Internet Messaging Access Protocol, a widely accepted standard.



For these organizations, however, the ability to migrate gradually is just as important as whether or not the technology can convert stored email messages from one format to another. Explains Robertson: "Migration is about more than just conversion, it's also about coexistence. The larger a company, the longer and more drawn out the migration process becomes. Customers are looking for solutions that require them to make a minimum investment not only in terms of money, but in terms of time and effort."

Wingra apparently agrees with this sentiment, given its newfound focus on services. Organizations can now call on

ERIN TERRY



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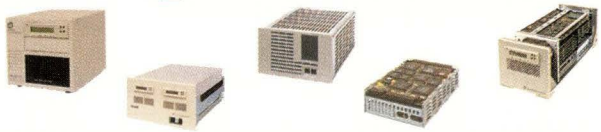

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Wingra not only to provide Missive technology, but also migration planning, infrastructure installation, pilot services, administrator training and rollout. Compare this to the brute-force approach offered by lower-end toolkits and vendor utilities, says Wingra: Less service-oriented approaches often result in substantial disruption to end users.

In the coming year, Wingra also plans to support other target messaging platforms, including Novell Inc. Groupwise, Microsoft Exchange and Lotus Notes. The company is also considering aiding customers in migrating from IBM PROFS and OfficeVision/VM, Digital Equipment Corp. VMSmail, Digital ALL-IN-1, Novell MHS and Global MHS. Pricing for Wingra's Missive technology starts at $50,000 with support for three different messaging systems. Wingra also offers a monthly licensing option when Missive is used as part of a messaging migration; charges vary from $4,000 to $6,000 per month, depending on the duration of the project.–*ab*

Storage Vendors Merge

Storage Dimensions Inc., Milpitas, CA, a vendor of RAID storage systems for the PC-LAN market, and Artecon Inc., Carlsbad, CA, a supplier of enterprise storage solutions for the UNIX market, have announced a merger. The merger is expected to create an open systems storage leader with annual revenues of approximately $170 million, based on recent revenue.

The combination will enable one company to provide enterprisewide server-independent disk and tape storage solutions from the smallest PC-server workgroup to the largest UNIX superservers in the data center. Artecon's network-attached storage products will now be available to Storage Dimensions' customers, and Storage Dimensions' tape backup products will support UNIX environments.

"With Storage Dimensions and Artecon, there really is a merger advantage in some of the technology that they already have. Artecon has some network-attached storage and some Fibre Channel products, which I think would merge nicely with Storage Dimensions' products. So there is a synergy as well there for the companies and, of course, combined they're now a larger force in the storage market," says Dennis Casey, analyst at Strategic Research Corp., Santa Barbara, CA.

Because Artecon is well-known in the UNIX market and Storage Dimensions in the PC-LAN field, a new name for the combined companies has not yet been established. Criss Marshall, vice president of corporate communications for Storage Dimensions, reports that the merger will not affect current resellers of either company.

James Lambert, president and chief executive officer of Artecon, will assume that same role in the merged company. David Eeg, president and chief executive officer at Storage Dimensions, will work closely with Lambert to ensure a smooth transition. The merger is expected to be completed by the end of March.–*mm*

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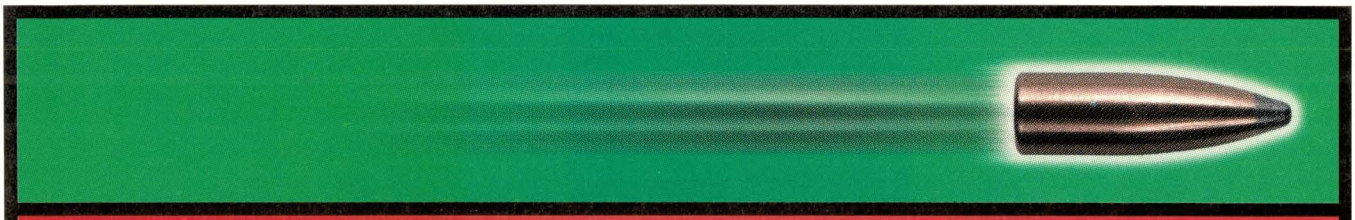

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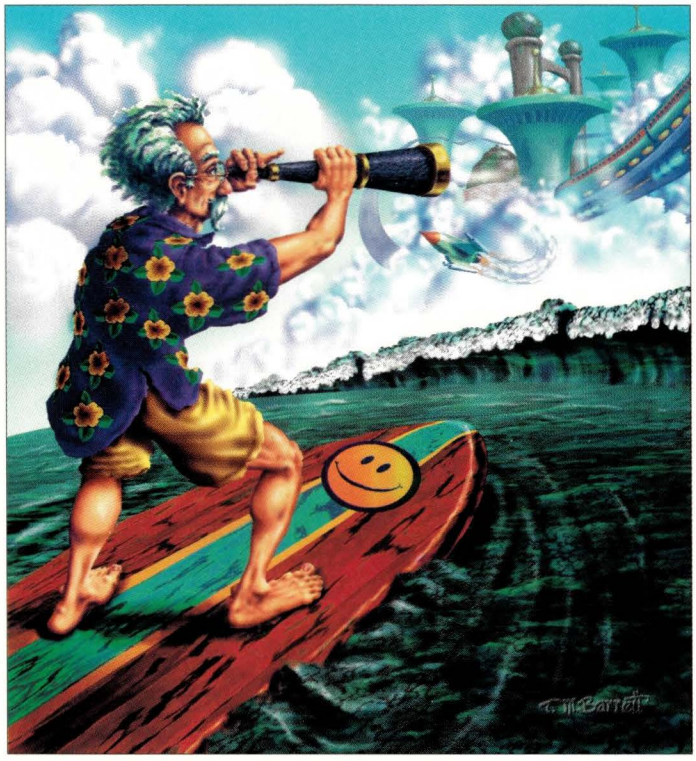
Circle No. 14

Ask Mr. Protocol

by Michael O'Brien



TOM BARRETT

"It'll never fly." – Someone wrong

"It'll never fly." – Someone right, under different circumstances

"The all-diesel kitchen of tomorrow!" – Cairo World's Fair 1938

Mr. P. and the Boring '90s

Q: *I have to say that, incomprehensible as he is, Mr. Protocol has always been the most even-tempered–whatever–I've come across. Why is he macerating that magazine article?*

A: Same reason you'd do it: He's irritated. He's been reading one of those unfortunate articles by glassy-eyed people trumpeting the march of technology, and it's all gotten a bit much for him. He lives life on an Internet timescale, and he's bored, bored, bored. Complains there hasn't been any spice in life since the cutover from NCP to TCP/IP. Stories about gigarouters bore him to tears. We were in the supermarket the other day, and an advertisement that temporarily interrupted the Muzak read out a URL. I thought he was going to throw the shopping cart through the nearest loudspeaker. Then he ran out into the parking lot, screaming "URN! URN! With festering boils, die! U-R-N!" I think he's discouraged in that particular case by the failure of Uniform Resource Name technology to keep up with the distribution of Uniform Resource Locators, which were never intended for humans to see or use.

It's all emblematic of a slowdown in a certain type of technology, one that almost no one seems to have remarked on. I don't know if it's journalistic laziness, or because it goes against the current religion, or what. Look at it this way: How often have you read some report that mentions how amazing things were for our grandparents? You know the sort of thing–"From horse and buggy to transcontinental jetliner in one lifetime! Zowie!" It's all true enough, but it's so trite by now that most editors throw the copy back with orders to get rid of 300 words of excess baggage without thinking twice about it. If you look at the history of those stories, though, there's a much more revealing truth.

Originally, those stories were part and parcel of the "iron foundry uber alles" pro-technology outlook that the Western press followed without question back in the days of Empire. It led to such pieces of nonsense as the university graduation speech that extolled the virtues of pushing out the decimal places now that all of the fundamental truths of science had been uncovered. It was easy enough to string together a staggering list of real-world accomplishments that, after all, represented the best technological runup the world has ever seen.

Around 1955 or 1960, though, those 20-minute public-relations films that were shown on Saturday morning under the title "Industry on Parade" (probably because animation was still too expensive to produce in sufficient quantity to fill up the time slots after Buffalo Bob and Andy Devine's extraordinary talents) began to pall. I mean, not only does watching a bottling plant run full-tilt become mind-numbing in pretty short order, but the steel plants and automated factories shown in those films looked...old!

Well, they were old, after all. They'd seen us through World War II while we stomped all the factories in Europe and

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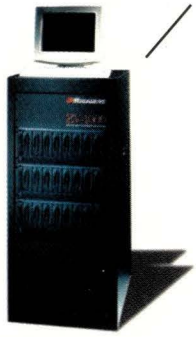

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Japan flat, so after those got rebuilt, the Rust Belt was pretty much a certainty, at least, after they figured out how to use those new factories to make structural steel that didn't have great big flaws in it, which only took 20 or 30 years after that. Funny how nobody talks about that, and everyone pretends there was just nothing going on in between the Marshall Plan and Deming's quality management.

Those were the golden years when Don Martin in *Mad Magazine* instructed us in the amazing noises that really big things make when they fall down, and that's no coincidence. But aside from all that, there just wasn't the quantity of whizzo technology that there used to be. In the old days, it seemed to flow right from the workshop to the streets, bypassing the laboratory completely most of the time.

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From Horses to Airplanes

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From 1950 to the 1990s, what we mostly get is the Defense Interstate Highway System. Eisenhower kicked it off, and it's only mostly finished today. It is extremely unlikely that it will ever be truly "finished," because the planners never get exactly what they want, and a lot of students of inner-city neighborhoods now believe they shouldn't have gotten nearly as much as they did in the first place. Be that as it may, now we have a road system that's truly national. Cars haven't changed much, except they're a lot more energy-efficient, a lot lighter, and you can ram them together at a lot higher speed and have a lot better success at putting the passengers back together afterwards.

No big technology has come along to replace cars. Popular Science has been unstintingly, courageously and consistently wrong for 100 years: Personal fliers aren't here and likely never will be. That niche has been too well filled by the airplane, which is the big long-distance people mover. If you've got the money, and you need to get yourself (and not too much other stuff) from here to there in a hurry, you do fly, but you don't do it by yourself.

That's the airplane, the other big

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Circle No. 17

transportation success story of the first half of the 20th century. In 1900, zip. You want to fly, you jump off something tall. A once-in-a-lifetime experience. Or you take a hot-air balloon. Now you're talking! You can stay up for days. Where you come down is mostly a matter of conjecture. Sometimes the results are the same as Method A.

By 1950, we have cross-country aviation, and we're beginning to think about replacing prop planes with jets. This conversion does change commercial aviation from a service used by the hardy and necessitous to one used by the common run, but it's a much smaller change than the change from no airplanes to a commercial fleet.

Or consider the field of medicine. In 1900, we could cure practically nothing. In 1950, almost all infectious diseases were within our scope, and immunization was a standard public health regimen. Surgery was a going concern, and although anesthetic was not unknown in 1900, few, if any, surgeries could be considered "routine." By 1950, operating rooms ran on a schedule.

To be sure, there have been many medical advances since 1950, including practically everything in the way of cancer treatment: imaging techniques, radiation and chemotherapy, the works. But while genetic engineering is definitely out of the starting gate, it will take the next 50 years to show us fundamental gains, and most of the gains in the fight against heart disease have had to do with prevention rather than cure. Mind you, if what you happen to have is something for which a recent cure has been found, these sorts of arguments are not likely to carry a lot of weight. On the whole, though, most medical miracles happened between 1900 and 1950. Ironically, the only clear way for genetic engineering to save as many lives as penicillin does, would be to engineer an immortal strain of the tobacco mosaic virus and destroy the world's tobacco crop. This effort is unlikely to win much support in the House Science and Technology Subcommittee.

How sure are we that this isn't being undertaken as a basement science project, anyway?

Mr. Protocol is glad you asked. Not sure at all, at all.

In military technology we have a sort of special case. It's not clear that anything in military technology could be said to better the human condition, but if there were to be a counterexample to the argument that everything happened in the first half-century, this would be it. In the first half-century, we had two world wars. In the second half-century, we've had a whole bunch of bush-league wars, and a really zippy technology to make sure that anything bigger than that would be a really, really bad idea.

Everyone believes that the arguments of the peaceniks in the '60s and '70s were straightforward, and you either agreed with them or not. Nothing could be further from the truth. The doctrine of Mutual Assured Destruction, a type of political thinking so loathsome that even the straightforward antiwar activists could only debate it through parody, did in fact operate completely successfully throughout the Cold War, merely because the planners on each side agreed that it should. That this exercise in voluntary schizophrenia should ever be accounted a success will stand as a pivotal point in human history, overshadowing practically every other accomplishment of the entire century. History will determine whether those who operated under its guidelines are painted as heroes or villains, but MAD did give us one other pivotal piece of 20th-century technology: games theory.

Movie Mania

In the field of communications, the first half-century gave us radio. The second half-century gave us television. One could argue either way here, but hearing live events as they happen around the world, versus seeing and hearing them, seems to Mr. Protocol to be a matter of protocol. Is the gap from nothing to radio larger than the gap from radio to television? On the whole, Mr. P. believes that it is. The difference is similar if you regard the Internet as a natural outgrowth of the phone system, which still carries most Internet traffic anyway (as television is a specialized form of radio). The difference between having to travel two weeks or two months to speak to someone, versus calling them on the telephone, is probably more profound than the difference between talking to someone on the phone and putting up a Web page.

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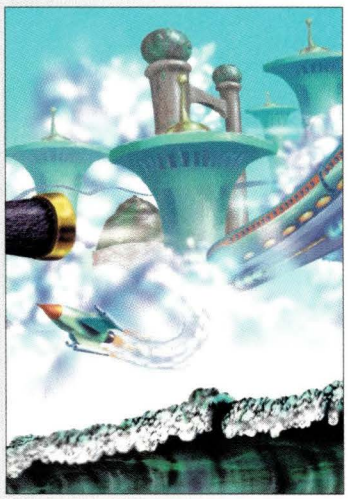

Motion pictures are a sterling example of technological slowdown. When they were first invented, they were a novelty. Entrepreneurs purchased not only films, but the equipment to show them, which was of necessity portable, as there were no "picture palaces" yet. Instead, movies were a vaudeville act, slotted in between the Sweet Belle of Savannah and the Incredible Barking Boy. It would be hard to overestimate their impact. One of the earliest movies was taken by a fellow who set up his camera in the middle of train tracks and waited for a train. He either leapt out of the way at the last second or yanked the camera away with a rope, it would be hard to say which. The result was all he could have hoped for. In spite of the lack of sound and color, audiences screamed, fainted or ran out of the theater according to personal inclination. One fellow is reported to have jumped to his feet and yelled, "Hold on, boys! She's going to hit!"

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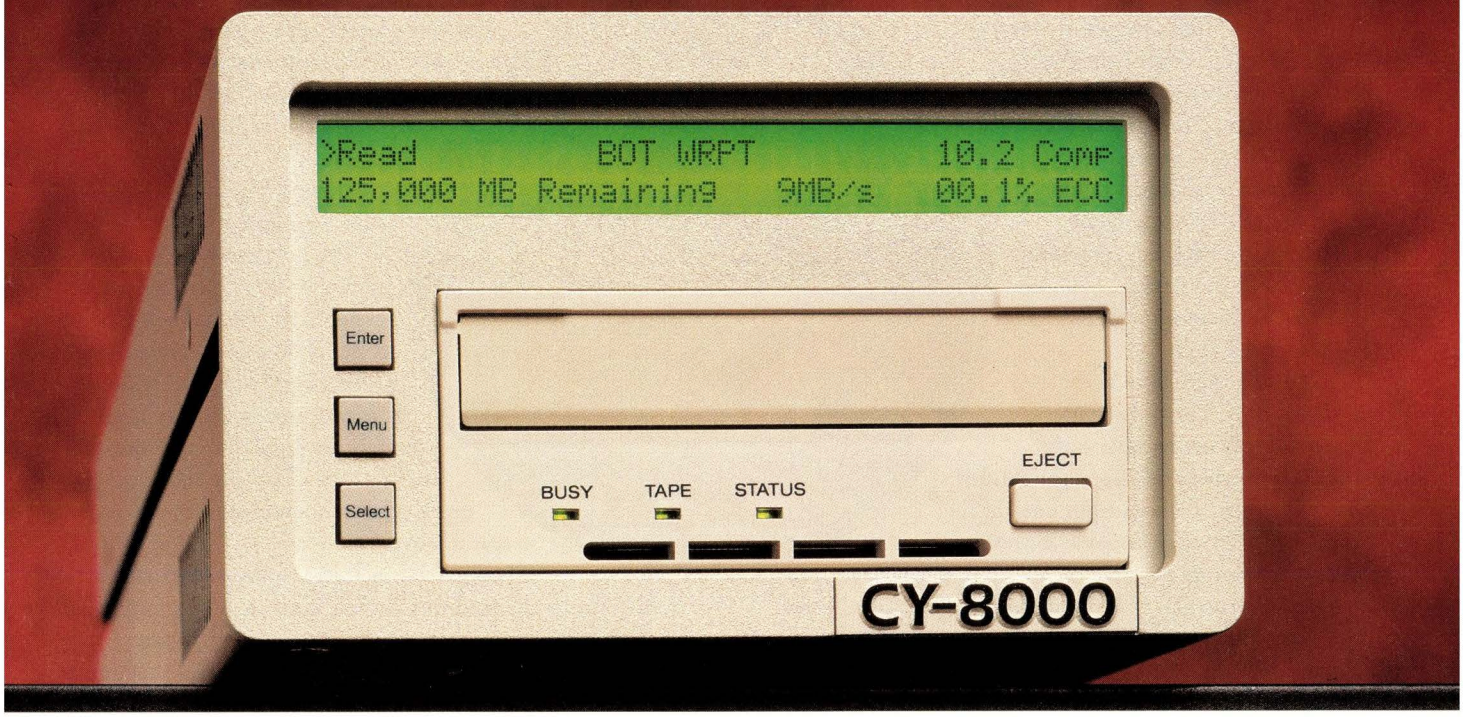

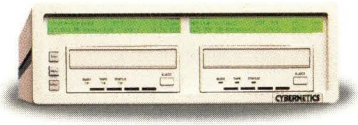

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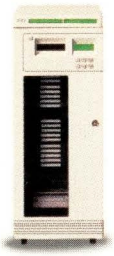

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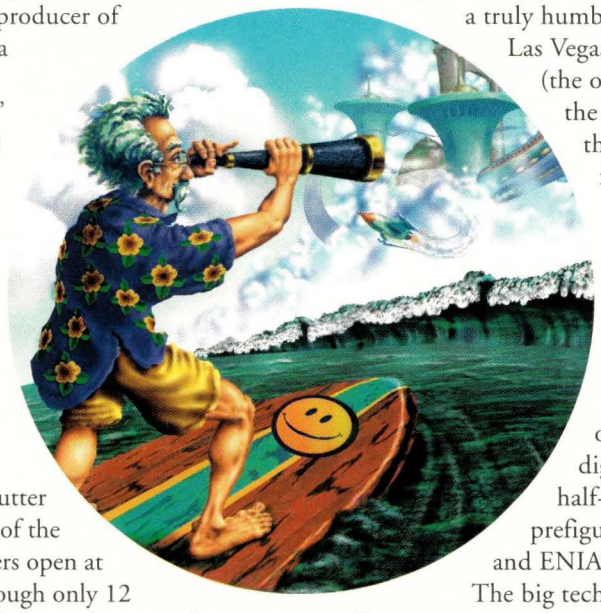
movieland in the latter half-century has been to replace the original tinny speakers with something like a modern sound system. The original soundtrack, encoded optically onto film, was replaced in around 1950 with a magnetic stripe. The first "mag-stripe" film, literally produced in a garage, was made by Arch Oboler, producer of "The Shadow" radio shows. It was a delightful adaptation of the Henry Kuttner short story, "The Twonky," starring Hans Conreid. Another 30 years or so had to go by before Dolby Logic introduced Dolby stereo, encoded on a separate magnetic tape synchronized with the film, and Industrial Light and Magic came forward with the THX sound system.



To be sure there have been improvements. The old silents appeared to flicker because early projectors opened and closed the shutter slower than the "flicker fusion rate" of the human visual system. Today's shutters open at a rate of 24 frames per second, although only 12 frames of film actually move through the projector in this time: Each frame is shown twice. This frame doubling is responsible for hideous visual artifacts in animation, which has no blurring due to motion. Computer-generated special effects have only begun to look "real" since "motion blur" was calculated and added to the film. (Trivia alert: "Dragonslayer" was the first film to do this.)

Special effects master Doug Trumbull has come up with a new type of movie, shot on 70mm film stock at a rate of 60 frames per second with no frame doubling. This type of movie, called Showscan, is like looking through a window and makes regular movies look ridiculously primitive. It's going nowhere because it requires all the old projection equipment to be junked. If you want to see Showscan, you'll have to go to one of the few Showscan theaters, which at present are set up as motion simulator thrill rides near amusement parks. There's one just outside the gates of Universal Pictures Studio Tour in Los Angeles, and another as one segment of the three-part attraction inside the Luxor Hotel in Las Vegas.

The Luxor itself is worth a look. The first skyscrapers were produced at the end of the last century, and the efforts of those like Paolo Soleri notwithstanding (Soleri developed the theory of "arcology," a concept of cities that embody the fusion of architecture with ecology), not much fundamentally new has happened in architecture since then. It isn't that technology hasn't progressed, it's just that no one has found a more economical way of throwing up more interior space in less square footage than a skyscraper. Consider the Luxor. Rip out all the really tacky stuff inside (Showscan unfortunately included: The film shown in that theater will remove actual IQ points), and what is left is an architectural triumph. It is a completely hollow pyramid of incredible size with no internal roof or wall supports whatsoever. From any point on the interior floor, you have an unobstructed view of all four walls, all the way to the apex. Even elevators have been eliminated. Instead, "inclinators" move up the four edges of the pyramid, at an angle of 37.5 degrees. It is a truly humbling accomplishment, making the Las Vegas kitsch inside even more irritating (the only really worthwhile content is the reconstruction of Tut's tomb in the basement, which is definitely first-rate).

So, what's going on here? Or, what isn't going on, and why?

I've purposely skipped computers to this point, which has exposed me to a ceaseless barrage of empty Big Stuf Ding-Dong cartons from the general direction of Mr. Protocol. Stored-program digital computers hit at about the half-century mark just about exactly, prefigured by such machines as Colossus and ENIAC.

The big technological innovations of the first half-century changed human life directly. Autos took people places, antibiotics cured them, airplanes flew them, telephones let them talk to people whose voices they might not otherwise hear again in their lives. Computers don't work that way. Very few people have had their lives as dramatically influenced by computers as they have been influenced by these other developments. Certainly, computers have reshaped the retail and banking industries, so in that sense they affect how and where we shop and bank. But we don't deal with the computers. They affect businesses, and the businesses affect us. We still shop, we still bank and we still go to the same places to do it. Up until the Internet came along to give them a purpose, most home computers were no more than adjuncts to other home activities and, in many cases, they were pure toys.

The Internet – Nothing New

So what about the Internet? It bucks the trend, certainly. It could be viewed, as I said above, as an extension of the phone system. It doesn't put any more people in contact than there were before. In fact, it could be argued that all it does is provide more players in the "information content" game than could be accommodated in the radio broadcast régime. For one-to-one contact via email, it provides something between the telephone and the postal service. Viewed this way, nothing it provides is fundamentally new; new in some ways, of course, but not fundamentally new. You and the Zulu tribe aren't in any better communication. You can view the Finn-Russian border in real time, but it doesn't give you access to the Stasi archives. Is there anything fundamentally new it can give you?

Mr. Protocol thinks we've all been fooled by this "march of technology" nonsense. Technology doesn't march. It

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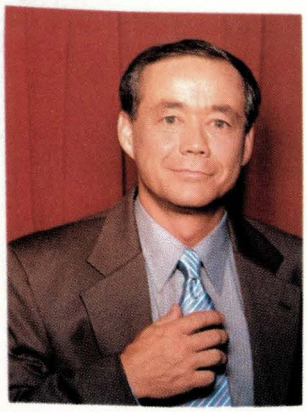

Thomas,
Legal Department

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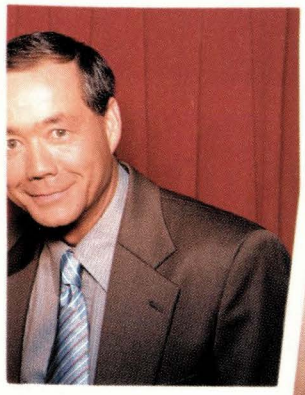
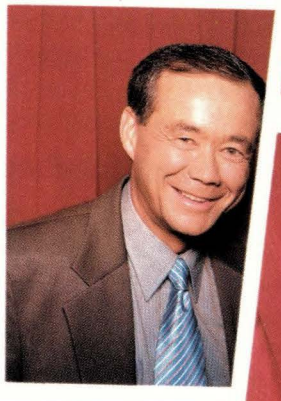
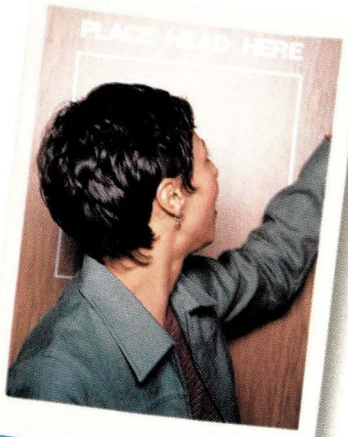
in 10 years.
His computer files
are another matter.







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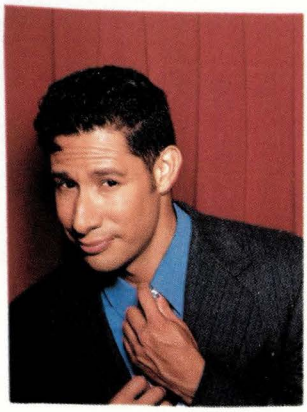

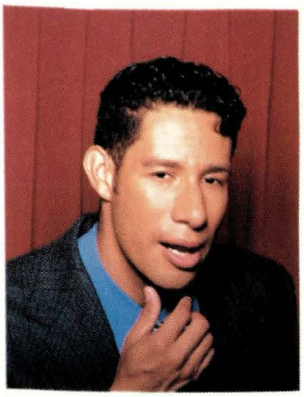

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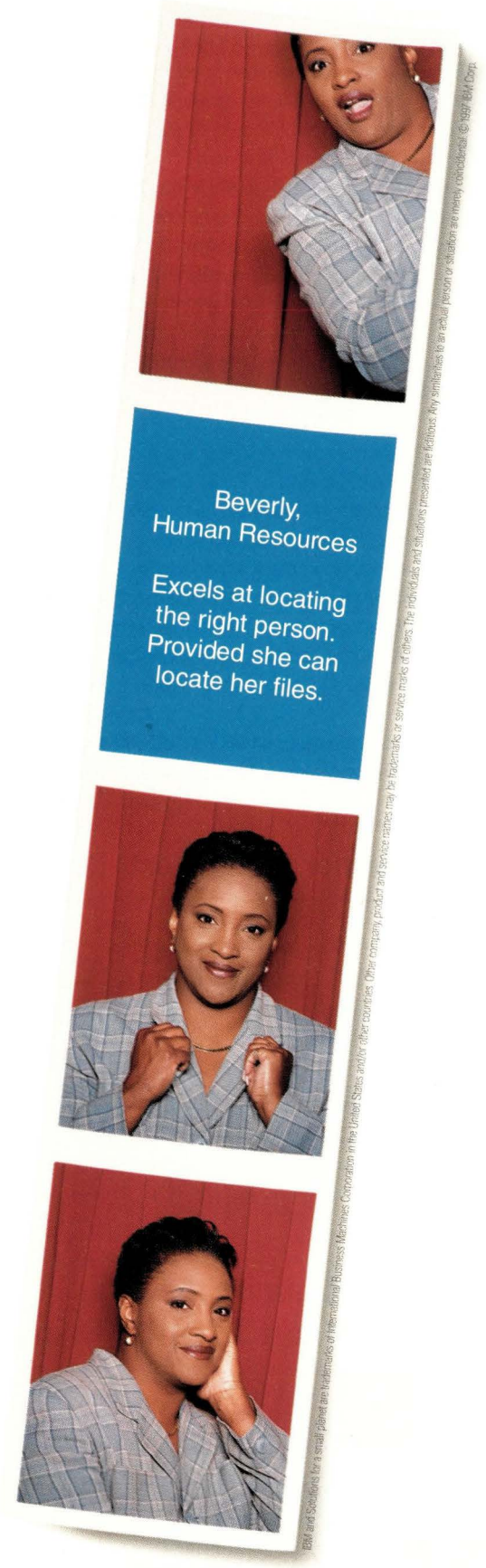

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proceeds in fits and starts. We had a whole bunch of fits happen in the first half of this century, more or less by accident. There'll be more fits to come; right now we're in sort of a lull. Some new advances are needed before we can expect further fundamental changes in our way of life. The Industrial Revolution was already complete by the time most of the changes of the first half-century came about, but its social effects hadn't come to roost yet. We're still working them out. But there are definitely more fundamental changes to come.

We need cheaper energy. Energy costs will have to fall by a factor of at least 10 before we can contemplate sustaining our current rate of consumption, let alone changing to a more energy-intensive way of life. We know perfectly well how to live a less energy-intensive life; some excellent scientific work done in the '60s and '70s has shown us how to do that, and some people have adopted this way of life by choice. Some of its tenets, such as recycling, have been adopted en masse. Research continues into alternative energy sources, so far either fugitive (fusion) or not cost-effective (wind and solar). A thousandfold or ten-thousandfold drop in the cost of energy seems more likely for a really big advance, and that would change our lives plenty.

We need more portable energy. Current energy-storage techniques are miserable. The problem is that you can store plenty of energy in a small space, but it's very dangerous. It's hard to keep it from letting go all at once. We've had hydroxy fuel cells for decades but they tend to blow up real good if you whack them hard enough, like in a traffic accident.

We need room-size quantum effects. Every time we get a quantum effect we can actually see, like semiconductors or superconductivity, things begin to get really interesting.

Genetic engineering. Just wait.

In the meantime, we'll do what we always do: consolidate and integrate. And that's where the Internet comes in. It's the greatest consolidator and integrator of information ever devised. It can act as a coupled set of machines, as in the Great Mersenne Prime Search, or as a mostly uncoupled sea of information to be mined. The Internet isn't a life-changing technology, really. Instead, it allows us to use the technologies we've already got to their fullest. ⊸

Mike O'Brien *has been noodling around the UNIX world for far too long a time. He knows he started out with UNIX Research Version 5 (not System V, he hastens to point out), but forgets the year. He thinks it was around 1975 or so.*

He founded and ran the first nationwide UNIX Users Group Software Distribution Center. He worked at Rand during the glory days of the Rand editor and the MH mail system, helped build CSNET (first at Rand and later at BBN Labs Inc.) and is now working at an aerospace research corporation.

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

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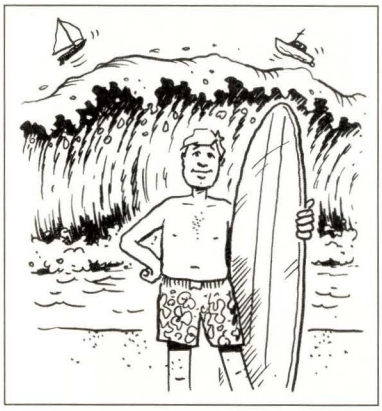

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Stop the Spam!

I'm becoming increasingly annoyed by spam, or to give it a somewhat less trademark-intensive name, unsolicited commercial email. I've been on the Net for about 10 years now, and my email address always seems to find its way into the clutches of the spam dispatchers. Over the weekend, my mailbox is deluged with tons of unwanted mail, all of which costs me time to scan and delete.

There's a huge danger that the world email network will simply become clogged with all this junk, that it will become less and less useful as a way of communicating with real people. One way to deal with the flood of messages is to simply ignore them, and I guess this seems the line of least resistance for many people. Ignoring the message is probably better than replying to the invitation to excise oneself from the list by returning a "remove" request. Many people are deeply suspicious of the efficacy of asking to be removed. After all, it's a good way for the spammer to see that the mail has arrived.

I suppose that what's most annoying is the inability to stop the mail from flowing in. I've spent some part of this year being essentially mail-bombed by a company in the Midwest who wanted to collect my debts for me. One message was sufficient for me to realize that I didn't need this debt collection service. At one point, I was getting five or six messages each Friday, Saturday and Sunday from this company. It's certain that the person doing this was extremely naive about the Net.

Anyway, this experience has caused me to be more proactive about spam. I've installed antispam measures on my machines and, for the harder cases, I've started to mail the companies who sell the IP service that is used by the spammers, asking them to stop the flow of mail. Many of the larger ISPs now have an `abuse` mail alias intended to allow people to complain, and when I do, they tell me that they have taken action to remove that customer from the Net. Before getting into that, let's look at what you can do at your site.

Most people running UNIX use Sendmail to send and receive mail. If your site uses a vanilla version from Sun Microsystems Inc., then you are well advised to upgrade to the latest version (which is Version 8.8.8 at this writing, see `http://www.sendmail.org`). You should install the newer version anyway because it is certainly more secure than the version you were supplied by your software vendor. Also, the more recent versions have hooks that allow for considerable checking of inbound mail, permitting you to defend yourself against a proportion of spam.

Incidentally, if you are worried about configuration, then Sendmail 8 has an automatic configuration system that works trivially. The new configuration system passes a three- or four-line setup file through the m4 macro processor to create your Sendmail configuration file, `sendmail.cf`.

Sendmail 8 should also be able to use your current configuration file, so from an engineering standpoint, you can drop

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Circle No. 25

in the new binary /usr/lib/sendmail and check that your mail works. You can then create a new configuration file using m4 and check again.

Once you have converted to using the m4 version, life becomes simple. Eric Allman, the author and maintainer of Sendmail, sometimes changes the way the configuration actually works when he releases a new version, and you get these improvements for free by simply reprocessing your m4 configuration file when you install the new release. I've been tracking new releases of Sendmail for some time and have never had any problem. I've always been able to drop in the new release, and things have continued to work as advertised.

The new antispam hooks in Sendmail work by looking at the incoming SMTP connection, so the mail isn't received by your system; it's rejected before you see it. The hooks can be used in several ways. First, you can simply refuse to accept mail from a set of sites that can be entered by name or IP address. I now instantly add the domain name of sites that originate spam, and so I never get more than one piece of mail from that domain.

Second, most sites will relay mail automatically by default. I can very probably send mail to some system on the Net using your machine as a relay. Your mail system will accept the mail and resend it to its destination, and you are completely unaware that this is happening. Free relaying is a legacy of the original precommercial networking days, when mail was moved around the world from machine to machine.

Spammers make considerable use of this legacy. They want to hide the origin of the mail and prevent their mail systems from being clogged by people complaining about spam. They pick some poor unsuspecting machine and send it a single message with multiple recipients. The unsuspecting relay will fan the mail out all over the world, and probably some proportion of the recipients will think that the mail originated on that relay. Notice also that the spammer has sent a single message and has essentially got the relay machine to do all the work of spamming people.

On the whole, there is no reason why your machine should do any relaying now, except to relay mail from machines on your site to the outside world. If suddenly we all stopped relaying mail, then we would force the spammers to originate mail themselves, and this is much easier to stop.

Third, spammers usually forge mail headers to hide their origin. Some of these forgeries create a piece of mail that apparently comes from a site that doesn't exist. Many of the do-it-yourself spam packages select a random number and send mail purporting to come from somewhere like 27793739@8383826.com. The new Sendmail hooks can use the Domain Name Service and refuse to accept mail from addresses that cannot be found. It looks up the name in the DNS and rejects the mail if the name doesn't exist. The rejection is somewhat imperfect because the DNS can take time to obtain information, so the lookup can fail to return a machine name when it is needed. In the case of a lookup failure, Sendmail cannot reject the mail absolutely, so it sends a temporary failure message, and the sender (usually an unsuspecting relay) will keep retrying that message until it times out, usually a week or so later.

At the moment, I find that rejecting mail from addresses that don't exist is a huge antispam win, although the folks that supply me with IP service are perhaps less happy. The mail that I reject ends up on their machine, because they advertise themselves as my secondary mail forwarder. When I reject the mail, it ends up on their relay machine, which tries to send it to me. I continue to reject it, until it eventually times out.

If you want to take these actions with your mail system, or

Antispam Recipes

Eric Allman distributes his own m4 configuration file with the Sendmail release: Look for cf/cf/knecht.mc. The bottom half of this file, from LOCAL_CONFIG to the end, contains the antispam measures that he has installed on his machine.

On a vanilla Sun Microsystems Inc. Solaris system, you'll need to make some slight changes to the way that files are configured. Eric's default setup places control files in /etc, and you will want to put them into /etc/mail. Also, his default file uses the Berkeley db package to provide fast keyword lookup on data files. If, like me, you haven't bothered with this and are using the dbm database system instead, then you'll need to change the word hash in your copy of the section from the knecht.mc file to dbm. Eric was talking about supplying the db system as part of the Sendmail release (for other reasons), so this need may go away.

You'll now need to create two new control files: /etc/mail/sendmail.cR and /etc/mail/domaincheck. The sendmail.cR file contains a list of machines, one per line, naming the machines for which you are happy to provide relaying. If you change this list, then you'll need to restart the running sendmail on your machine.

Domains are accepted or rejected with the domaincheck file. The file contains lines, each holding a domain name and a rejection message:

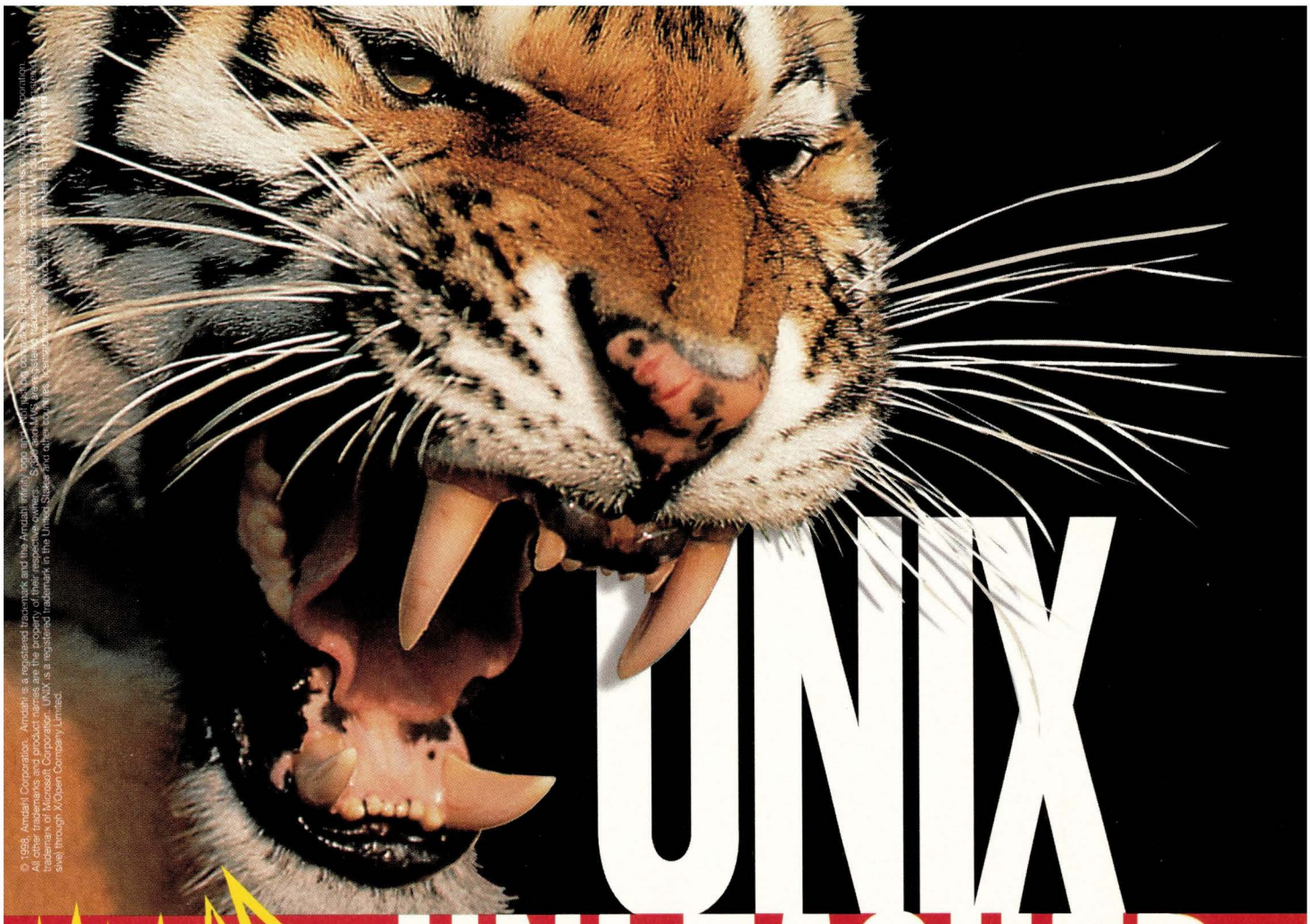
```
.abuser.com    553 Domain restricted
abuser.com     553 Domain restricted
```

There should be a tab character after the domain name. This file is processed by the makemap program. If you are using the dbm package then

```
% makemap dbm domaincheck < domaincheck
```

will create the necessary dbm access files. You can add lines to this file without having to restart the running sendmail.

Now check that your mail works. You must ensure that relaying for internal machines is working properly and also that it fails when someone tries to relay mail through your machine from outside.–*pc*



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Circle No. 44

only some of them, then it's not too difficult. I believe that you should stop relaying mail at the very least. There are some recipes for code to add to your m4 configuration file on the `http://www.sendmail.org` Web pages, and these pages also point elsewhere to other prescriptions. I've found that some of these recipes don't work too well, so I am using Eric Allman's solution, which is distributed with the Sendmail release (see "Antispam Recipes").

Interpreting Mail Headers

These solutions don't make spam go away, but they stop the easy cases from ending up on your machine. The hard cases are where the mail has been relayed and the header has been forged. As we have seen, if the forgery maps to a machine that doesn't exist, then we can ignore it. It's harder to discriminate against mail purporting to come from a real site.

As I said, I've taken to complaining, very politely, to the owners of the machines that originated the message. If you want to do this, then you need to know how to decode the headers that you can see on the message to determine the machine that was used to send it. Looking at the `From:` line isn't good enough; it's probably been forged anyway.

The first thing you need is the complete message with all its headers. Sadly, many mail programs suppress this information. On UNIX, you'll find that the information is very probably available, but you may need to edit your mailbox file to get it. There are so many different mail systems available, it's hard to talk generally about what you need to do to get the actual message that was received by your system. Beware that some systems strip headers when they save messages, so storing the mail may eliminate the information you need when making a complaint.

If you complain, then the ISP will need all the header information to prove to themselves that they are at fault and also to track down the villain. I've also taken to annotating the headers when I send complaint mail, because I find that the first-line support at some ISPs is unable to perform correct decoding.

On my machine, the very first line of the mail was added by my Sendmail program when it received the mail. It will look something like this:

```
Received: from relay.unsuspecting.com
    (relay.unsuspecting.com [279.254.254.254])
    by craggy.hillside.co.uk (8.8.7/8.8.7)
    with ESMTP id IAA06271 for <pc@hillside.co.uk>;
    Sun, 7 Dec 1997 08:11:21 GMT
```

Of course, the line is wrapped for printing. The parts in italics show that I've edited the original mail to protect the people involved in sending me this particular spam message. The line tells me that I got this mail from a machine calling itself `relay.unsuspecting.com`. But there's some confidence that this name is correct because the section in the round brackets is a decode of the IP address from where the mail arrived, and here the DNS reverse lookup succeeded, giving me a name that matched the name of the site. So, assuming I can trust my machine's DNS, I can determine the machine that sent me the mail.

The next two lines get more interesting:

```
From: someone@relay.unsuspecting.com
Received: from relay.unsuspecting.com
    (some.ipseller.net [299.53.52.8])
    by relay.unsuspecting.com (8.7.5/8.7.3) with
    SMTP id BAA28421;
    Sun, 7 Dec 1997 01:06:18 -0700 (MST)
```

The `From:` line is added by the relay mail system using the information that was carried in the SMTP call when it received the mail. The contents of this line are completely bogus and forged by the sender, who has configured their mail-sending program to lie–the `Received:` line underneath it tells us that. The DNS reverse lookup gave a different value for the real name of the IP address of the sending machine. When the sender originated the mail, they claimed to be the machine that was receiving it! Setting things up like this seems common practice with spammed mail. However, we can detect the forgery. The reverse lookup result tells us the IP address of the machine that was faking the mail.

Underneath this active `Received:` line is another one. This is also a fake and was added by the sender in an attempt to hide the originating machine. The body of the mail message and the actual spam follows all the header lines.

Incidentally, don't think that it's always the second `Received` line that is of interest. What's interesting is the point at which the spammer injected the mail into the network, and you need to look for inconsistency between the quoted address and the reverse lookup to see that.

Finding the ISP

We can usually deduce one truth: the IP address used by the sender when the mail was originated. Sometimes, as in the example above, we are also told the name that IP address resolves to. What next?

Well, now we need to find some contact address to send polite complaining mail. It's a good idea to do reverse lookup on the IP address yourself to check that the name to which it's supposed to resolve is correct. If it doesn't resolve, then there's a good chance the line is faked. I use the `dig` program to do reverse lookups on IP addresses. Giving the program the `-x` flag and the IP address will do this trivially. However, you may not have this on your machine because it's not standard.

Your machine will have the `nslookup` program (tucked away in `/usr/sbin` on Solaris) and you can use that to deduce the address, with some work. IP-to-domain name address mappings are stored in the DNS by reversing the IP numbers and then placing the resulting name in the DNS in the `in-addr.arpa` domain. So to look up the invented address above, you'd do this:

```
$ /usr/sbin/nslookup
> set type=PTR
> 8.52.53.299.in-addr.arpa
```

and hopefully you would be returned the relevant information.

```
$ /usr/sbin/nslookup
> set type=PTR
> 8.52.53.299.in-addr.arpa
```

and hopefully you would be returned the relevant information. The `set type` line tells `nslookup` to look for reverse addresses, which are called `PTR` records. Incidentally, you have to type a Control-D to get out of the `nslookup` program.

Another check that can be worthwhile for investigating IP addresses is to use the `traceroute` command. Again, this isn't readily available on your machine, but copies are floating around on the Net. I got my Solaris version from the Sun Freeware folks (see below).

The `traceroute` command is intended to help you determine the route your packets are taking through the Internet from your machine to some other system. Each step of the way will generate an IP address, which is looked up in the DNS, so you can see whose machines the packet has been through. The command can be invaluable for finding who owns addresses that are not registered in the DNS. These days, addresses are allocated in blocks, and if `traceroute` shows that the packet originated from a machine behind the gateway of an ISP, then it's a good bet your mail originated from that ISP's customer.

We've checked that the mail came from someone's system and now need to find the address of someone to whom we should send a complaint. The address in the example is `some.ipseller.net`, and it's a good bet that sending mail to `postmaster@ipseller.net` will work. Many ISPs have `support` addresses, and the larger ones are setting up `abuse` addresses. You can check that a domain name is likely to work for mail by looking for an MX record in the DNS:

```
$ /usr/sbin/nslookup
> set type=mx
> ipseller.net
```

which should give a response like this:

```
ipseller.net preference = 10,
  mail exchanger = postoffice.ipseller.net
```

If you don't get a response, try looking for any record for the site:

```
$ /usr/sbin/nslookup
> set type=any
> ipseller.net
```

and if the name exists you should be able to send mail and get a response.

If you cannot make up your mind about where to send the mail, then another valuable tool is the `whois` command. This tells you who owns a domain name for the main US domains. Typing

```
$ whois ipseller.net
```

will give you a bunch of useful information about the site you are trying to contact, including the email address of the person who is technically responsible for the domain. Other countries can be somewhat less open with this information. For European sites, consult the RIPE database (`http://www.ripe.net`).

This may all seem long-winded, but, most of the time, it's easy to find the name of the owner of the machine that was used to originate the spam. Send them polite mail–being rude doesn't help–and if they are responsible they will have an acceptable use policy that will allow them to remove the offender from the Net. I also tend to mail to the owner of the relay machine, suggesting that they should stop relaying mail.

Some people use a program called `procmail` to eliminate spam. The `procmail` program started life as a way for users to sort their mail into identifiable folders, perhaps filtering mail from mailing lists into folders based on the mail header. It's now being used to filter out undesirable mail, looking for common strings in the mail that has been received and placing possible spam mail in some folder that contains junk. Because it looks at the whole mail message and not just the header, it can perhaps do a better job.

Paul Vixie has gone even further. He provides router and DNS information that forces IP traffic from known IP addresses into a black hole. The Real Time Blackhole lists networks that are known to be friendly to spammers, and by friendly, Paul means that these networks tolerate the sending of spam over their services. Various other networks are now making use of this black hole list to stop the activities of spammers.

Where to Find out More

A good place to start to look for antispam resources is `http://www.spam.abuse.net`. The Sendmail site is `http://www.sendmail.org`. The Sun Freeware project, where you can find binaries of `dig` and `traceroute` for Solaris, is `http://sunfreeware.com/`. A good place to start for `procmail` filtering is `http://www.best.com/~ariel/nospam/`.

All the names used in my examples are fictitious. The spam examples are taken from real mail. The domains `abuser.com`, `unsuspecting.com` and `someisp.net` were not registered at the time I wrote this. If they are registered by the time you read this, then the examples do not relate to mail processed by those machines. ⊸

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

by Richard Morin, **Technical Editor**

ERIC YANG

Page Preprocessing in Perl

Perl is highly admired for its ability to create Web pages "on the fly." Sometimes, however, you just need to create a few static pages, with minimal effort. In fact, a CGI script may be exactly what you wish to avoid.

In my efforts to create indexing pages for a MacPerl CD-ROM recently, I ran into just such a situation. I did not want to force the user to set up server and CGI support just to use my Web pages. On the other hand, I wanted to give the user the "feel" of dynamic pages. So, I cheated.

In brief, I created a "little language" for describing related sets of HTML files. Using a simple encoding scheme, I specified which lines should appear in which HTML file. With a bit of fancy footwork (described below), this allowed me to provide assorted buttons that would look familiar to my intended (Mac OS) audience. The language I created falls into the general class of "macro languages," so let's begin there.

Macro languages allow specially encoded input files to be "expanded" in assorted ways. A macro preprocessor can include or omit lines of information, incorporate lines from other files, calculate values from pre-set variables and more. Although the output file may just be "data," often it is program code.

UNIX is rife with macro processing languages. `m4` is a very nice general-purpose macro language. The C preprocessor (`cpp`) is a useful, albeit rather tame, facility. The UNIX shells can be used to provide a form of macro processing on any embedded scripts (for example, `awk`, `sed` or Perl). That is, shell variables can be expanded within the body of the embedded `awk` code. Going up another level, `make` provides similar preprocessing for bits of embedded shell code.

Unfortunately, my development was taking place on a Macintosh, which is not so replete with macro facilities. Having MacPerl, however, I was able to continue in the face of such minor difficulties. In fact, lacking a general-purpose macro language, I was able to create a specialized macro processor that met my needs quite nicely.

s4ways

My macro processor, named "s4ways," splits an encoded input file into four HTML files. Each of the output files contains a slightly different set of information, along with navigation links that let the user select a desired "view."

One of my HTML files contains sets of useful links (i.e., links to directories on the disk or to relevant Web sites). These lines could get in the way of a simple scan, however, so I wanted to make them optional. By setting up some "buttons" at the top of the page, I could allow the user to turn this information on or off. Two switches in two states sounds like four combinations, hence, s4ways.

The s4ways "language" is very simple. A string of four characters at the beginning of each input line tells the processor how the line should be handled. Because the most common case–"include this line

Example 1

```
__  Show: <A HREF="p_.html"><IMG SRC="b0.gif"></A> CD  <A
__          HREF="_w.html"><IMG SRC="b0.gif"></A> WWW  <A
__          HREF="pw.html"><IMG SRC="b0.gif"></A> All
X_  Show: <A HREF="__.html"><IMG SRC="b1.gif"></A> CD  <A
X_          HREF="pw.html"><IMG SRC="b0.gif"></A> WWW
_X  Show: <A HREF="pw.html"><IMG SRC="b0.gif"></A> CD  <A
_X          HREF="__.html"><IMG SRC="b1.gif"></A> WWW
XX  Show: <A HREF="_w.html"><IMG SRC="b1.gif"></A> CD  <A
XX          HREF="p_.html"><IMG SRC="b1.gif"></A> WWW  <A
XX          HREF="__.html"><IMG SRC="b0.gif"></A> None
```

in all output files"–should be easy to encode, s4ways uses a string of four blanks to specify it:

```
<HTML>
  <HEAD>
    ...
```

Our example looks just like indented HTML; how convenient. Now, let's find ways to encode some other output selections:

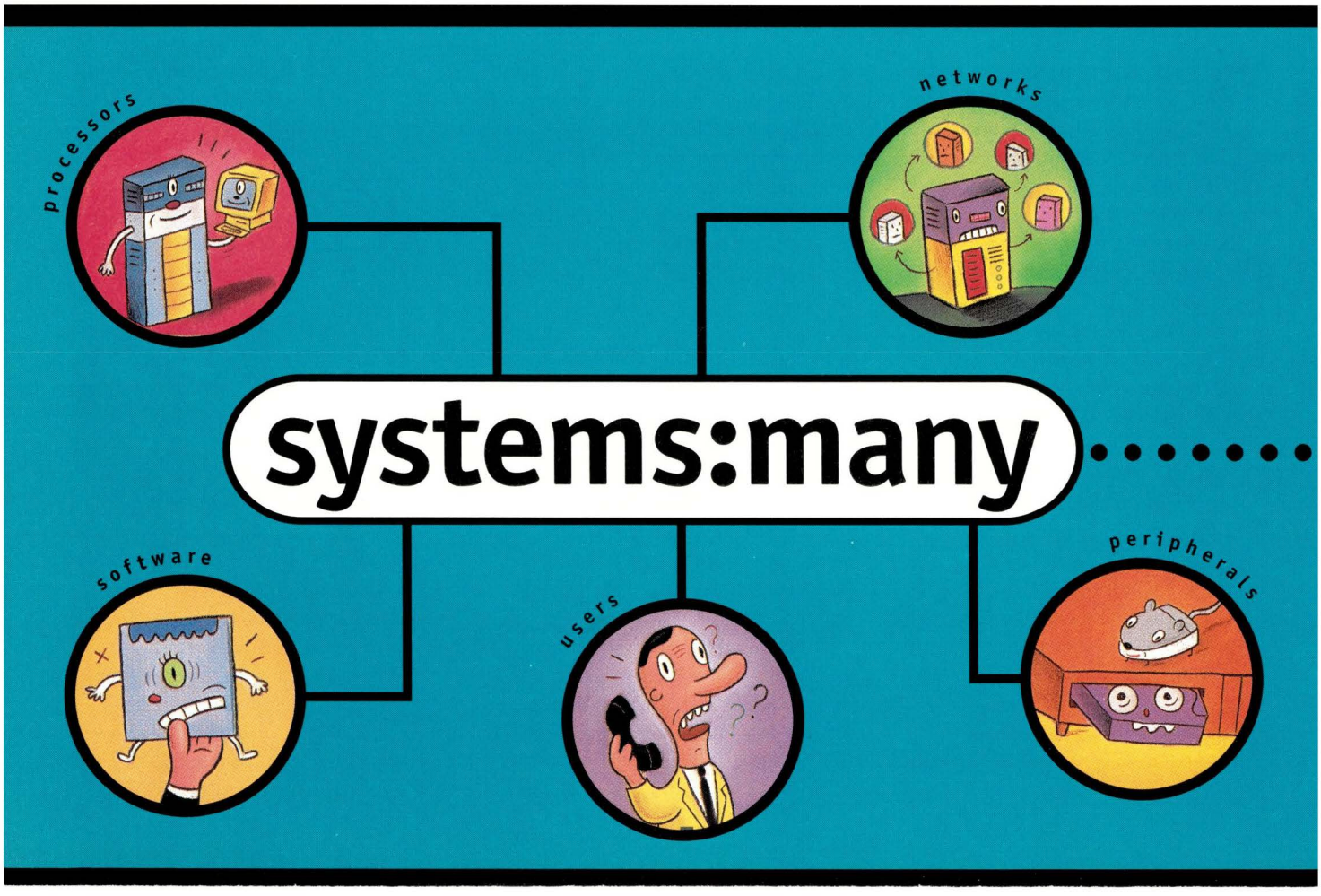
```
X   disc links
 X  Web  links
__  no   links
XX  both links
X_  disc links only
_X  Web  links only
```

The first two of these, along with the common (blank) form, make up most of my input file. If I want to include a line with a CD (WWW) link, I preface it with `X.` (`.X`). The other codes are used for the navigation section, allowing each of my four output pages to have a unique "navigation bar." After several false starts, I settled on the following navigation lines:

```
Show:  [ ] CD   [ ]  WWW  [ ]  All
Show:  [X] CD   [ ]  WWW
Show:  [ ] CD   [X]  WWW
Show:  [X] CD   [X]  WWW  [ ]  None
```

In practice, I used a pair of GIF files instead of the `[ ]` and `[X]` text shown above. This presented the user with colored squares that darkened to indicate selection (see Example 1).

To control the character spacing in the HTML pages, I used the `<PRE>` (preformatted text) tag. The rather peculiar positioning of the line breaks and angle brackets in Example 1 allows me to "hide" my input spacing from view. This lets my input file be (reasonably) presentable, while getting the desired output appearance. I also found, by the way, that setting `BORDER=0` improved the appearance of the GIF files.



Radio Buttons

By changing the navigation code section slightly, I could have presented the user with a rather different "look and feel" but exactly the same information and choices:

```
Show: [ ] CD  [ ] WWW [ ] All [X] None
Show: [X] CD  [ ] WWW [ ] All [ ] None
Show: [ ] CD  [X] WWW [ ] All [ ] None
Show: [ ] CD  [ ] WWW [X] All [ ] None
```

Here is the code for the "radio button" format. The code for each navigation line is the same, save for the selection code and the position of the darkened square:

```
__  Show: <A HREF="p_.html"><IMG SRC="b0.gif"></A> CD  <A
__          HREF="_w.html"><IMG SRC="b0.gif"></A> WWW  <A
__          HREF="pw.html"><IMG SRC="b0.gif"></A> All  <A
__          HREF="__.html"><IMG SRC="b1.gif"></A> None
...
```

Turning Triangles

On another page, I had two major sections that I wished to make optional. Using right- and down-pointing triangles in the left margin, I was able to achieve quite a nice simulation of Apple's "turning triangle" format, which Macintosh users would find familiar (see Figure 1). Here is the navigation code for the "turning triangle" format:

```
__  <A HREF="1_.html"><IMG SRC="t0.gif"></A> Header 1
X_  <A HREF="__.html"><IMG SRC="t1.gif"></A> Header 1
_X  <A HREF="12.html"><IMG SRC="t0.gif"></A> Header 1
XX  <A HREF="_2.html"><IMG SRC="t1.gif"></A> Header 1
 X   Optional text 1 ...
__  <A HREF="_2.html"><IMG SRC="t0.gif"></A> Header 2
X_  <A HREF="12.html"><IMG SRC="t0.gif"></A> Header 2
_X  <A HREF="__.html"><IMG SRC="t1.gif"></A> Header 2
XX  <A HREF="1_.html"><IMG SRC="t1.gif"></A> Header 2
 X   Optional text 2 ...
```

To understand this code, let's walk through the states and transitions. In the HTML file `"__.html"`, both triangles are pointed to the right (`"t0.gif"`), and no optional code appears. Selecting the first triangle jumps us to `"1_.html"`, where the top triangle points down (`"t1.gif"`) and the top set of optional code appears.

Because the macro processing is quite simple, the implementation code is short. (Feel free to skip over this section if you aren't a Perl aficionado!) My production script has a bit more bulletproofing and such, but it basically looks like that shown in Example 2.

The preloaded hash `%m` provides a level of indirection, allowing my syntax to be more abstract than it might otherwise be. This paid off in easier editing of (and fewer errors in!) the input files.

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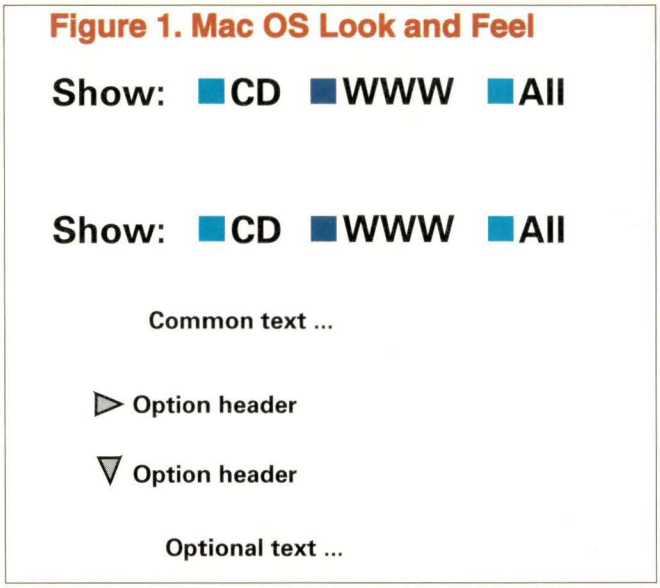
Example 2

```
#!perl
$base  = 'Perl:PTF';

@keys  = ('__', '_w', 'p_', 'pw');
splitter("$base:x1.mf", "$base:", '.html', @keys);

@keys  = ('__', '_2', '1_', '12');
splitter("$base:x2.mf", "$base:", '.html', @keys);

sub splitter { # $in, $pre, $suf, @keys
#
# Read from $in, write to $pre{@keys}$suf

  my ($in, $pre, $suf, @keys) = @_;
  my ($s0, $s1, $s2, $s3)     = @keys;
  my ($flag, $line, $text);

  #           0123
  $m{'  '} = 'XXXX';   # print on ??
  $m{' X'} = '.X X';   # print on ?X
  $m{'X '} = '..XX';   # print on X?
  $m{'XX'} = '...X';   # print on XX only
  $m{'_X'} = '.X..';   # print on _X only
  $m{'X_'} = '..X ';   # print on X_ only
  $m{'__'} = 'X...';   # print on __ only

  open(MF, "<$in")         or die;
  open(S0, ">$pre$s0$suf") or die;
  open(S1, ">$pre$s1$suf") or die;
  open(S2, ">$pre$s2$suf") or die;
  open(S3, ">$pre$s3$suf") or die;

  while (defined($line = <MF>)) {
    chomp($line);
    $line .= "    " if (length($line) < 4);
    $flag  = substr($line, 0, 2);
    $text  = substr($line, 4);
    print(S0 "$text\n") if ($m{$flag} =~ /X.../);
    print(S1 "$text\n") if ($m{$flag} =~ /.X../);
    print(S2 "$text\n") if ($m{$flag} =~ /..X./);
    print(S3 "$text\n") if ($m{$flag} =~ /...X/);
  }
  close(MF); close(S0); close(S1); close(S2); close(S3);
}
```

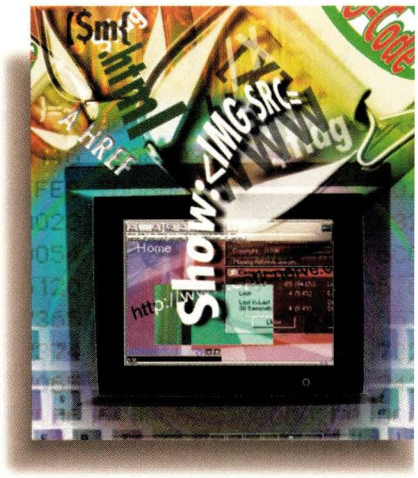
Figure 1. Mac OS Look and Feel



Post Mortem

Because I wrote s4ways for my own purposes, I was able to be quite lazy and self-centered about its design. The language has exactly the syntax I wanted; no more, no less. The implementation is very simple, if not very efficient.

Designers of general-purpose macro languages such as `m4` are required to be more "professional" in their approach than I was. But then, that's their problem (:-).



Splitting a file into four versions is trivial. I expect that splitting it into eight or 16 versions would be a somewhat trickier task, but no real challenge. After that, the sheer number of generated files might start to get oppressive.

On the other hand, I cheerfully generated a set of 200 HTML files for another part of the disk, so moderation appears to be a matter of taste. In this other case, by the way, the files were split up on a data-driven basis. The moral here, I suppose, is that you should never be afraid to generate new "languages" when the old ones are beginning to run out of steam.

For more information on little languages–as well as some educational and pleasant reading–take a look at Jon Bentley's delightful books *Programming Pearls* and *More Programming Pearls* (Addison-Wesley Inc., ISBNs 0-201-10331-1 and 0-201-11889-0, respectively). ⊸

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`.

the net prophets

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by S. Lee Henry

KEN CALL

Cleaning Up After cron

It's been a while since we tackled log files–those sometimes useful files that grow large when you're not looking and always contain more detail than you have time to absorb. I just tripped over a *new* log file, a *new-to-me* log file, `/var/cron/log`. Although I've been setting up jobs to run via `cron` for 15 years, I hadn't had anything to do with this one. Not only does this log file record evidence of each `cron` job that runs on my system, it exists by default in Solaris. My occasional perusals of the `/etc/default` directory had not brought this to my attention.

On one of the systems that I routinely administer (which just happens to be in Brussels; I'm in LA), said new-to-me log file had grown to more than 34 MB (769,000 lines) in little more than a year. That means it started growing well before I was on the job and has quadrupled in size since. Very seldom do I concern myself with anything that happened on my system more than a month earlier. It's enough trying to keep up with current activity and ward off new problems before they get out of hand.

My first impulse on discovering how large `cron`'s log file had become was to build a script to periodically trim the file the way I would trim any log file that grows continually. I like to solve problems "permanently" whenever I get the chance. If I can automate a cleanup task, then I don't have to remember to do it manually and, with good organizational skills (for example, keeping all my `cron` scripts in one place), I can easily monitor what my automated tasks are doing.

It didn't take me long to realize the flaw in this logic. Could I ask `cron` to trim its own log file? Wouldn't this be like trying to paint the handle of a paintbrush with the paintbrush itself? This might, I thought, turn out to be the only log file on my system that I *cannot* manage with `cron`'s help. Because `cron` is a process that runs all the time, it's likely that it keeps its log file open all of the time. If so, and if I were to move the log file to a different name, `cron` would continue to write to the file as if nothing had changed. This turned out to be the case. The process was not going to stop writing to the log file unless I stopped and restarted `cron`, moving the log file in between.

Processes like `cron` open files and hold onto them with "handles" or "pointers." If the file name changes (for example, when a file is moved using the `mv` command), only the directory entry changes. The running program doesn't know, or care, about the change and continues to write to the file. Only software that opens a file for each write operation would notice if a file were gone. Then, depending on the particular coding, that software might re-create the file, toss out a message about not being able to locate the file and abort, or simply continue without writing any more messages.

The cleanest way to clean up after `cron` would be to kill the process, trim the log file and restart `cron`. Provided I didn't do this *just* when some important `cron` job was about to run, I could get away with it. I'd have to remember in another month or so to clean up the log file again, though, and I already have too much to remember!

The easiest way to trim the log file

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Listing 1

```
17 5 * * 1 /bin/tail /var/cron/log > /var/cron/olog
18 5 * * 1 /bin/cat /dev/null > /var/cron/log
```

Listing 2

```
> root 10204 c Wed Mar 18 11:11:11 1998
> CMD: /usr/bin/find /* -name core -exec rm {}
< root 10204 c Wed Mar 18 11:11:44 1998
```

periodically *without* having to remember anything is to set up a `cron` job to `cat /dev/null` to the file. This works well. `cron` empties the log file using the `cat /dev/null > /var/cron/log` command and then adds a couple of lines, its normal logging operation. Because the `cat /dev/null > /var/cron/log` command doesn't change the identity of the file–the handle–`cron` continues to write to the log without complaining (or even noticing) that the old records are gone.

If I were to first copy the end of the old log file to another file (for example, `tail /var/cron/log > /var/cron/olog`) and then empty out the active log file (`/var/cron/log`), I could keep some log history around until the next time I clean out the log file. The `crontab` lines in root's `cron` file, `/var/spool/cron/crontabs/root`, would do this once a week (see Listing 1).

Using cron's Log

Of course, if all we want to do is keep the data in `cron`'s log file from filling up our disks, we shouldn't save it at all. We could prevent the creation of the log data by reversing the option in the `/etc/default/cron` file:

```
CRONLOG=NO
```

On the other hand, if we want to be able to see from time to time if `cron` jobs have run, keeping the file is a good idea. Beyond providing answers to the occasional "Did my `cron` job run?" the file contains statistical data about the number and frequency of `cron` tasks that might be painful to extract from the `/var/spool/cron/crontabs/*` files. Perusing this kind of statistical data might help you avoid creating `cron` "rush hours." You can also get an idea of how long various `cron` jobs take to run. See Listing 2 for a sample of the records in the `/var/cron/log` file. The start and stop times for the `cron` job and the process ID are included along with the command that was run. This kind of information may or may not be useful to you. If not, make the switch from "Yes" to "No" in your `/etc/default/cron` file and you won't have another log file to manage.

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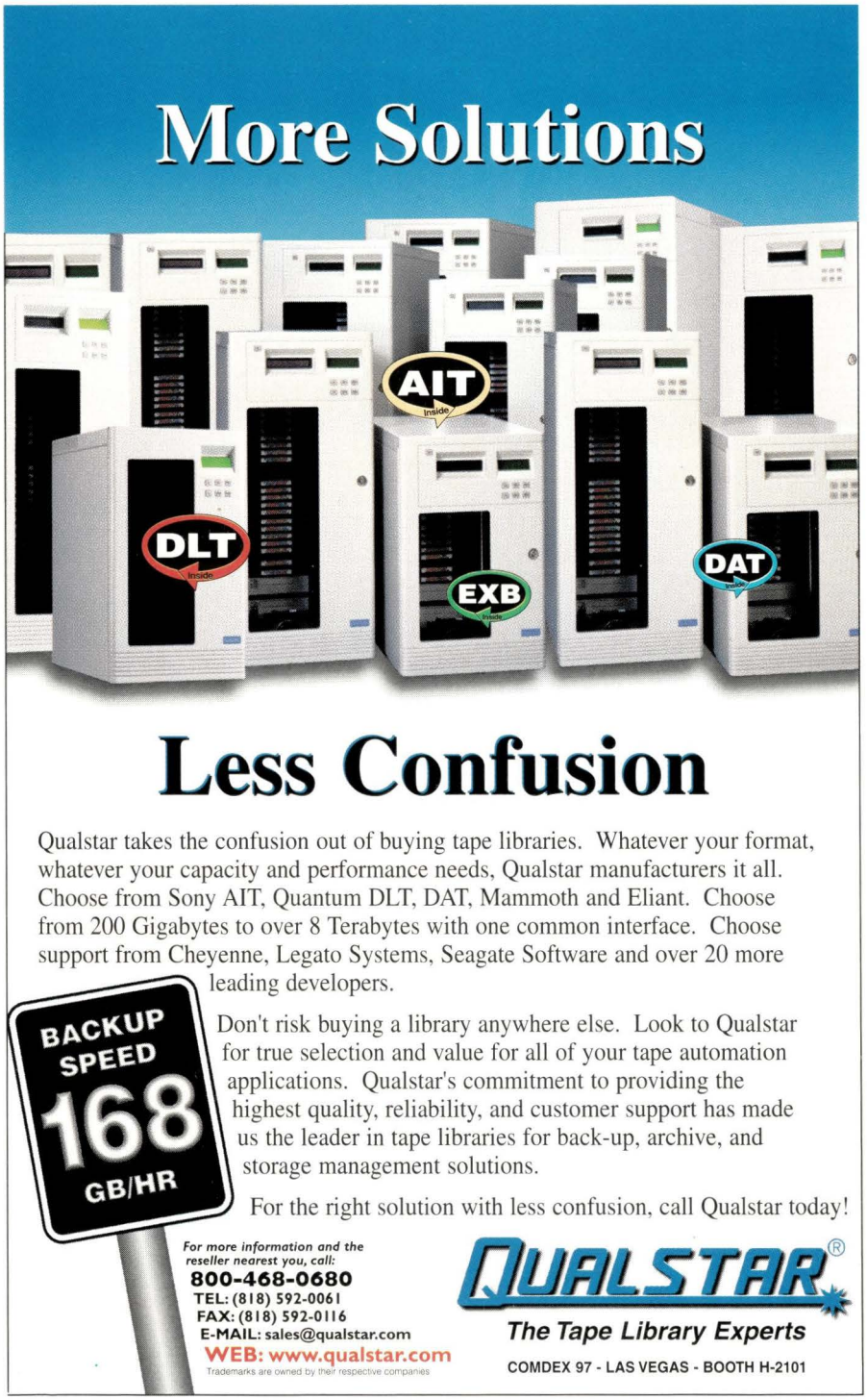

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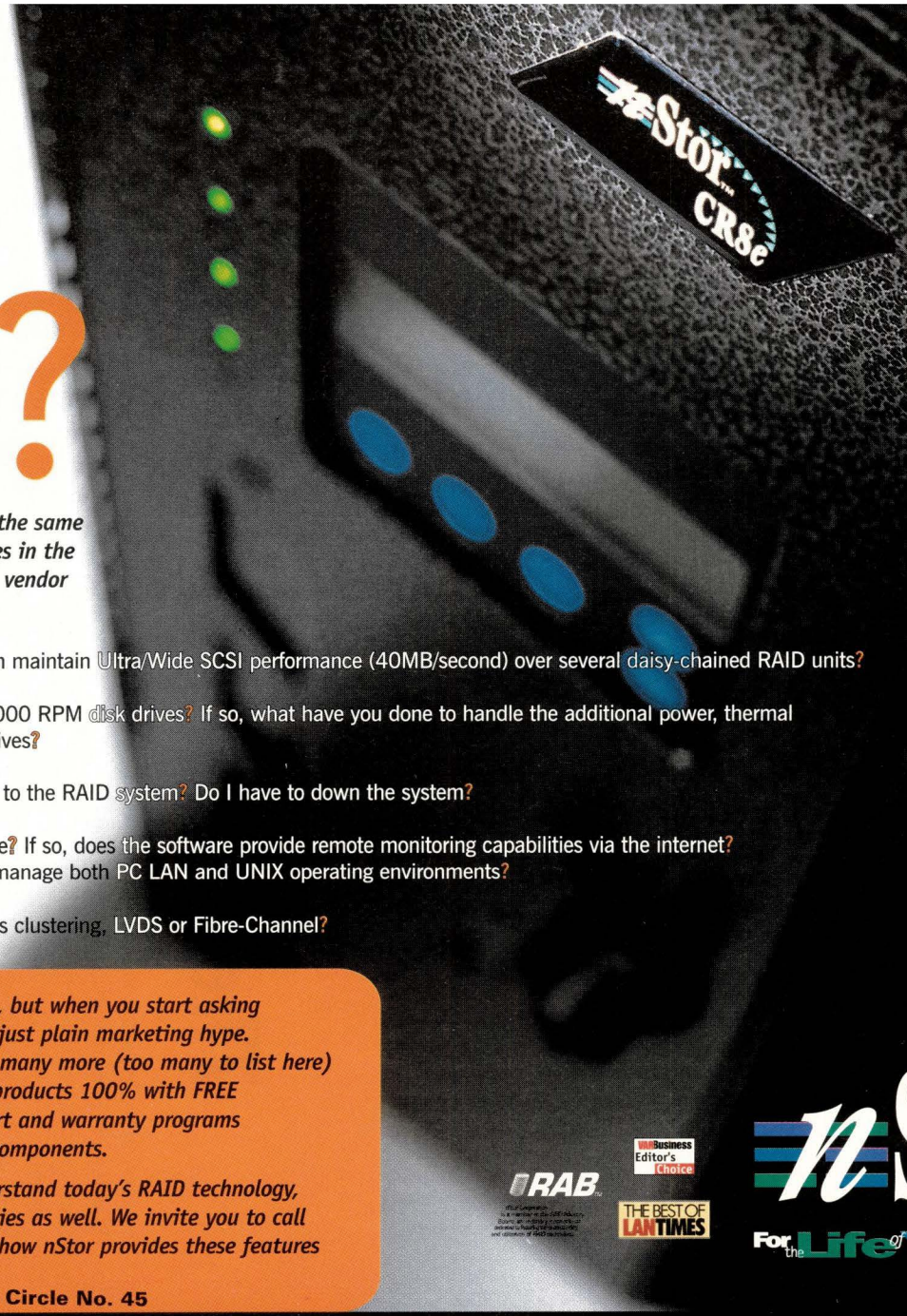

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by Æleen Frisch

LYNNE CANNOY

The NTFS File System

Last month, we looked at how Windows NT handles disk partitions and the various sorts of entities that may be constructed from them. We'll complete this picture by considering file systems under Windows NT in a two-part column running this month and next.

Types of File Systems

Over the years, Windows NT has supported the following file systems:

- **FAT**: The 16-bit file system type supported by DOS and Windows 3.1/95 systems. However, Windows NT does not support the Windows 95 FAT-32 file system, a 32-bit version of FAT.
- **CD-ROMs**: Windows NT provides transparent support for reading CDs in the standard ISO 9660 format.
- **HPFS**: Previous versions of Windows NT supported the **HPFS** file system, which is the native OS/2 file system type. However, support for HPFS was removed from Version 4.0.
- **NTFS**: The NTFS file system is a file system type created especially for Windows NT. NTFS is a vast improvement on the FAT file system. I use it for all file systems on Windows NT systems. I recommend it in all cases except when you need to share a partition with a dual-booted UNIX or DOS operating system in read-write mode.

The NTFS file system includes the following common features of modern file systems:

Journaling – Like many modern file systems found on UNIX, the NTFS file system is journaled. All changes to the file system structure are recorded in a log file before being carried out, for example, what file a particular disk cluster belongs to (beware that this does not include the actual contents of files–that is, the data stored in that particular cluster). When the system boots, the NTFS file system structure is automatically synchronized with the contents of its log. This technique, borrowed from real-time transaction processing, ensures that the file system is always in some consistent state. Note, however, that this does not always prevent data loss. For example, in the event of a power failure, the file system may be restored to some consistent state that existed shortly before the power went out, and subsequent additions to the file system may not be recoverable.

A lazy-write scheme – Disk writes are made to a cache in memory rather than directly to disk, and the cache is periodically written to disk as a background operation. The purpose of such write strategies is to optimize overall system I/O performance. In some cases, it can result in file changes being lost in the event of a power failure. Note that FAT file systems on Windows NT also use a lazy-write strategy (in contrast to the DOS careful-write scheme).

Discretionary Access Control (DAC) – DAC provides for enhanced file security over the more primitive schemes used on Windows and UNIX systems. Access control lists (ACLs) enable permitted and forbidden access to be specified in considerable detail on a file-by-file basis.

Table 1. Important MFT Metadata Files

$Mft	– Master file table (MFT) table of contents
$MftMirr	– Location of the copy of the metadata files elsewhere on disk
$LogFile	– Transaction log (deployed as a circular buffer)
$Volume	– Information about file system volume (including its name and NTFS version)
$AttrDef	– Attribute definition table
$.	– Root directory
$Bitmap	– Cluster bitmap file indicating the used/free status for each cluster in the file system
$Boot	– Boot file
$BadClus	– List of bad clusters
$Quota	– Reserved for future use for disk quotas (unused at present)
$Upcase	– Unicode lowercase-to-uppercase conversion table (for translating file names)

Mirrored master file table and boot sector – The NTFS file system stores a second copy of the files specifying the file system's structural and boot-related data in the middle of the disk.

Master file table (MFT) – The NTFS file system is structured around the MFT. The first 16 records of the MFT hold structural information about the file system, and all other files/directories in the file system exist as later records in the MFT. Table 1 shows the most important MFT metadata files.

A file itself is a collection of attributes stored in an MFT record (and possibly elsewhere on disk). The following are the most important attributes:

- Basic file information such as the file's DOS attributes (the read-only, hidden, system and archive bits), its creation, modification and access times and the number of hard links to the file.
- The name of the file. Note that more than one file name attribute is usually present, holding the file's long file name, its short (eight-plus-three) DOS-style file name and alternate file names for files to which there are multiple hard links.
- A security attribute holds the file's Windows NT DAC-based access permissions.
- The data attribute, comprising some or all of the data stored in the file.
- Additional indexing data for directories.

For all but the smallest files, the data attribute is too large to fit into the MFT record. In this case, the attribute indicates the disk locations of the actual data. In some cases, the security attribute is too large to fit into the MFT record and so is handled similarly. Occasionally, the MFT record data itself grows beyond a single record. In this case, additional MFT records are used–an attribute list is created for the record detailing the list of the attributes for the file along with their respective MFT record locations.

I recommend two reference works that describe the NTFS file system in more detail: *Inside the Windows NT File System* by Helen Custer, Microsoft Press, ISBN 1-55615-660-X; and *Windows NT File System Internals: A Developer's Guide* by Rajeey Nagar, O'Reilly & Associates, ISBN 1-56592-249-2.

Creating an NTFS File System

An NTFS file system may be created on a disk partition (or other defined entity such as a stripe set) using the Disk Administrator tool or from the command line using the `format` command. (On Alpha systems, the Disk Setup facility of the AlphaBIOS program can also be used to format disk partitions.) In the first method, start the Disk Administrator and select the desired partition (or other item). Then, use the **Tools=>Format** menu path to format the selected disk partition. If this menu item is disabled, select the **Partition=>Commit Changes Now** menu path to force any modifications to the current disk configuration to be written to the device.

The resulting dialog box is illustrated in Figure 1. The various fields in the dialog box indicate the file system's total capacity and allow you to specify the file system type, the allocation unit size (discussed below) and a volume label. The check boxes at the bottom request a quick format operation (if possible) and specify whether or not automatic file compression is turned on by default for this file system.

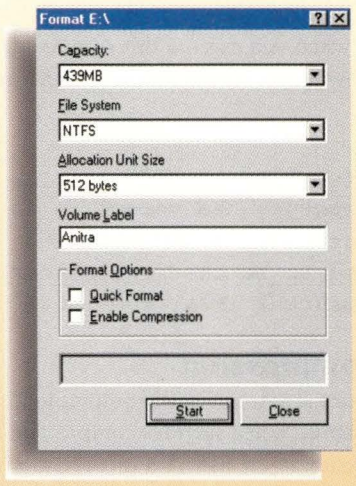
The `format` command can be used to create (or re-create) a file system on any defined disk drive from the command line. For this purpose, it has the following basic syntax:

```
format [/fs:ntfs] [/V:label] [/C] [/A:n] x:
```

where *x* is the drive letter of the partition you want to format. The `/fs` option specifies the type of file system to be created; its argument must be either `ntfs` or `fat`–beware that FAT is the default for a new file system. The `/V` option sets the label of the new file system to *label*; `/C` enables automatic file compression for the file system.

The `/A` option specifies the file system's allocation unit size. This parameter specifies the unit in which disk space is allocated (the cluster size). It defaults to 512 bytes for file systems of 512 MB or less, to 1 KB for file systems between 513 MB and 1 GB, to 2 KB for file systems between 1 GB and 2 GB, and to 4 KB for file systems 2 GB or higher. Its

Figure 1. Formatting a Partition with the Disk Administrator



When using the Disk Administrator tool to format a partition, a dialog box will pop up (left) that shows the file system's capacity and allows you to specify the file system type.

valid range is any power of 2 from 512 bytes to 64 KB. However, file compression cannot be performed on file systems using a cluster size of more than 4 KB.

In most cases, the default value works fine. You might want to use a smaller size if you anticipate that the file system will be used for many very small files (smaller than the default allocation unit size). In this case, a smaller size might reduce the amount of internal wasted space. At the other extreme, if the file system will be used exclusively by an application that performs very large I/O operations (say, hundreds of KB at a minimum), then a larger cluster size will sometimes improve its I/O performance.

For example, the following command creates an NTFS file system on drive *M:* with an allocation unit size of 4 KB and automatic file compression enabled, labeling the file system as *Tirzah*:

```
C:\> format /C /fs:ntfs /A:4096 /V:Tirzah M:
```

Checking and Repairing File Systems

All file systems become corrupt from time to time. The `chkdsk` utility can be used to check the file system's structural integrity and repair any problems within it. This utility is similar to the UNIX `fsck` command, which compares items such as the volume bitmap against the disk portions assigned to files in the file system. As with `fsck`, `chkdsk`'s scope is limited to repairing the structure of the file system; it can do nothing for corrupted data within otherwise intact files.

A systems administrator will only rarely need to run this utility manually for NTFS file systems, when flaky system behavior leads you to suspect there may be file system corruption. However, because FAT file systems in traditional Windows environments are notoriously prone to corruption, I still run `chkdsk` manually on them once in a while (whether they need it or not). This is probably just superstition on my part, but it comforts me.

`chkdsk`'s `/f` option says to find and repair any problems with the specified file system. The following command checks and repairs the file system on drive *K:*, for example:

```
C:\> chkdsk /f K:
```

If the file system is in use when you execute this command, you will get a message allowing you to schedule the check at the next system boot:

```
The type of the file system is NTFS.
Chkdsk cannot run because the volume is in
use by another process. Would you like to
schedule this volume to be checked the next
time the system restarts? (Y/N) Y
```

Automatic File Compression

As we've just noted, optional automatic file compression is available for NTFS file systems. When such file compression is enabled, it occurs transparently to the user: No special actions are needed to access compressed files, and files are compressed in place. Compression can be enabled for the file system as a whole when it is created, or individually for directory trees and individual files–the former effectively enables compression for the file system's root directory. Note that the compression status of a directory is used as a default value for its component files, and it is propagated to all files and subdirectories subsequently created within it. Compression can also be enabled for individual files even if their parent directory has it disabled.

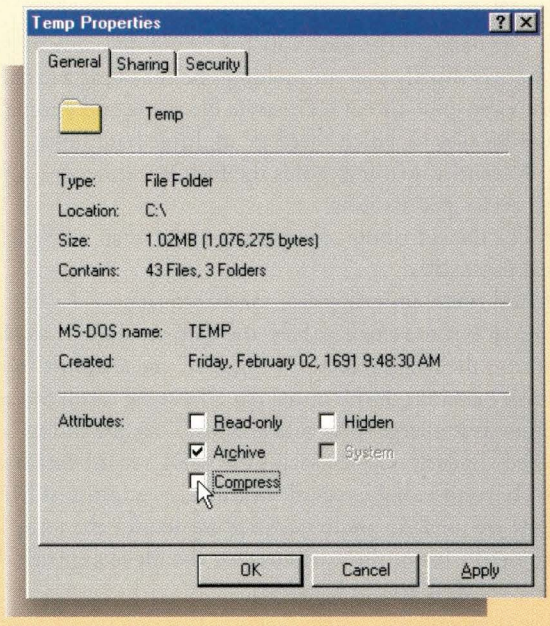
You can modify the compression setting for a particular file or directory via the **General** tab of the item's **Properties**. For a directory, checking the **Compress** box in the **Attributes** area at the bottom of the panel (see Figure 2) will enable automatic file compression for that directory and immediately compress all files within it (you also have the option of enabling and compressing any subdirectories within it at the same time). For an individual file, checking the same box (labeled **Compress**) will compress that file. Similarly, clearing the check box for a compressed item will disable automatic file compression and expand the corresponding compressed file(s).

The `compact` command may be used to enable and disable automatic file compression and compress/expand files via the command line. It has the following syntax:

```
compact [/C | /U] [options] [file(s)]
```

The first option specifies whether the items are to be compressed (`/C`) or uncompressed (`/U`). If neither of these is included, the command displays the current compression state of the specified items, which defaults to files in the current directory.

Figure 2. Enabling Automatic File Compression



The compression setting for a file or directory can be modified via the General tab (above) under Properties. The Compress box (pictured at bottom) will enable/disable automatic file compression.

Other useful options include:

- `/S` – Recurse all subdirectories under specified directories.
- `/I` – Continue processing after an error.
- `/Q` – Quiet mode: request terse command output.

For example, the following command will compress all of the files in the *Data* subdirectory and any subdirectories it may have, marking all of them as compressed directories.

```
C:\> compact /C /S Data\*
```

In contrast, the following command will simply mark the *Metals* subdirectory for automatic compression without affecting any of its current files or subdirectories, specifying terse command output:

```
C:\> compact /C /Q Metals
```

The Resource Kit includes the `compress` command for more traditional manual file compression and expansion. It can create compressed or uncompressed versions of a set of specified files in place or in a separate directory location. For example, the following command creates a compressed version of each file in *C:\Ohio* in *C:\Akron*:

```
C:\> compress C:\Ohio\*.* C:\Akron
```

The standard Windows NT `Expand` command performs the reverse operation using similar syntax. Both commands also have a `/R` option that says to rename the created files using the standard renaming method: replace the final character of the file extension for the compressed version with an underscore, for example, `Test.Exe` becomes `Test.Ex_`.

The Resource Kit also includes the `ExpndW32` command, a graphical utility for expanding files manually from the Windows NT distribution CD or other Windows distribution media.

Existing FAT file systems may be converted to NTFS file systems using the `convert` utility. For example, the following command converts the file system on drive *F:* to an NTFS file system:

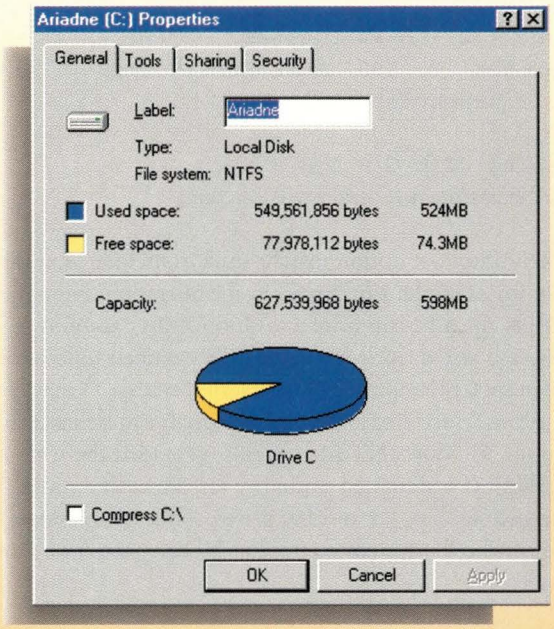
```
C:\> convert /fs:ntfs F:
```

The conversion process is nondestructive and preserves all existing files within the specified file system. NTFS file systems cannot be converted back to FAT, however.

There are many ways of viewing information about a file system. For example, selecting a file system in the **My Computer** view will display its total capacity and free space in the window's information bar (bottom center and right). Alternatively, the **General** tab of the **Properties** dialog box will display a file system's total capacity and current used and free space. This is illustrated in Figure 3.

Joachim Marder has written a freely available utility named `TreeSize` (`http://www.bhs.com/download/default.asp`). It summarizes disk usage on a directory-by-directory basis in a similar way to the UNIX `du` command

Figure 3. File System Properties



The General tab under Properties will display a file system's total capacity and current used/free space.

(see Figure 4). Once the utility is running, you specify the directory you are interested in by selecting the **File=>Select Directory** menu path. The free space within the file system, the total number of files in it and its allocation unit size are displayed in the window's information bar.

There are several versions of the UNIX `df` utility for Windows NT; most are part of various UNIX-compatibility packages. Listing 1 gives a simple Perl script that performs this same task. Here is an example of its use:

```
C:\> perl df.pl
Drive  Total  Free   Used
       MB     MB     MB

C:\    598    52     546
D:\    499    4      495
G:\    1019   1015   4
H:\    509    505    4
I:\    683    679    4
J:\    1161   1006   155
K:\    300    5      295
L:\    439    273    166
```

Other Useful Utilities

We'll conclude this month's column by considering some other freely available utilities related to file systems under Windows NT.

The freely available NTSync utility (written by Mark Russinovich, `http://www.ntinternals.com/misc.htm`) may be used to manually force all disk buffers to be written out at any time, thus performing the identical function to the standard UNIX `sync` utility. Here is an example

of its use:

```
C:\> ntsync
NTSync 1.2 - Disk Flusher
Copyright (C) 1997 Mark Russinovich
http://www.ntinternals.com

Flushing: C D G H I J K L
```

Drive letters display as each one is synched.

The utility's `/R` option may be used to include removable media (for example, Zip drives) in the operation. Note that the utility must be run from an Administrator account.

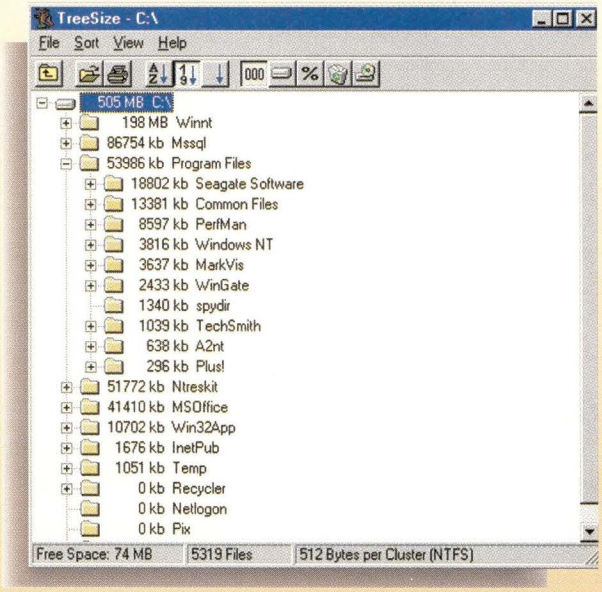
There is also a freely available utility named `unmount` (written by Christoph H. Hochstaetter, `http://www.bhs.com/download/default.asp`), which can be used to unmount Windows NT file systems (provided there are no open files). It is designed primarily for use with removable media such as Zip, Jaz and EZ drives. This command will unmount the file system referred to by drive letter *G:*, for example:

```
C:\> unmount G:
```

The command will fail if there are any references to the file system. It will also not unmount partitions on disks containing multiple active partitions. The package also provides a `mnt` command for mounting unmounted file systems.

Mark Russinovich has also written `NTHandle` (`http://www.ntinternals.com/nthandle.htm`), another free utility that displays information about current open files within the current file system.

Figure 4. The TreeSize Utility



TreeSize, the free utility written by Joachim Marder, summarizes disk usage on a directory-by-directory basis.

Listing 1. Simple df Command in Perl

```
# df.pl
use Win32::AdminMisc;

# Get list of local filesystems
@drives = Win32::AdminMisc::GetDrives(DRIVE_FIXED);

print "\nDrive\tTotal\tFree\tUsed\n\t\tMB\tMB\tMB\n\n";

foreach $fs (@drives) {
   # Get total space and free space for each drive
   @size = Win32::AdminMisc::GetDriveSpace($fs);

   # Convert to MB, compute used space and print
   $tot  = int ($size[0] / (1024 * 1024));
   $free = int ($size[1] / (1024 * 1024));
   $used = $tot - $free;

   print "$fs\t\t$tot\t$free\t$used\n";
   }
```

The script relies on functions from the *AdminMisc* Perl module for Win32 written by Dave Roth (see *http://www.roth.net/perl/adminmisc.htm*).

`NTHandle` has the following general syntax:

`nthandle [/A] [/P` *proc*`]` [*which-files*]

By default, information on all open files is given. The `/P` option limits the command to files belonging to the specified processes; its argument is a string that is used to match the process name (usually the executable name). The optional *which-files* argument may be used to limit the display to files matching the specified string. The `/A` option provides detailed information about each file handle.

For example, the following command lists information about all open files whose names contain "saturn":

```
C:\> nthandle saturn
NTHandle V1.0
Copyright (C) 1997 Mark Russinovich
http://www.ntinternals.com

EXCEL.EXE      pid: ff    D:\Work\saturn.xls
CMD.EXE        pid: 113   D:\WORK\saturn.txt
more.com       pid: 126   D:\Work\saturn.txt
```

Similarly, the following command displays information about the open files in use by processes with names containing "excel":

```
C:\> nthandle /p excel
```

```
NTHandle V1.0
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EXCEL.EXE pid: ff
 4: Section   C:\MSOffice\Excel\EXCEL.EXE
 140: File    C:\MSOffice\Excel\Examples
 144: File    D:\Work\Figures.txt
 150: File    C:\TEMP\~DF9FA6.tmp
 15c: File    C:\MSOffice\Excel\Examples\SAMPLES.XLS
 164: File    C:\TEMP\20.tmp
 178: File    C:\TEMP\~DF131C.tmp
 188: Section C:\MSOffice\Excel\XL5EN32.OLB
 18c: Section C:\WINNT\system32\VBAEN32.OLB
 190: File    C:\WINNT\system32\VBAEN32.OLB
 198: File    C:\WINNT\system32\stdole32.tlb
 19c: Section C:\WINNT\system32\stdole32.tlb
 1a8: File    C:\MSOffice\Excel\XL5EN32.OLB
```

The following command displays information about open files whose names contain "saturn" in use by processes whose names contain "excel":

```
C:\> nthandle /p excel saturn
NTHandle V1.0
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http://www.ntinternals.com

EXCEL.EXE    pid: ff    D:\Work\saturn.xls
```

We'll continue our look at file systems under Windows NT next month, when we will consider the mechanisms for sharing file systems with other Windows NT and UNIX systems. Also next month (April 1998), I'll be in London at UK LISA, and I hope to meet some of you there. ⊸

Æleen Frisch *is systems administrator for a very heterogeneous network of UNIX and NT systems. She is also the author of the books* Essential System Administration *and* Essential Windows NT System Administration *(both from O'Reilly & Associates Inc.). 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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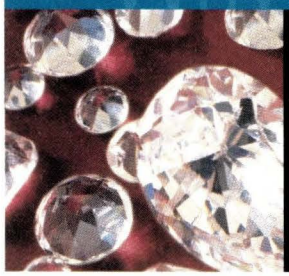

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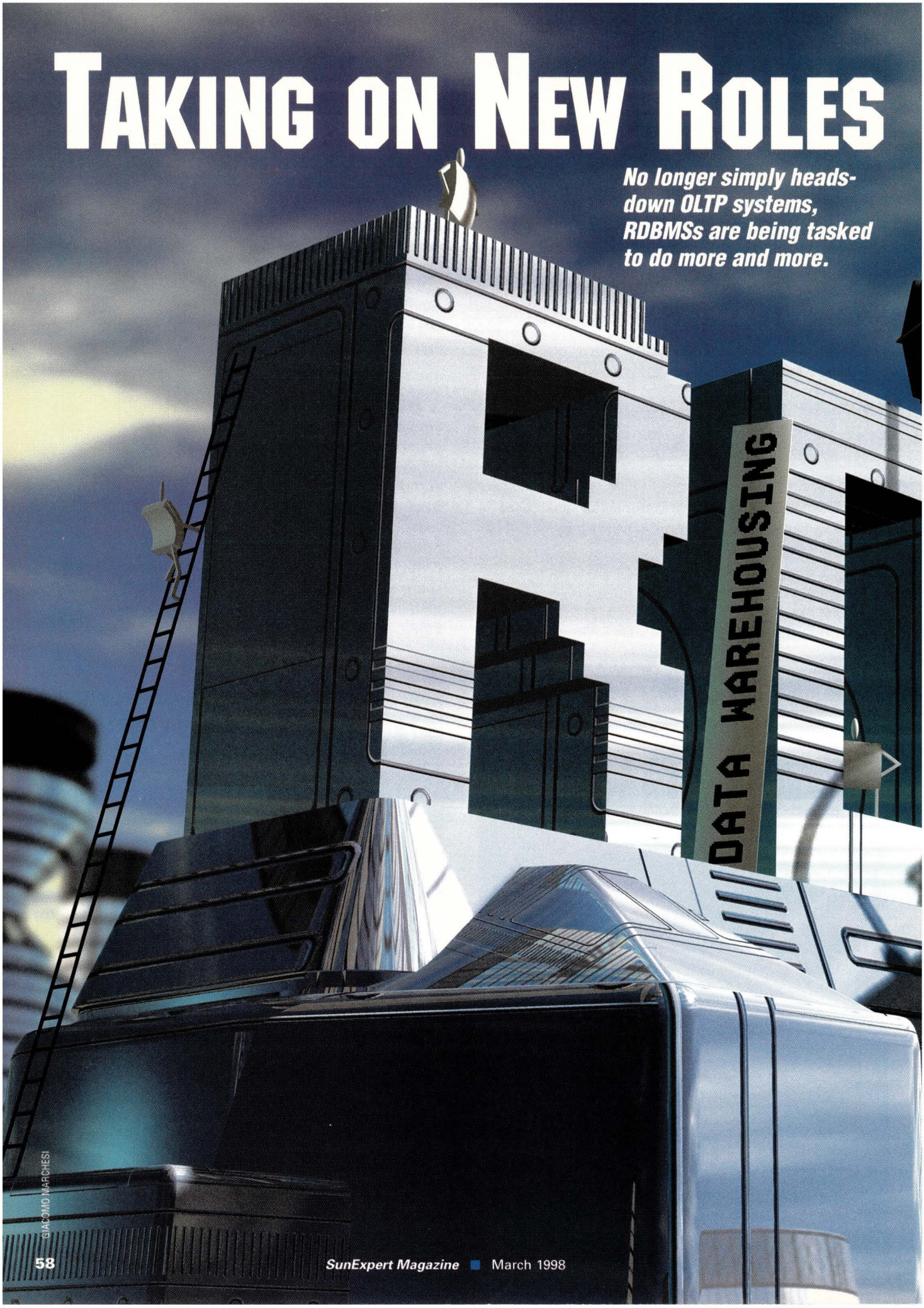
TAKING ON NEW ROLES

No longer simply heads-down OLTP systems, RDBMSs are being tasked to do more and more.



GIACOMO MARCHESI

by Karen Watterson

Relational databases these days are being harnessed to provide data warehousing, support e-commerce and offer better integration with both legacy data and enterprise financial and resource planning systems. In the July 1997 issue ("RDBMS in the Spotlight," Page 44), I wrote about what the leading relational database management system (RDBMS) vendors were doing to offer support for multimedia and other "specialty" data types. In this article, I'll continue that discussion but also consider where traditional concepts like concurrency and integrity fit in.

Common wisdom is that today's RDBMSs are little more than commodity items. Whether you use RDBMSs from Oracle Corp., Informix Software Inc., IBM Corp.'s DB2 or Sybase Inc.'s Adaptive Server, it really doesn't matter that much, because they all support the basic notions of data integrity and multiple concurrent users. And while it's true that any RDBMS worth its salt supports locking, concurrency and referential integrity, you need to realize that,

especially for Web-based e-commerce applications, you can't simply rely on the back-end server to supply these features–the focus shifts to the middle-tier application servers. Because of this, it's worth reviewing (at a high level) some of the basics of transaction processing (see "Transaction Basics").

Common wisdom is that because the database vendors face both slowing sales growth and narrowing profit margins, it's all the more important for them to find new, more profitable niches. As a result, Oracle, Sybase and IBM are changing their focus from selling all-purpose database server software to pitching applications software, middleware and specially targeted systems for e-commerce and decision support applications.

As Janet Perna, general manager of data management for IBM, says of IBM's more than $1 billion database business, "I see a change in segments. Business intelligence software sales are growing. Oracle's traditional business is slowing. Look at what analysts project for online transaction processing software sales. They see a 6% compound growth until the year 2000. For business intelligence software, they see 40% growth."

"The turbulent database market is causing Oracle to reinvent its business," says Mark Jarvis, vice president of system products marketing at Oracle. "Oracle's business is changing. We're in the process of reinventing the company and moving into serving vertical businesses like telcos and utilities." This changing market is forcing Oracle to adopt a business model more like IBM's, with more focus on providing services and selling entire packages of software, services and consulting.

Sybase, rather than focus on high-margin consulting, however, seems bent on leveraging its strong Powersoft division and middleware tools. At press time, Informix, still trying to emerge from its 1997 financial difficulties, seems likely to continue to emphasize database software as its primary product line.

Let's drill down a bit.

ORACLE – THE MARKET LEADER

Oracle continues to be the market leader in the database arena. Like the other database vendors, it works with both hardware and leading application vendors–even vendors like SAP AG and PeopleSoft Inc., which compete with its own products–to guarantee that its database server takes advantage of technological advances in hardware and is optimized to work with new software releases as well. As Richard French, vice president of Oracle's Enterprise Platform Division, says, "We have teams that are dedicated to all the major hardware vendors, including Sun, HP, Digital, Compaq, Sequent, SGI and others. The goal is to optimize our products with those platforms and to work closely with those partners to produce the 'best of breed' solutions for our customers." As a result, Oracle is often first to market with support for new technology (see Table 1).

As the world's largest information management company, with revenues of more than $6 billion, Oracle has a complex product line that now includes hardware (Network Computers from its NCI subsidiary, which may explain why it no longer bills itself as the world's second largest software company).

It is not widely known that Oracle is the number two vendor in the so-called "applications" market behind SAP AG of Germany, and it is a segment that's growing, thanks to Oracle's savvy and aggressive marketing and easy integration with new technologies, including e-commerce, data warehousing and online analytical processing (OLAP) and new multimedia data types. In first-quarter '98, Oracle shipped Oracle Applications Release 10.7 Network Computing Architecture (NCA) suite, a Java-based version of the complete suite of Oracle Financials, Human Resources, Manufacturing, Supply Chain and Sales Force Automation software, including more than 35 applications.

On the e-commerce front, Oracle's Commerce Server 1.1, a bundle that includes Oracle 7.3.3, Oracle's Web Application Server 3.0 (soon to be replaced with an updated, renamed Application Server 4.0) and cartridges that extend the middle-tier Web Application Server with functionality such as Verifone or CyberCast e-payments, continues to be a solid performer, and the forthcoming Java-based Payment Server will let customers who already have Web sites add storefront support in the form of Secure Electronic Transaction (SET) and/or Secure Sockets Layer (SSL) support.

Although the overall growth rate in e-commerce probably

TABLE 1. NOTABLE ORACLE 'FIRSTS'

Year	Technology
1979	First SQL database (Oracle 2.0)
1984	First PC SQL database (Oracle 4.0)
1986	First distributed database (SQL*Star)
1986	First relational database with row-level locking (Oracle 5.0)
1987	First PC SQL database server (Oracle 5.0)
1990	First relational database vendor to deliver parallel database support (Oracle 6.0)
1991	First relational database to break the 1,000 tps TPC-C benchmark (Oracle 6.0)
1992	First relational database vendor to support spatial data (Spatial Data option)
1993	First relational database vendor to offer U.S. government B1 certification (Oracle Secure Server)
1994	First relational database vendor to offer linguistic and full text searching (ConText option)
1994	First SQL database for NT (Oracle 6.0)
1995	First relational database vendor to support video data (Oracle Video Server)
1997	First NT parallel database server (Oracle7 Parallel Server, which shipped in June)
1997	First NT database to support NT clustering (beginning in April, on a Compaq) and Microsoft Cluster Server (aka Wolfpack) with Oracle7 Fail Safe (which shipped in October)
1997	First relational database vendor to support very large memory (VLM) for NT on a Digital Alpha
1997	Oracle ships Oracle Fail Safe and Oracle Parallel Server for Oracle8 in December

outstrips that of data warehousing, there's a good deal of overlap between the two. Indeed, Oracle's decision support, data warehousing and data mart markets continue to grow at explosive rates. Oracle sells NT-based data mart bundles, supports data warehousing-related star schema on the server and offers a stand-alone OLAP server in the form of the Oracle Express Server. Oracle Express, acquired from IRI Software in 1995, remains complex, proprietary and powerful; it is also Web-enabled and has attractive options such as the Express Financial Analyzer and Express Sales Analyzer. Better integration between the Oracle Express and Oracle RDBMS servers is now available via the Express ROLAP option.

Although its tools division stumbled with Sedona, which was to be the next-generation, object-oriented development environment to support Oracle's object/relational, universal server Oracle8, Oracle is working with Borland International Inc. to develop new Java-centric developer tool code-named "Valhalla." Announced in December and due out in the middle of this year, the Oracle version of Borland's JBuilder is expected to interoperate with both Developer/2000 and Designer/2000–which remain the foundation of Oracle's developer tools line.

As Jeremy Burton, vice president of Oracle Tools Division, puts it, "Oracle Corp. is delivering real products to back up our Network Computer message, with Oracle Tools taking the lead. Developer/2000 and Designer/2000 are years ahead of client/server tools such as Sybase's PowerBuilder, Borland's Delphi and Microsoft [Corp.]'s Visual Basic as they are still nearly useless at generating thin clients–so much so that we think these products will fade to irrelevance in a few years for client-side development projects."

Oracle8, introduced mid-1997, represents an evolutionary step in the migration toward a "universal" object/relational server. For example, although Oracle continues to offer its own ConText, Spatial and Video servers as options to its basic Oracle7 and Oracle8 Enterprise Servers, Oracle8 is designed to support plug-in "cartridges" that allow user-developed and third-party extensions to the basic server. Oracle8 also supports object references known as REFS, which are table pointers that can offer better performance than traditional SQL table joins in some applications. Oracle8.0.4, which began

TRANSACTION BASICS

Because of the growing importance of e-business and Web-enabled transactions in general, it's worth reviewing the basics of transaction processing.

SQL RDBMSs have been optimized to support online transaction processing (OLTP) systems. Although transactions vary in length and complexity, they're generally characterized by four characteristics (atomicity, consistency, isolation and durability), which computer science majors conveniently remember thanks to the mnemonic "ACID."

Atomicity refers to the well-known "all or nothing" aspect of transactions. No one wants a system that somehow lets half a transaction get recorded, for example, that takes your credit card number and debits your account, but doesn't complete your order by forwarding all the necessary data to shipping. If you've used SQL databases, you should be familiar with the `COMMIT` and `ROLLBACK` commands that are used to enforce this notion.

Consistency refers to the idea that transactions need to maintain the internal consistency of the target database. This is where both referential integrity and other issues related to data integrity come in. In relational databases, you're not supposed to be able to have duplicate rows in a given table, and each row in a given table should have a unique "primary key" value. Most RDBMSs support a variety of other "constraints" that help prevent bad data from getting into a database. Referential integrity is a bit more complex than "plain" data integrity and refers to the fact that data in related tables should be synchronized. You shouldn't be able to delete customers that have outstanding orders, for example.

The notion of isolation is straightforward: A transaction should execute as though it were running all by itself. Technically, isolation is referred to as serializability, meaning that the effect of isolation is that transactions execute serially, one after another, with no overlap. This is where things get more complicated (there are even formal mathematical proofs for the two-phase locking theorem) related to locks, isolation levels and distributed updates. For in-depth discussions of these issues, I encourage you to read Philip Bernstein and Eric Newcomer's *Principles of Transaction Processing for the Systems Professional* ($39.95, ISBN 1-55860-415-1, Morgan Kaufmann, `http://www.mkp.com`) or Jim Gray and Andreas Reuter's classic *Transaction Processing: Concepts and Techniques* ($84.95, ISBN 1-55860-190-2, also from Morgan Kaufmann). Bernstein and Newcomer summarize the goal of their 350-page book in layman's terms by stating that "transaction processing systems have to efficiently handle high volume, avoid errors due to concurrent operation, avoid production partial results, grow incrementally, avoid downtime, and never lose results."

Life was easier when transactions were small, predictable and local, but now that databases are being used for applications like e-commerce and data warehousing (with its notoriously unpredictable ad hoc queries), it behooves you and your database administrators to understand locking and concurrency issues and how your RDBMS's configuration settings can affect performance.

The final characteristic of transactions is that they're durable, or persistent. There are often legal requirements for this, so database administrators and Web application developers need to pay particular attention to how online database connections are handled. RDBMS vendors, often in conjunction with hardware vendors, differentiate themselves here in the degree to which they support failover, hot standby and other high-availability options. At the simplest level, RDBMSs all support some notion of log files that record recent transactions, including partially completed ones.–*kw*

shipping in December, supports JDBC and native binary large objects (BLOBs) for image data, but server-side Java support isn't expected until Oracle8.1, probably late 1998.

In 1998, Oracle remains the database vendor to beat.

SYBASE 'RUNS' WALL ST.

"As far as concurrency and integrity go," says Craig Woods, Sybase's marketing director for server products, "that's something we do extremely well," pointing out that "the majority of Wall Street" runs on Sybase. Sybase is also proud of the fact that its engine provides the database beneath the extremely active CNET and Sandbox Entertainment Internet sites, and that it will provide the database underlying the forthcoming 1998 World Cup soccer tournament to be held in France. While Sybase doesn't offer a branded commerce server suite, per se, Woods says that some 90% of the Open Market's Transact e-commerce customers use Sybase. Application and e-commerce vendors like Open Market that use Adaptive Server "under the covers" cite the new Logical Process Manager as providing key functionality in supporting fluctuating loads. Customers with popular sites have to be able to move resources around quickly to support special events, contests and so on.

Sybase, like Oracle, is primarily a database company and offers a rich and complex product line. Although Sybase doesn't derive any of its $1 billion revenue from hardware–Adaptive Server does support NCs, however–and doesn't sell its own line of financial applications, it does offer nearly three-dozen products. Its four servers, Adaptive Server Enterprise (formerly Sybase SQL Server), Adaptive Server Anywhere (formerly SQL Anywhere, and before that, Watcom SQL), Adaptive Server IQ (formerly Sybase IQ) and middle-tier Jaguar CTS (Component Transaction Server) remain Sybase's core products, but its tools division, Powersoft, is a major player in the client/server, Web application development and Java tools arenas.

Sybase, like Oracle, offers an extensible server that can support specialized data stores. Although Sybase plans to integrate both Verity Inc.'s SEARCH97 Information Server 3.0 and Virage Technologies Inc.'s Visual Information Retrieval (VIR) engine into its own text data and image data types, respectively, this quarter, Sybase plans to rely primarily on third-party vendors for additional "specialty" data types. Network Imaging Corp. (NIC) already offers a special data store for images that works with Adaptive Server, Vision International, an Autometric Inc. Group, supports geospatial data, and other vendors are developing specialized stores for data such as time series.

Probably the only area where Adaptive Server 11.5 lags technically is its lack of support for row-level locking, but that's scheduled for a first-quarter point release that may be

TABLE 2. 'UNIVERSAL' SERVERS SUPPORT LARGE OBJECTS

	IBM	Informix	Oracle	Sybase
Architectural Components	Extenders	DataBlade modules	Cartridges (Oracle8 and above)	Specialty data stores
Text	Text Extender available for Common Server and UDB	Text DataBlades from Verity Inc. and Excalibur Technologies Corp.	ConText option available for Oracle7 and above	Full-text search engine based on Verity engine available Q198
Image	Image Extender available for Common Server and UDB	Visual Information Retrieval (VIR) DataBlade from Virage Technologies Inc.	Third-party cartridges under development	Third-party product available from NIC; Sybase expected to include its own
Video	Video Extender	Video Foundation DataBlade	Oracle Video Server	
Audio	Audio Extender	Audio Information Retrieval (AIR) DataBlade from Muscle Fish LLC	Third-party cartridges under development	
(Geo)spatial	IBM and Environmental Systems Research Institute (ESRI) are co-developing	ESRI, MapInfo Corp. and Informix have have all developed DataBlades	Oracle Spatial option available for Oracle7 and above	Third-party data stores available
Time series	Third-party extenders under development	DataBlades ship with Informix Universal Server	Third-party cartridges under development	Third-party data stores under development

Note: All vendors are looking to partners to help them with object extensions.

shipping by the time you read this. Server-based Java support is slated for later this year, first in Adaptive Server Anywhere, and then in Adaptive Server Enterprise. Sybase's server-based Java Object Model will allow developers to create JavaBeans that execute off the server.

Sybase doesn't have a multidimensional OLAP server product. Adaptive Server IQ, which uses an innovative indexing technology that can be used with any RDBMS engine, not just Adaptive Server, is intended to be the basis for large data warehouses.

Sybase, like the other RDBMS vendors, faces a shrinking market that is changing from being a high-profit-margin business to more of a shrink-wrapped commodity business. Perceived as being a conservative company that's far less aggressive than Oracle (both on the sales and marketing fronts) and also generally slower to market with support for new technology, it's unclear how Sybase will fare in 1998, especially once Microsoft's SQL Server 7.0 ships with a new assault on the low end of Sybase's market. Its small-footprint Adaptive Server Anywhere, already widely used to support mobile worker applications, could emerge as an important profit center in Sybase's business.

DB2 RANKS NUMBER TWO

Strangely, DB2 hardly ever figures as a leader in the RDBMS market, but that's probably because analysts don't count DB2's mainframe sales. When you look at the overall $5.7 billion RDBMS market–as market research firm Dataquest (`http://www.dataquest.com`) did in its April 1997 report, "Worldwide Database Preliminary Market Statistics," for example–IBM ranks number two, just 4% behind number one Oracle. And, by the way, DB2 has been available on Solaris for more than a year.

The big news on the DB2 front is DB2 Universal Database (UDB) Version 5, the newest version of what used to be called DB2 Common Server. It began shipping in late 1995 with support for multithreaded servers and extended data types, including user-defined types, and some parallel operations. It represented IBM's initial effort at consolidating technology for the UNIX and Windows platforms into a single "common" server.

The major difference between DB2 Common Server and DB2 UDB is that the latter merges the functions of DB2 Common Server Version 2, including DB2 Database Server Version 4, and DB2 Parallel Edition. At press time, however, the UDB version of IBM's Common Server Parallel Edition, now referred to as DB2 Universal Database Enterprise Edition and designed to support massively parallel processing (MPP) systems such as IBM's Scalable POWERparallel 2, was still only available under AIX, although NT and Solaris versions were scheduled to be released this quarter.

UDB ships with four extenders: Text Extender, Image Extender, Video Extender and Audio Extender, and other extenders are under development. Extenders basically define new data types and functions using DB2 UDB's built-in support for user-defined types (UDTs) and user-defined functions (UDFs). It's important to note that, despite the industrywide trend toward "universal" servers that offer support for large "objects" (see Table 2), they're not yet easy to use. There's a big difference between supporting 2-GB BLOBs and being able to search the contents of documents that may be stored in those fields. That's the difference between plain BLOBs and "extended" searchable text field support.

IBM doesn't have to prove itself in the domain of database reliability, integrity and scalability and seems poised to capitalize on its reputation in the arena of e-business. Despite some early setbacks with World Commerce and its Cryptolope technology (an encryption technique for copyrighted information), IBM provides a rich line of software ranging from developer tools, including Visual Age for Java, Net.Commerce, NetObjects Fusion and the Lotus Domino Web server, to its Web-ready DB2 UDB. Indeed, IBM's main problem may be market

Circle No. 35

confusion about which combination of tools to use. IBM is also a major player in supporting Java standards and tools.

Although IBM has been selling an inexpensive NT-based data mart product, Visual Warehouse, for almost two years, the product has never taken off and is expected to be relaunched as a data warehousing product midyear. Probably more significant, however, is IBM's recent entry into the business intelligence arena with a new OLAP product based on the Arbor Software Corp.'s Essbase OLAP server.

Make no bones about it, IBM has all the pieces anyone needs to build database-based applications. Its venerable message-based middleware product MQSeries is enjoying a renaissance. Its Tivoli Systems Inc. network and systems management suite shares the market leadership position with Computer Associates International Inc.'s Unicenter and Hewlett-Packard Co.'s OpenView. Its DB2-based Digital Library is the basis for displaying world-class collections over the Internet. And, although IBM's business model has focused on the high end and on providing a complete bundle of products and services, it's beginning to market more aggressively to small and medium-size businesses–rather than leave that market all for Microsoft.

INFORMIX KEEPS LOYAL FOLLOWING

Despite its recent financial difficulties and apparent miscalculation of customer interest in the universal server market, Informix remains a major player in the database market with thousands of loyal customers for its OnLine Dynamic Server (ODS) and Extended Parallel Server (XPS) products.

Late last year, Informix announced plans to simplify its database line by adopting a single-server approach and introducing a single application programming interface (API) for all of its databases. The seemingly ill-fated object/relational Informix Universal Server, initially launched in December 1996, along with OnLine Dynamic Server and XPS, is now marketed as a single database called Informix Dynamic Server. The new Dynamic Server ships with several configuration options covering data warehousing, distributed applications and object-relational applications in addition to traditional OLTP applications.

Informix has apparently adopted the Oracle model of selling advanced functionality in the form of "options" as follows: an Advanced Decision Support Option, with data warehousing capabilities taken from XPS; an Extended Parallel Option offering symmetric multiprocessing (SMP) support also based on XPS; an object/relational option called the Universal Data Option similar to the original Universal Server; a Web Integration option; and a MetaCube ROLAP Option offering Informix's relational OLAP engine.

Although Informix has a tools product line, its offerings have never been popular, and that's not likely to change, despite the company's 1996 acquisition of a new Visual Basic-based application development tool, CenterView's Data Director, now renamed Informix-Data Director and also available in Java and Web versions. Nor is it likely that Informix will emerge with its own comprehensive e-commerce suite. It's likely to "stick to its knitting" and attempt to rebuild market confidence in its basic product: database servers.

FOOTNOTES

Another database worth considering is NCR Corp.'s Teradata. Although Teradata is only available on NCR systems running its own version of UNIX, that's supposed to change this year when an NT version of Teradata ships. Further down the line, probably next year, when Sun Microsystems Inc.'s 64-bit Solaris for Intel Corp.'s Merced ships, Teradata is scheduled to be available on Sun systems. Teradata is the basis for more than 700 large data warehouses and is known for its scalable, high-availability systems. It might be worth experimenting with the NT version when it ships later this year.

Speaking of NT, *SunExpert* readers may be interested to hear that all the RDBMSs mentioned above are available on NT, often at a fraction of the cost of the Solaris or other UNIX versions. It often makes sense to use NT as a development platform, even if you have no intention of deploying a production system based on NT. The release of Microsoft's SQL Server 7.0 (code-named "Sphinx") this year is also likely to focus attention on the NT database market, so it behooves you to keep an eye on what Microsoft has to offer. SQL Server 7.0 will be bundled with the new BackOffice 4.5 and is expected midyear. ⊸

Karen Watterson is an independent San Diego, CA-based writer and consultant specializing in data architecture and data warehousing issues. She writes monthly columns for *Windows NT Magazine* and *DM Review* and is old enough to have written programs both on punched cards and Apple II cassette tape. Email: karen_watterson@msn.com.

COMPANIES MENTIONED IN THIS ARTICLE

IBM Corp.
Contact local sales office
http://www.software.ibm.com/data/db2

Informix Software Inc.
4100 Bohannon Drive
Menlo Park, CA 94025
http://www.informix.com
Circle 150

Microsoft Corp.
One Microsoft Way
Redmond, WA 98052
http://www.microsoft.com/sql
Circle 151

NCR Corp.
1700 S. Patterson Blvd.
Dayton, OH 45479
http://www.ncr.com/teradata/
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Oracle Corp.
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Redwood Shores, CA 94065
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Sybase Inc.
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Circle 154

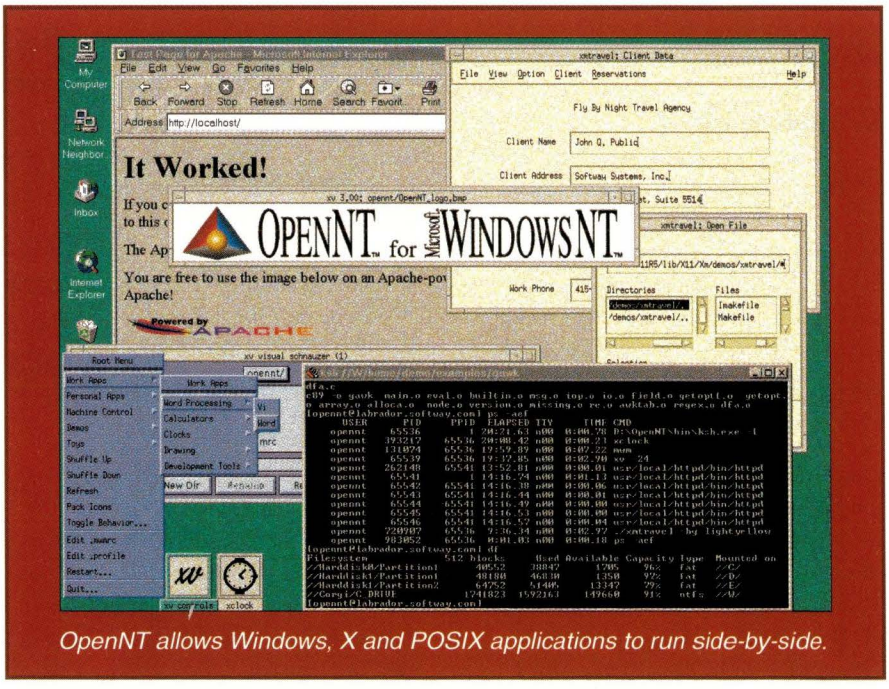
OpenNT – More Than Just UNIX and NT

by **IAN WESTMACOTT**, Technical Editor

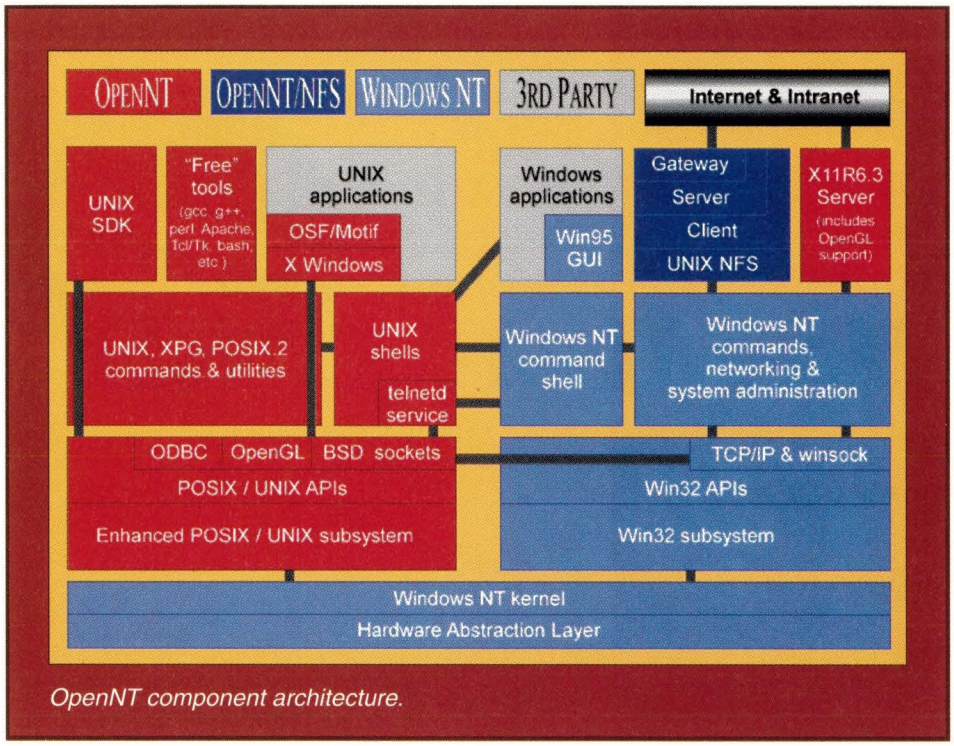
Over the years, the Computer Publishing Lab has looked at various attempts to bring UNIX and Windows under a single desktop: Microsoft Corp. Windows X servers, Sun Microsystems Inc.'s WABI, Citrix Systems Inc.'s multiuser WinFrame and so on. All of these have worked to some extent, but none has offered a seamless, efficient solution with extensive support of both environments.

Ironically, perhaps, recent advances in the personal computer market have created the technologies to make the promise of elegant multioperating system support on the same desktop a reality. First, advances in the Intel Corp. x86 architecture have made it a feasible architecture for running the UNIX operating system. Today, many flavors of UNIX run on the architecture with great success. Second, Microsoft's Windows NT operating system and environment has support for multiple (C2-class) users, a robust ACL file system (NTFS), and is architected to support multiple operating environments. In fact, out of the box, Windows NT includes a POSIX subsystem, which provides a POSIX system call (POSIX 1003.1 or POSIX.1) API to Windows NT. The IEEE POSIX standards are the standards by which an operating system is tested for UNIX compliance. POSIX 1003.1 compliance alone does not a UNIX system make, but it is enough to build a UNIX system.

This is precisely what Softway Systems Inc. has done with its OpenNT product. OpenNT 2.1 extends the Windows NT POSIX subsystem to include full POSIX 1003.1 (system calls) and POSIX 1003.2 (commands and utilities) compliance. Moreover, OpenNT provides ANSI C interfaces, BSD sockets (mapped to Winsock), SVID interprocess communication (IPC), X11R6.3 server, a telnet server and standard TCP/IP clients, and a UNIX development environment, including an optional OSF/Motif development environment. Familiar UNIX shells (Korn and C), with full shell job control, and scripting languages (awk, sed and Perl) are also



OpenNT allows Windows, X and POSIX applications to run side-by-side.



OpenNT component architecture.

included. More than UNIX and NT on the same desktop, OpenNT offers a POSIX development environment on NT systems.

OpenNT was developed under contract with Microsoft, and Softway Systems holds a Windows NT source code license and strategic marketing agreement with Microsoft. This means that Softway Systems has access to NT implementation details and developers. Softway Systems has already won large contracts in both U.S. government and industry corners.

Components

There are a number of OpenNT flavors and components. The OpenNT Workstation product ($379) includes commands and utilities, X11R5 runtime, X11R6.3 server (Intergraph Computer Systems' eXalt 3.0) and a single-user telnet daemon. The Workstation Lite product ($229) leaves out the X11R6.3 server. The OpenNT Server ($979) is the same as the Workstation product but allows 25 telnet connections. The OpenNT SDK ($199) includes UNIX and X11R5 development tools. The OpenNTiF Window Manager ($99) is a Motif (1.2.4) window manager, while the OpenNTiF SDK ($149) is a Motif (1.2.4) development environment, which includes the window manager.

Also available is OpenNT/NFS Workstation ($495), an NFS client; OpenNT/ NFS Server ($1,495), NFS client and 25-user server; and OpenNT/ NFS Enterprise ($5,995), NFS client and 25-user server and gateway. We were not provided with any of the NFS products for review.

OpenNT 2.1 requires Windows NT 3.51 or higher and runs on either Intel x86 or Digital Equipment Corp. Alpha platforms. The development kits also require Microsoft Visual C/C++ 4.0 or higher. Thus, to have a system that resembles commonly available UNIX systems, you must purchase Microsoft Windows NT Server ($730), Microsoft Visual C ($450), OpenNT Server ($979), OpenNT SDK ($199), OpenNTiF SDK ($149) and OpenNT/ NFS Server ($1,495), for a grand total of $4,002. However, Version 2.1 includes the Free Software Foundation's GNU C/C++ compiler, so if you can use this–subject to the GNU general public license–you can avoid Visual C. However, the Visual C/C++ compiler also gives you an NT development environment. By contrast, Solaris Server and Visual C++ for x86 will run you about $1,690; add in Windows NT Server and Visual C/C++ and you can create a dual-boot system with development on both sides for a total of $2,870. This will give you a full, proven UNIX system with more than 10,000 applications and a huge freeware/shareware collection, but you don't get integration or concurrency. The real power of OpenNT is the ability to run POSIX applications locally from the NT desktop, and for that you only need NT Server and OpenNT Workstation or Workstation Lite, for a total of $1,109 or $959, respectively.

The real power of OpenNT is the ability to run POSIX applications locally from the NT desktop.

Installation and Documentation

The OpenNT Server media includes a CD-ROM and 25-page *Getting Started Guide*. You will also receive license sheets for each of the products you purchased. A Windows setup program installs the product components, except OpenNTiF SDK, which must be installed via a shell script after OpenNT is installed. Our version made us run the script with the license code as argument, and then presented us with a challenge key. We then had to send this key to Softway and await a response key to finish the installation.

There are several things to keep in mind when installing OpenNT. While the product does not have to be installed on an NTFS partition, full POSIX file operations are only supported on NTFS partitions (even when OpenNT itself is not installed on an NTFS partition). To get true POSIX compliance, you must also disable NT's Bypass Traverse Checking right for all users–this right allows users to enter a directory to which they have appropriate permissions, even when they do not have permissions in parent directories, which is a violation of POSIX file sys-

tem semantics. While OpenNT may be installed in an arbitrary subdirectory, to mimic typical UNIX directory hierarchies, `/etc`, `/usr` and so on, OpenNT should be installed in the root directory of a partition. We installed it in the root directory of an NTFS partition.

OpenNT includes manual (man) pages, as one would expect. Product documentation is available online as Adobe Systems Inc. PDF files (Acrobat reader included), although several documents that were supposed to be installed were not. The documentation is fairly comprehensive, for both novice and expert, and further documentation is available from the OpenNT Web site.

We interacted with OpenNT technical support primarily via email. While not all of our problems were resolved, we found tech support to be competent, expedient and friendly.

Shells and Utilities

OpenNT includes two shells: Korn (`ksh`) and C shell with file name completion and command line editing (`tcsh`). The commands `sh` and `csh` are links to `ksh` and `tcsh`, respectively, and the Bourne shell (`bash`) is available (unsupported) from the contributed software section of the OpenNT Web site. Our first real difficulties with OpenNT appeared in `tcsh`. We discovered several bugs. For example, in most cases, recalled commands from the history stack were not editable (I suspect this is a problem with terminal emulation). We also had an intermittent problem with pathnames on FAT file systems. Neither of these problems were completely resolved with Softway Systems' technical support. Otherwise, the shells operated as expected (no problems with `ksh`).

Most of the utilities you would expect are included, even beyond POSIX.2 (see Table 1). For example, other familiar commands (more than 140 of them), such as `grep`, `file`, `more`, `nice`, `spell` and `split`, are included. Even nonstandard but common commands like Perl Version 5.003 are included, as are a number of GNU utilities such as `gzip` and `gawk`. Even more are available from the OpenNT

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contributed software site, including xv, JOVE, f2c, gmake, ghostscript and Tcl/Tk. We weren't missing a single user command. We did find some bugs here too, though. For example, the find command was not case-sensitive (that is, 'find /* -name BIN' would find 'bin'). After we reported this, Softway Systems fixed the bug and incorporated it in the official release.

Perhaps the most noticeable difference between OpenNT and other versions of UNIX is in systems administration. A number of administration tasks, such as user account administration, are handled by Windows NT, not OpenNT. Standard facilities and tools, such as cron, syslogd and tar, are included. There is also a tech note available on the OpenNT Web site that details differences in systems administration, including summaries of how to perform common operations using Windows NT command-line utilities (which are usable in scripts).

Development Environment

Initially, the C compiler provided with OpenNT (cc and c89) was simply a shell script to invoke the Visual C/C++ compiler (purchased separately) with the appropriate options and libraries. Then, the GNU C/C++ compiler appeared on the contributed software list, and now in Version 2.1 it is included with the product. The ANSI C interfaces and libraries conform to POSIX.1, so developing POSIX applications is fully supported. All the familiar development tools are also included, such as ar, as, make, ident, nm, strip, rcs, lex and yacc.

However, some peculiarities of OpenNT present obstacles for porting applications and building packaged software on OpenNT. For example, not all system calls have entry points in the C library libc.a, but rather in a dynamic library psxdll.a; many ioctl() functions are not supported; and symbolic links are not supported. Also, OpenNT does not have a single-rooted or completely standard file hierarchy, although you may set up OpenNT to appear single-rooted and standard. These peculiarities will affect the porting of applications and building of software using configure scripts, such as GNU configure, which usually make assumptions regarding the file system hierarchy and libraries. These will take some hand recoding, and there is a tech note providing guidelines available on the OpenNT Web site. We attempted to build a number of such packages, including the Secure Shell (ssh), Concurrent Version System (CVS) and the SML/NJ compiler with varying degrees of recoding and success, but did not find an example that couldn't be ported. As with any UNIX system, however, applications using device drivers will need special attention.

Table 1. POSIX.2 Commands

awk	ls
basename	mailx
cd	mv
chmod	od
cp	pax
dirname	sed
echo	sh
ed	stty
find	test
ln	touch
locale	tr
localedef	uname
logger	

X11R5 and Motif 1.2.4 development is almost exactly as you will find on other UNIX platforms, including the standard examples and utilities, such as imake, xmkmf, mkdirhier and uil.

X Server

The X server provided with OpenNT is Intergraph's eXalt Version 3.0. This is an X11R6 server with OpenGL support for Windows NT (on Intel x86 or DEC Alpha), and does not require OpenNT. Moreover, you may use any NT X server with OpenNT. This is fortunate, as we were not overly impressed with eXalt. The server has most of the options and features you would expect, but compared with other PC X servers we have tested, eXalt rated low on speed tests. It was also fairly easy to crash the server, particularly during remote operations, by connecting more than four or five clients or connecting clients with rapidly updated displays. To eXalt's credit, it did perform well on R6 operations, such as connecting to the server via a low-bandwidth X (LBX) proxy server.

All the usual X clients are included, such as xterm, xclock, xcalc and xfontsel. All the clients performed as expected, including the Motif window manager (mwm), which worked like clockwork. We were even able to drop in an X resource file from our UNIX machines to give the Windows desktop the look and feel of our UNIX desktop. The only difficulty is deciding whether you want root mouse events to go to X or to Windows (in multi-window mode).

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Telnet Server

Although it may seem like a simple thing, the OpenNT telnet server is perhaps one of OpenNT's best features from an administrator's point of view. We've heard over and over from Internet service providers and IT departments running large numbers of servers with large numbers of users that one of the most difficult things about Windows NT is remote and automated administration. With the telnet server (which in Version 2.1 is a port of 4.4 BSD-lite `telnetd`) you can effectively open a console window or launch an `xterm` window on your Windows NT systems from anywhere, and perform configuration and administration tasks. With OpenNT's scripting tools and shells, and the `cron` and `syslog` daemons, you can automate administration tasks as you would with a UNIX system.

Summary

Whether it's UNIX commands, UNIX administration or POSIX development you're after for your NT systems, OpenNT is the only product that gives you both environments running natively and concurrently. Those porting UNIX products to NT, moving UNIX users to NT, looking for UNIX-style administration on NT, or simply looking for a mixed UNIX/NT environment, would be well-advised to take a look at OpenNT. What you won't get is a UNIX kernel, or a large set of tools and applications, but hopefully Softway Systems will continue to promote OpenNT as an open system, and development in the OpenNT user community will become as rich as with other systems like Linux.

Despite a few bugs, for those waiting for a workable, robust release, 2.1 is it. OpenNT is well-engineered, and experienced UNIX users should have no trouble with the system. Moreover, administrators can easily set up NT desktops with access to UNIX applications that is completely transparent to the user, so even those with no UNIX experience should have no trouble. Watch out UNIX vendors, you're not the only open game in town. ⊸

OpenNT Server 2.1

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OpenNTiF SDK: $149

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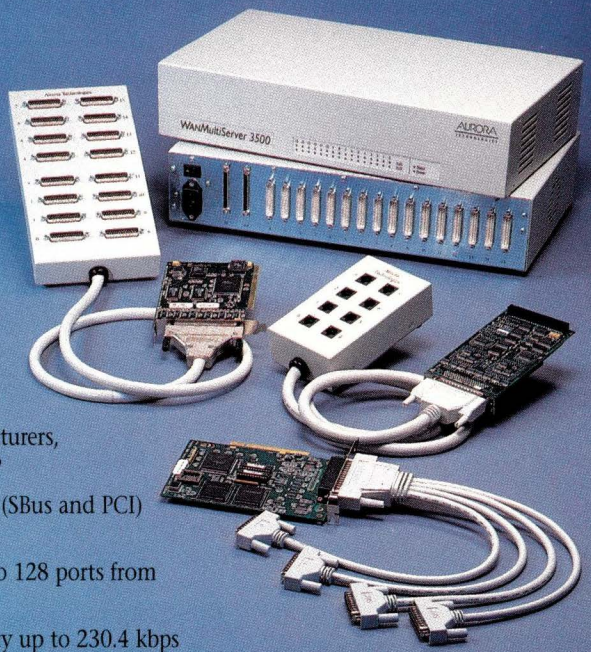

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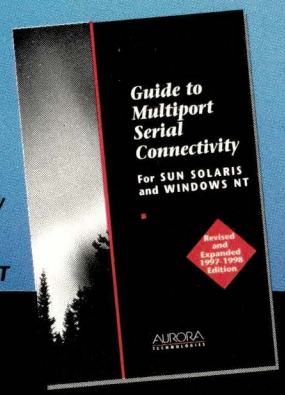

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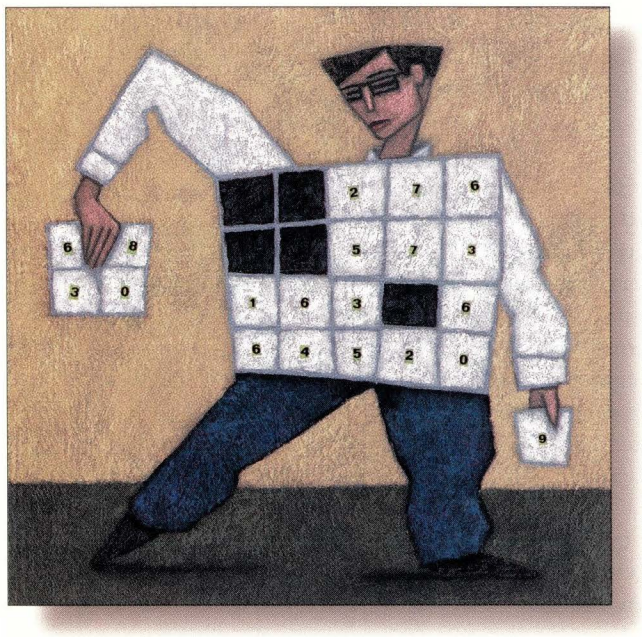
Q&AIX

by Jim Fox



Making a List, Sorting It Thrice

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`.

A *wizard's apprentice*

AA *super user*

AAA *wizard*

Q: I am working on some legacy systems, and the output has to be resorted. The output consists of sets of records with fields separated by commas. For each set, the output should be sorted first on the third field, then on the first field, finally on the fifth field. So the output might look like this (note that some lines have blank fields):

```
"B",00015,69946925,,,971123
"D",00016,69946924,064,50451977354,971121
"D",00017,69946925,064,66706217524,971119
"D",00018,69946925,064,66706217734,971121
```

How should I sort this output on an AIX system? A

Rodger Lepinsky
ADP Systems Partnership

A: This question was taken from one of the "UNIX questions" Internet newsgroups. I wanted to answer it here for a couple of reasons, not the least of which was because a few incorrect answers were offered.

In his famous series, *The Art of Computer Programming*, Donald Knuth pointed out that, at least in 1970, more than 25% of all computer time was allocated to sorting. That was before *Doom*, of course, but I suspect the percentage of computer time spent sorting is still very high. However, the importance of efficient sorting is not usually recognized by UNIX programmers and users. Mainframers have long been aware of the difficulties encountered in sorting and searching problems. They are generally more aware of the need for efficiency than are UNIX people.

Those of us who work with AIX are blessed with one of the best UNIX sort packages. Let's take a quick look at the `sort` command and see what's new.

sort Command

The basic UNIX `sort`,

`sort -o` *outfile infiles*

or

`cat` *infile* `| sort >` *outfile*

sorts lines in the input files into the output file. Without options, it uses the entire line to order the records. Usually, you want to

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2. Your system always crashes at 4:59 PM!
3. When you need it most, your backup is NOT bootable, doesn't work and is corrupted!
4. Your 10 hour system upgrade is in its 20th hour!
5. When you need them most, your software vendor just closed their office for a 3-day company outing!
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Circle No. 39

sort on specific parts in each record. To that end, `sort` logically breaks each input record into *fields* and *sort keys*. Fields are sections of the input record delimited by field separators. The default separator is one or more spaces (or tabs), but you can assign any character as the separator using the `t` parameter–use `-t` followed immediately by the new separator character.

Each record of your data, which uses a comma as the separator, contains six fields. The record

```
"D",00017,69946925,,,971119
```

also has six fields. The fourth and fifth are null.

Sort keys are specific columns within a field. Often a key is the entire field. With AIX `sort`, there are two ways to specify a sort key: by field and column position, or by field and column skip counts. The latter should be considered obsolescent. Unfortunately, the former method is not available on many systems, so you may find yourself stuck using the older method.

I think the position method of AIX is the easiest to use. A key specification looks like this:

`-k` *Fstart*`.`*Cstart*`,`*Fend*`.`*Cend*

where

Fstart = Starting field of the sort key (default is the start of the line).
Cstart = Starting column in the field (default is the start of the field).
Fend = Ending field of the sort key (default is the end of the line).
Cend = Last column in the ending field (default is the end of the field).

All parts are optional. You can append the following modifiers to the end of the starting specification:

`b` Ignores blanks.
`d` Uses only the letters, digits and spaces, and ignores all other characters.
`f` Changes lowercase to uppercase before sorting.
`i` Uses only printable characters and ignores all others.
`n` Interprets the field as a number.
`r` Reverses the order of the sort.

If you specify multiple keys, the first is the primary. All records whose primary keys are identical will appear together in the output, and they will be sorted among themselves by the secondary key. This continues for all keys. If two records have identical keys, they are finally sorted by the entire line.

Suppose we wanted to sort your password file, for example, by group and then by user ID: The group number is the fourth field, the ID is the first field and the separator is a colon. Thus, we would use

```
sort -t: -k 4n,4 -k 1,1 /etc/passwd
```

Notice that if you leave off the ending part of the key specification, you're really sorting the rest of the line–maybe not what you intend. It's more precise to specify the keys exactly.

Also, notice that `sort` does not retain the original order of records with identical keys; this is why sequential sorts do not have the intended effect: `sort -k 2,2 | sort -k 3,3` is not the same as `sort -k 3,3 -k 2,2`.

The modifiers (`b`, `d`, `f`, `i`, `n` and `r`) can all appear as command-line options, if they come before the first sort key. Used this way, they apply to all sort keys. For example, the command

```
sort -n -k 2,2 -k 4,4
```

interprets both sort keys as numbers. Check out the man page for other parameters.

On lesser systems, you may be forced to use the old key specification. It looks something like this:

+Fskip1`.`*Cskip1* *-Fskip2*`.`*Cskip2*

where

Fskip1 = Number of fields to skip before finding the sort key (default is zero).
Cskip1 = Number of columns in *Fskip1* to skip (default is zero).
Fskip2 = Number of fields to skip to get past the sort key (default is just past the end of the line).
Cskip2 = Number of columns to skip in the ending field to get past the sort key (default is just past the end of the field).

All parts of this form are optional. And you can append the modifiers to change sort criteria, just as with the `-k` form. Notice that in the *skip* form, you first specify the skip counts to the sort key and then to get just past it. Use, for example, `+1 -2` to sort just on the second field. I find this syntax more confusing than the newer, positional notation.

Dealing with Blanks

Blank spaces are troublesome. Sometimes they're ignored; sometimes they're not. By default, spaces count as columns, even the default field separator counts as the first column of a field. However, the leading blanks of a line are not normally considered when counting columns of the first field. In addition, different sort programs (different systems) will treat blanks differently. Consider these two sorts, which by the documentation should be equivalent.

Using this input data

```
abc
  acc
    adc
```

on AIX, we find

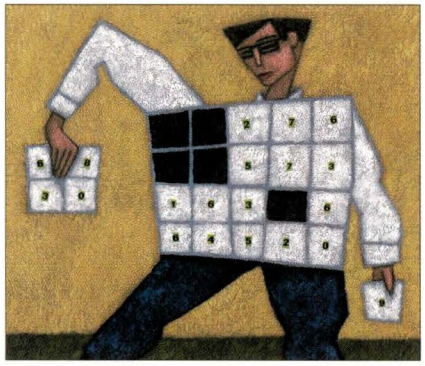
```
$ sort -b
abc
  acc
```

```
adc
```

correctly ignoring the blanks. However, using the same command on SunOS we find

```
$ sort -b
adc
  acc
    abc
```

seemingly ignoring our `-b` option. If you have significant spaces in your data, you should check that the sort program you intend to use really does what you want.



Further Reading

The best book on sorting and searching, and on computer algorithms in general, is still *The Art of Computer Programming* by Donald Knuth (now in its third edition), published by Addison-Wesley Inc., ISBN 0-201-89685-0. For sorting and searching, you'll need volume three. Don't go right out and buy the series, though; these books are expensive and full of advanced mathematics and some ancient assembly code. They're not for everyone. Do check them out if you're working on your own algorithms, or if you enjoy some really challenging problems and exercises.

* * * *

Computer people use the term *sort* to mean arrange in ascending order. We've done this our whole lives, or for 50 years, whichever is smaller. It seems like the normal, English use of the word, but it's not. You won't find our definition in a dictionary. Remember this when conversing with the masses. ➸

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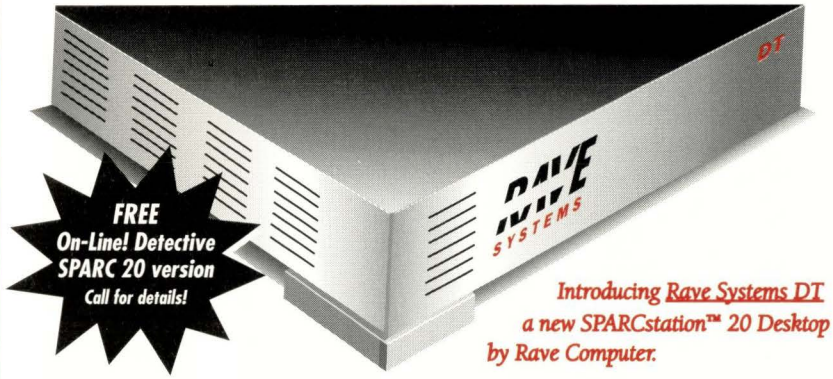

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by John S. Quarterman

Fast Remote File Copying

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.*

A few months ago I mentioned `rsync` among a list of UNIX network tools. I've found this particular tool so useful since then that I think it's worth a column on its own.

What rsync Does

The `rsync` facility is intended to be a "faster, flexible replacement for `rcp`." It is that, and more. It

- Transfers only files that are different.
- Transfers only the differences in those files.
- Compresses data as it transfers it.
- Preserves file modes, owners and groups.
- Copies devices and links.
- Uses either `rsh` or `ssh` for network transport.
- Does everything it does without needing to be setuid.
- Accepts or rejects files according to parameter files.
- Pipelines transfers to avoid network lockstep delays.

The command-line syntax is like `rcp`. To retrieve a set of source files from one of my office machines to my notebook computer for easy modification while traveling, I might type the following command:

```
rsync -ravz files:/src/mm /src
```

When I'm finished modifying the sources, I might type the following one-line command to send the modifications back to the office machine:

```
rsync -ravz /src/mm files:/src/
```

Simple, easy, and the two commands are even symmetric.

These are the options I commonly use, as in the above examples:

- `-r`: Recursively copy directories.
- `-a`: Archive, preserving permissions, groups, owners, etc. It also implies `-r`, so I don't need to say `-r` explicitly.
- `-v`: Verbose, just because I like to see what's going on.
- `-z`: Compress, for big speed wins over slow links.
- `-e ssh`: This option means use `ssh` instead of `rsh` to carry the data, thus gaining authentication and encryption, which spells added security.

Because I use these options all the time, I have a `csh` alias set for them:

```
alias rsync 'rsync -ravze ssh'
```

Circle No. 46

So all I actually have to type is

```
rsync files:/src/mm /src
```

or

```
rsync /src/mm files:/src/
```

Because I would normally change into the directory of interest first,

```
cd /src/mm
```

all I actually type is

```
rsync files:/src/mm ..
```

or

```
rsync . files:/src/mm
```

According to the documentation, this should also work:

```
rsync files:/src/mm/ .
```

Note the trailing slash on the source pathname; that's supposed to mean to copy the files in the directory rather than the directory itself. This permits the target to be the local directory (`.`), not the parent directory (`..`). Personally, I've never liked trailing slash conventions, so I always forget to use that one, but I have to admit it is a little more intuitive in this case.

Backups and Mirrors

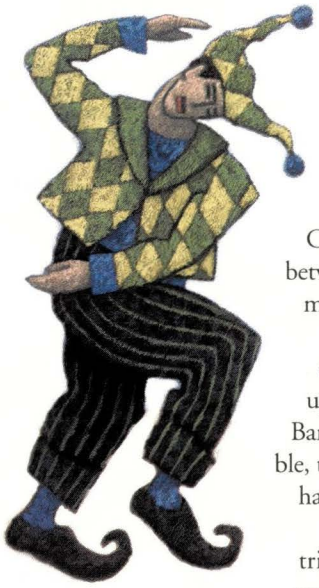
Another use for `rsync` is to back up directories whose master copy is always on one machine. In this case, you can set up a `cron` entry to periodically use `rsync` to synchronize the master copy with another copy on some other machine. The `cron` entry can either be on the machine with the master copy or the machine with the backup copy, because `rsync` can synchronize in either direction. Such backup transfers will be more efficient than the traditional UNIX method of using `dump`, although the `rsync` backup method does require keeping a complete copy on the backup machine. Disks are cheap these days, so that's not usually a big problem.

Similarly, FTP or HTTP servers that function as mirrors of other servers can be synchronized via `rsync` called from `cron`.

Here at MIDS we use `rsync` for all these purposes: synchronizing notebooks, backups and distributing to Web and FTP servers.

The latest `rsync` version as of this writing, Version 1.6.9, has added options to use relative pathnames, follow

symbolic links and copy the files they point to, and to force copying whole files, not just pieces of them. I'm not sure why anyone would want to use that last option, but I suppose over fast network links it could be more efficient.



What rsync Doesn't Do

This program will never replace anonymous FTP. It's designed for careful replication of local ownerships and file modes, not for anonymous distribution of files.

The `rsync` man page actually recommends using the Concurrent Version System (CVS) to pick up the latest `rsync` off the Net. We'll discuss CVS in a later column.

The standard FTP repository for `rsync` is `ftp://samba.anu.edu.au/pub/rsync/`. Mirrors are available at

- `ftp://sunsite.auc.dk/pub/unix/rsync`
- `ftp://ftp.sunet.se/pub/unix/admin/rsync`
- `ftp://ftp.fu-berlin.de/pub/unix/network/rsync/`

There is a Web page, which includes an interface to a bug tracking system, at `http://samba.anu.edu.au/cgi-bin/rsync`. You can also send bug reports by electronic mail to `rsync-bugs@samba.anu.edu.au`. Installation is usually trivial using the usual `configure` script plus `make`.

Comparing rsync and rdist

There appear to have been subtle differences in the design criteria for `rsync` and `rdist`. The original `rdist` program was written to facilitate distribution of a few large programs such as `sendmail` to up to a hundred computers around a university campus. It's usually safe to assume in such an environment that

- The new program binary will be very different from the old one.
- Plenty of bandwidth is available.
- So much bandwidth is available that no one else will be affected by using it.
- There's no need to optimize the distribution program for small files.
- Copying whole directories or file system trees will not be the norm.
- Carefully selected files may need to be copied, necessitating a parameter file.

While `rdist` performs well in an environment that matches such criteria, it is not as well adapted to an environment of many small files that need to be synchronized over relatively slow network links.

The characteristic example for `rsync` is synchronizing files on a notebook computer with files back at the office. The design criteria for `rsync` thus appear to have been different. Certainly, sets of files need to be synchronized between a pair of computers, and the synchronization may be initiated from either computer. There can be many files, and the files may be in subdirectories, and the program must select those that need to be updated. The intervening network link may be slow. Bandwidth usage must be optimized as much as possible, therefore, the transfer of only pieces of files that have been changed (or file compression) is desirable.

The result is a program that can be used to distribute a few small binary files, just like `rdist`, and is usually faster and easier to use. But `rsync` has other uses as well, and can do at least one thing that `rdist` can't do, namely pull files from a remote computer to a local computer. `rsync` has at least two big efficiency wins: It transfers only the *pieces* of files that have changed, and it will compress data before transfer if requested. A third, more subtle, efficiency win is that, unlike `rdist`, which waits until each previous transfer is finished before starting another one, `rsync` pipelines transfers, thus avoiding that kind of network lockstep delay.

Another big advantage in my view is that with `rsync` you don't have to have a parameter file. If you need to synchronize a directory between two systems, you don't have to fiddle with files. Just use `rsync` instead of `rcp`, but with the same syntax as for `rcp`, which of course is very similar to `cp`.

You can also use `rsync` to distribute files (small or large, few or many) to multiple systems quite easily. Just write a small shell script that calls `rsync` with each target system as a destination.

***

Thanks to Jan Howell for bringing `rsync` to my attention, and to Andrew Tridgell and Paul Mackerras for writing the program.

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by Jim DeRoest

Keeping Watch over the Flock

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`.

This month, I'm climbing back up on my soapbox and continuing to proselytize a devotion to hardening system security. Last time, my focus was on techniques for reducing exposure to network eavesdropping attacks. This month's sermonette will expound on a simple but often ignored tool, system logs. I say "ignored" because we tend to overlook how valuable this information is until we really need it.

Logs are large and take up valuable disk space. Many of us either turn them off or have `cron` nuke them every night. The fact we all have to face is that someday someone is going to exploit some security hole in our network infrastructure. Without good audit trails, we won't be able to easily discover the who, how, when and where of the attack. If you can't prevent an attack, then at least extract a little revenge by hunting the attackers down. Keeping good system logs will also improve relations with other systems administrators hit by the same attack.

Secure Audit Computer

None of us want to clutter up our production systems with a lot of multimegabyte log files. It's also true that sophisticated hackers will tend to cover their tracks by modifying log entries if the logs are left within easy reach. The solution is to close out each service log periodically and then move them to a secure remote computer. With all your logs in one basket, so to speak, you can easily build tools to cross-reference entries, scan for access patterns, and merge and condense audit information. Other administrators and support personnel will have one place to go when sleuthing suspected break-ins. This will save time in large distributed environments by eliminating the need to check the logs on each and every machine in the system.

In that you will be consolidating a large amount of valuable auditing data on one computer, make sure the system is secure and recoverable. This machine is a good place to practice your firewall skills. Shut down and remove any network service that isn't required for your security work. Limit the user base to only those who need access to the information. You might consider requiring additional credentials to access the system, such as smart cards or the exchange of public keys. Don't copy logs onto your audit site using NFS. In fact, don't allow any NFS-mounted file systems on the log archive machine. To copy logs onto the system in bulk, use a secure

copy mechanism like ssh (see "Process Management, Part Deux," January, Page 65). When possible, consider logging directly to the site using syslog, and don't forget to periodically audit your audit site.

Most of you are probably familiar with syslog. It provides a mechanism for collecting audit, error and debugging information from server daemons, sorting it and distributing it to various files and remote sites. The syslogd daemon receives messages via datagram sockets created by applications that invoke the syslog subroutine to record their state, and then redirects the incoming messages to files or other machines as described by entries in the /etc/syslog.conf file (see Example 1). This file is read each time syslogd is started or receives a hang-up signal. Each line in /etc/syslog.conf contains message selectors separated by semicolons followed by a field indicating where the message is to be sent. Incoming messages specify a facility code that represents one of the selectors. For AIX, see /usr/include/sys/syslog.h for a list of default codes and selectors. As I mentioned earlier, use syslog to funnel important auditing information directly to your secure server.

Accounting Logs

A good place to start collecting audit data is by regularly archiving copies of the standard accounting files: pacct, utmp and wtmp. These files are especially valuable when your system has been compromised or when it is being used as a base for attacking other systems. The /var/adm/pacct file contains per process information such as the associated user ID, group ID, user name, elapsed wall clock time, CPU time, memory usage, I/O totals and commands. This information provides an audit trail of application use that may be helpful in tracking security incidents. The bad news is that because pacct data is recorded at process exit, you may miss processes that have not exited before the pacct file has been closed.

Connect time data is accumulated in the /var/adm/wtmp and /etc/utmp files. Each time you log into AIX, the login process writes a record to wtmp and utmp. The data indicates the user name, date, time, port and connecting address. A similar record is written by the init process when you exit the system. This data represents the start and duration time of your connection to the system. Combinations of rsh and X11 clients can make some of the connection data a bit fuzzy. For example, the xterm terminal emulation client provides a user flag indicating whether or not an /etc/utmp record should be written. Older versions of xterm also have a nasty habit of trashing the /etc/utmp file. You'll notice the latter problem when your uptime statistics look too good to be true.

Who's Knocking at the Door?

A basic rule of network security practices is being a good network neighbor. This means maintaining secure systems that can't easily be used to attack other sites and providing tools to assist remote sites if an attack is being launched from your computers. One way you can assist is by running the identd service. The Identification Protocol (identd, RFC 1413), formerly known as the Authentication Server Protocol, provides the identity of a user accessing a network service given the port number pair. The identd server listens on port 113 for requests indicating the decimal client and server port numbers, and then returns system-dependent user identification information about the connection, which can include user name, UID, PID, command and arguments. This information can also be directed to syslog to maintain audit trails. identd can be started like other network daemons from inetd (see Example 2).

A common use of identd is identifying pests trying to take over channels on the network root of all evil, Internet Relay Chat. IRC certainly has merits as a tool for facilitating Internet discussions, but there isn't a network administrator alive who won't finger IRC as also being a den of hacker iniquity. OK, enough said, I'll stop bashing IRC.

Only What You Intend

Another way to be a good network neighbor is to allow access only to the services you intend to provide and to log access to those services. If a particular machine's role is only to provide network file service, then it's not prudent to leave sendmail or ftp services running just because they were set up by default at the time of system installation. Don't leave any more possible doorways into your system than you intend.

A great tool for filtering and logging connections on your systems is TCP Wrappers, developed by Wietse Venema at Eindhoven University of Technology, The Netherlands. Venema developed TCP Wrappers in response to a particularly nasty individual who liked to break into systems and play with the rm -rf / command string. For my non-UNIX readers, this essentially gives you a nice clean clear disk, but certainly not what you want for an operating system. As they say, "on a clear disk you can seek forever."

Anyway, the story goes that Venema decided to sleuth this problem by logging connection attempts for the various network services. This was done by installing a middle-

Example 1. /etc/syslog.conf

```
**********************************
* SYSLOG.CONF
**********************************
local0.debug @loghost.foo.bar
mail.info /usr/spool/mqueue/syslog
```

Example 2. /etc/inetd.conf

```
****************************************************************
* INETD.CONF
****************************************************************
ident stream tcp wait sys /usr/etc/in.identd in.identd -w -t120 -l
```

Example 3. TCP Wrappers /etc/inetd.conf Entry

```
**********************************************************************
* INETD.CONF
**********************************************************************
ftp  stream tcp nowait root /usr/sbin/tcpd /krb5/sbin/ftpd ftpd
telnet stream tcp nowait root /usr/sbin/tcpd /usr/sbin/telnetd telnetd
login stream tcp nowait root /usr/sbin/tcpd /usr/sbin/rlogind rlogind
```

ware (wrapper) between the request and the service application. The wrapper would record the computer address of the requestor, time stamp and service type, and then invoke the request service for successful requests. This technique is transparent to the user community, doesn't require modification to system commands or daemons, and doesn't exchange any data with the network requestor, limiting exposure to attacks on the wrapper code itself.

The natural follow-on to determining the computer name used by the bad guy was to block connections from the offending site. This was done using a couple of access control files that list service and host domain names, `/etc/hosts.allow` and `/etc/hosts.deny`. Another enhancement enlisted the computer address to determine the account name of the user on the remote system via calls to the `finger` and `sysstat` services on the remote site. The happy ending to Venema's story is that this type of logging and service filtering helped him shut down his hackers. It will do the same for you. Definitely consider installing TCP Wrappers. Again, it can be invoked using `inetd` and make use of `syslog` for logging purposes. The `tcpd` entry in Example 3 represents the wrapper daemon.

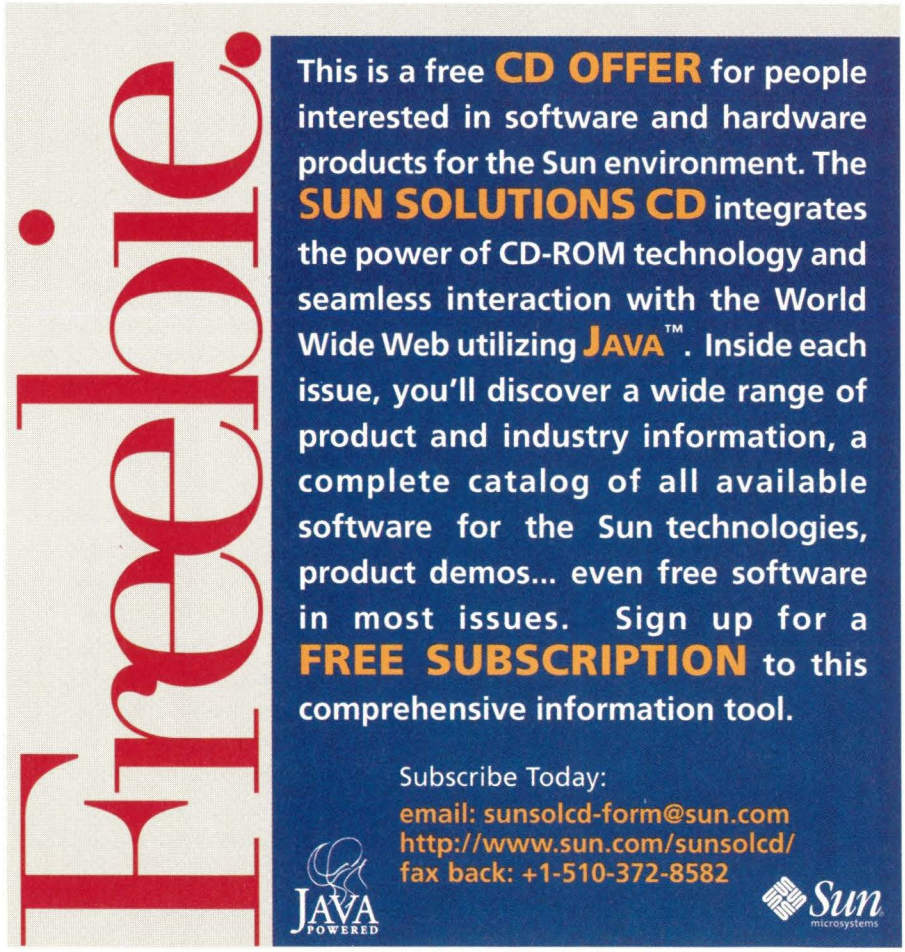
Other Sources

You should be getting the idea that by judiciously maintaining a few key log files you can quickly track down most types of network attacks on your system. Other logs you might add to your information cache would include network router logs, terminal server logs, `sendmail` logs and domain name service logs. In the central computing and networking organization here at the University of Washington, we run more than 2,000 network and compute clusters providing Internet services for the campus. As you might imagine, maintaining a secure central repository for network service logs drastically reduces the effort required in tracking network attacks. It vastly simplifies the task of cross-referencing information from different service log types over multiple machines. It does require a bit of work initially to set up, but the payoff is big.

Table 1. Security Coordination Sites

CERT – Computer Emergency Response Team	
Email:	`cert@cert.org`
WWW:	`http://www.cert.org`
CIAC – Computer Incident Advisory Capability, DOE	
Email:	`ciac-notes-request@llnl.gov`
FIRST – Forum of Incident Response and Security Teams	
Email:	`first-request@first.org`
WWW:	`http://www.first.org`

One final comment before I step off the security soapbox this month. Make sure you stay up-to-date on the latest security tools and incident announcements. I've listed a couple of the common security sites in Table 1. You can find the tools described above at these sites. Check out these Web sites from time to time for updates on security-related issues and subscribe to their mail lists. It will make your job and my job much easier. ⊸



Circle No. 41

by Jeffreys Copeland and Haemer

Looking Through Our Mail

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Note: The software from this and past Work columns is available at http://alumni.caltech.edu/~copeland/work.html.

Letters, We get letters,
We get stacks and stacks of letters ...
– Perry Como

Recently, we received a letter from a corporate attorney advising us that the courts had ordered his client to produce all of our correspondence with that client. We were surprised by this–wouldn't you be?–if for no other reason than we didn't think we'd had any. But with as much mail as we get, who could tell?

Curious, we tried using `grep` to look through all our old, saved mail, but the strings we were looking for were very common. Worse, `grep` really didn't give us what we wanted: mail messages. Stepping back a moment, we realized that we needed a tool that understood the semantics of mail. In fact, we reasoned, this wasn't even a limited-utility tool. Questions like, "Where the heck are those messages from Charlie about the Viper project?" are pretty frequent.

How long would it take to write such a tool from scratch? All morning, as it turned out. What's more, doing it is a good illustration of how to build tools quickly, so in this column, we'll walk you through the process.

As a side benefit, the next time you know of someone who's trying to look through large volumes of electronic mail, you'll be prepared to help with a line-by-line explanation of this tool.

Design by Analogy

Start by asking yourself how the tool should look to the user. Even if you're making something that no one else will ever use, design the interface as though you're writing it for someone else; chances are, six months later, you'll forget why you made the choices you did. A good rule of thumb is to make the tool look as much as possible like something else familiar to you. Because "theft" is a poor choice of words around lawyers, we like the phrase "design by analogy."

Here, we want something `grep`-like, so we'll try to make the interface look like `grep`'s. We'll even call our tool `mgrep`, for *mailgrep*, to keep things simple. This decision means that in two years, after we've forgotten what we did, when we sit down to look for mail messages containing the string `zzazz` in the mailboxes `Feb.mbox` and `Mar.mbox`, we can start out trying `mgrep zzazz Feb.mbox Mar.mbox` and not be surprised with the result. Also, a little attention to detail now will let us pull out all messages containing

zzazz or ZZAZZ or Zzazz with mgrep -i zzazz Feb.mbox Mar.mbox. Why -i? Because that's the flag grep uses for case-insensitive matches.

Moreover, this saves us from having to design all the features and options either from scratch or at once. For example, if we do a bare-bones implementation now, and a year later we want to add an option that means "report all mailboxes that contain messages with this pattern," we won't have to convene a design committee. All we need to do is glance through the grep man page, note the -l option (which prints only the names of files containing lines that match the pattern), and write code to add a -l flag to mgrep.

More Theft

Man is a tool-using animal... Without tools he is nothing, with tools he is all. – "Sartor Resartus," Thomas Carlyle

On to implementation. Our goal is to get something working quickly, so Perl seems like a good tool to use because we know Perl–familiarity is never a factor to be ignored. What's more, this is a text-processing problem–one of Perl's strengths. If we're going to use Perl, our first impulse is to continue to steal by raiding the Comprehensive Perl Archive Network (CPAN). Oh, sorry. Make that, "...build on the work of others."

We'll begin by perusing the modules list at http://www.perl.com/CPAN/modules/. Well, not actually *there*, because going to http://www.perl.com/CPAN/ takes you to a multiplexer that automatically throws you to the nearest mirror site. This trick gets you good performance without making you memorize a lot of URLs. (Note: The trailing slash is very important. Without it, you don't get the multiplexer.) Once there, we quickly find our way to http://www.perl.com/CPAN/modules/00modlist.long.html, the current module list, and begin looking. Modules are Perl's rough equivalent of Ada packages or C++ classes: language extensions, often object-oriented, to handle specific problems.

What will we need? Something to handle argument parsing would be nice, so we don't have to handcraft our emulation of grep's flags. A search for "option" quickly yields an entire section of the CPAN, which begins like that shown in Listing 1.

Getopt::Std ("Implements basic getopt and

Listing 1

```
12) Option, Argument, Parameter and Configuration File Processing

Name           DSLI    Description                                    Info
---------      ----    -------------------------------------------    ---------
Getopt::
::EvaP         Mdpr    Long/short options, multilevel help            LUSOL
::Gnu          adcf    GNU form of long option handling               WSCOT
::Help         bdpf    Yet another getopt, has help and defaults      IANPX
::Long         Supf    Advanced option handling                       JV
::Mixed        Rdpf    Supports both long and short options           CJM
::Regex        ad      Option handling using regular expressions      JARW
::Simple       RdpO    A simplified interface to Getopt::Long         RSAVAGE +
::Std          Supf    Implements basic getopt and getopts            P5P
::Tabular      adpr    Table-driven argument parsing with help text   GWARD +
```

Listing 2

```
19) Mail and Usenet News

Name           DSLI    Description                                    Info
------------   ----    -------------------------------------------    --------
Mail::
::Address      adpf    Manipulation of electronic mail addresses      GBARR
::Alias        adpO    Reading/Writing/expanding of mail aliases      GBARR
::Cap          adpO    Parse mailcap files as specified in RFC1524    GBARR
::Field        RdpO    Base class for handling mail header fields     GBARR +
::Folder       adpO    Base-class for mail folder handling            KJOHNSON
::Header       RdpO    Manipulate mail RFC822 compliant headers       GBARR +
::Internet     adpO    Functions for RFC822 address manipulations     GBARR
::MH           adcr    MH mail interface                              MRG

::Mailer       adpO    Simple mail agent interface (see Mail::Send)   GBARR
::POP3Client   bdpO    Support for clients of POP3 servers            SDOWD
::Send         adpO    Simple interface for sending mail              GBARR
::Util         adpf    Mail utilities (for by some Mail::* modules)   GBARR
```

Listing 3

```
tar -zxvf MailTools-1.1003.tar.gz   # unpack the archive
cd MailTools-1.1003                 # enter the source directory


perl Makefile.PL                    # build a Makefile for your system
make                                # build the package
make test                           # test (!) it
make install                        # install it
```

getopts") should do the trick, working to match the familiar POSIX.1 call, `getopt()`. What's more, the "S" in the second column means that this module is a standard part of the Perl 5 distribution, so we don't even have to pull a copy off the archive. What else? Well, Section 19 looks pretty good (see Listing 2).

Most of these are packaged up in a single `tar` file, by Graham Barr, called "MailTools," so we pull over the most recent version, `MailTools-1.1003.tar.gz`. After we unpack it (assuming we have GNU `tar` with a decompressor–the `-z` flag–otherwise, we can pipe `gzcat` into `tar`), building and installing the module and its documentation requires only following the instructions in the `README` (see Listing 3).

A little manual page perusal reveals that this is enough. A small amount of work–some of it cut-and-paste, which one of our colleagues calls "snarf-and-barf"–gives us the code shown in Listing 4.

Exegesis

Lines 1 through 4 are boilerplate: They guarantee that the script is interpreted by a version of Perl that has enough features to support it; they provide an RCS ID string, to let us know what revision of our code we're dealing with; and turn on lots of warnings, both at compile time and runtime, to prevent us from wasting time debugging really stupid mistakes. We are trying to minimize development time, not running time.

Lines 5, 6 and 7 pull in the three modules from which we'll be using functions. Lines 8 and 9 declare variables. (Line 4 tells the compiler to complain about undeclared variables, which helps catch typos.) We could declare them as we use them but have found that if we collect most of our declarations in one place then it's easier to notice when we're using several different variables to do almost the same thing. We also like to declare our scalar, hash and array variables in separate statements, but that's idiosyncrasy, not Perl.

Lines 10 through 16 process the command-line arguments and give them default values. After the call to `Getopt::Std::getopts()`, all option values are contained in the hash `%opt_args`, and the only things left in `@ARGV` are the pattern to search for and the file names–no muss, no fuss, nothing to tidy up. The loop beginning on line 14 gives any unselected options the value zero. (For the really nitpicky, we are aware that it also sets `$opt_arg{':'}` to zero: meaningless, but harmless.)

Lines 17 through 23 actually interpret some of the options. As long as we are looking for mail messages that contain strings, why not let users specify what part of the mail message to look in? As it turns out, the `Mail::Internet` module lets us get

Listing 4

```
1  #!/usr/local/bin/perl -w
2  # $Id: mgrep,v 1.4 1997/12/27 00:11:13 jsh Exp $

3  require 5.004;
4  use strict;

5  use Getopt::Std;
6  use Mail::Util qw(read_mbox);
7  use Mail::Internet;

8  my ($options, $parts, $pattern, $usage);
9  my %opt_args;

10 # parse args and check for proper invocation
11 $usage = "usage: $0 [-b|-h|-H Header_field|-W] [-i] [-v] pattern [mailbox ...]";
12 $options = 'H:Wbhiv';
13 getopts $options, opt_args or die $usage;
14 foreach (split //, $options) {
15   $opt_args{$_} ||= 0;
16 }

17 $parts = $opt_args{'b'} + $opt_args{'h'} + ($opt_args{'H'} ? 1 : 0);
18 $parts < 2 or die $usage;
19 $opt_args{'W'} = ! $parts;

20 $pattern = shift;
21 if ($opt_args{'i'}) {
```

```
22    $pattern = "(?i)$pattern";
23  }

24  if (@ARGV == 1) {push @ARGV, "/dev/stdin";}
25  while (@ARGV) {
26    my $mbox = shift;
27    $^W = 0;
28    my @msgs = read_mbox $mbox or die "Can't read $mbox:$!";
29    $^W = 1;
30    foreach (@msgs) {
31      my ($tgt, $mail);
32      $mail = Mail::Internet->new($_);

33      my $head = $mail->head;
34      my $body = $mail->body;

35      if ($opt_args{'W'}) {     # the default
36          $tgt = [@$body, @{$head->header}];
37      } elsif ($opt_args{'b'}) {
38          $tgt = $body
39      } elsif ($opt_args{'h'}) {
40          $tgt = $head->header;
41      } elsif ($opt_args{'H'}) {
42          $tgt = [ $head->get($opt_args{'H'}) ];
43      } else {
44          die $usage;
45      }

46      $mail->print
47          if ( grep /$pattern/, @$tgt xor $opt_args{'v'} );
48    }
49  }

50  =head1 NAME
51  mgrep - look through mailboxes for messages containing a string

52  =head1 SYNOPSIS

53    mgrep [-bhiv] pattern [mailbox ...]

54  =head1 DESCRIPTION

55  =over 2

56  I<mgrep> looks for mail messages containing a pattern,
57  and prints the resulting messages on standard out.

58  By default looks in both header and body for the specified pattern.

59  When redirected to a file, the result is another mailbox,
60  which can, in turn, be handled by standard User Agents,
61  such as I<elm>,
62  or even used as input for another instance of I<mgrep>.

63  =back

64  =head1 OPTIONS AND ARGUMENTS

65  Many of the options and arguments are analogous to those of grep.

66  =over 8

67  =item B<pattern>
```

each of these, separately, so we use the options `-b`, `-h`, `-H` and `-W` to tell `mgrep` to look in the body, header, specific header field or whole message, respectively. (The same flags given to `grep` aren't all that interesting, so we'll use the letters for something more meaningful.) Lines 17 and 18 enforce a prohibition against mixing these options and make `-W` the default.

Line 20 grabs the pattern. This pattern can be any Perl regular expression, which means that our tool will actually be a little easier to use than `grep`, or `egrep`, which only understand POSIX regular expressions. Lines 21 through 23 implement the `-i` (case-insensitive matching) option, with Perl 5's new syntax for regular expression extensions. Unlike the syntax `/pattern/i`, which specifies case-insensitivity at compile time, putting `(?i)` at the beginning of a pattern makes case-insensitivity part of the pattern itself, so you can specify case sensitivity at runtime.

Lines 24, 27 and 29 are hacks, impelled by the current implementation of `Mail::Util::read_mbox()`. Lines 27 and 29, which bracket the call, are there to temporarily turn off the `-w` flag and block a complaint about the internals of `read_mbox()`.

Line 24 lets `mgrep` read from standard input if no files are named in the argument list. Here again, the normal Perl idiom, `while(<>)`, is unavailable because of a detail of the implementation of `read_mbox()`. This brings up an important point: We could have avoided having to put in these three hacks, by writing our own replacement. But how much work would that be?

Lines 26 and 28 grab the mailbox named on the command line and transform the mailbox into an internal form–an array of individual mail messages–for processing. The remainder of the program loops through that array, looking inside each message for the pattern, and printing the requested messages.

Line 32 turns an individual mail message into an object with methods listed in the `Mail::Internet` module, and lines 33 and 34 use these methods to extract the header and body.

Lines 35 through 45 use other methods from the same module to create an array of text lines to search for the pattern. What gets stuffed into the array depends on the value of the `-b`, `-h`, `-H` and `-W` flags, but the end result is a reference to the target array, `$tgt`. (You might think that lines 43 through 45 are superfluous. You might think you could even prove, mathematically, that earlier code

```
68 The pattern to search for in the mail message.
69 May be any Perl regular expression,
70 but should be quoted on the command line
71 to protect against globbing (shell expansion).

72 =item B<mailbox>

73 Mailboxes must be traditional, UNIX C</bin/mail> mailbox format.
74 If no mailbox is specified, takes input from stdin.

75 =item B<-b>

76 Look only in the bodies of mail messages.

77 =item B<-h>

78 Look only in the headers of mail messages.

79 =item B<-H>

80 Look in the specified header of mail messages.
81 Field names are case-insensitive.

82 =item B<-i>

83 Make the search case-insensitive (by analogy to I<grep -i>).

84 =item B<-v>

85 Invert the sense of the search, (by analogy to I<grep -v>).

86 =item B<-W>

87 Look through the entire mail message (default)

88 =back

89 =head1 EXAMPLE

90  find . -name '*mbox' -print | xargs mgrep -i alstadt > /tmp/alstadt.mbox

91 This finds every file whose name ends in C<mbox>
92 under the current directory, searches each for messages containing
93 the strings "alstadt," "ALSTADT," "Alstadt," etc.,
94 and puts a copy of everything it finds into C</tmp/alstadt.mbox>

95  find . -name '*mbox' -print | xargs mgrep -H to brother

96 This searches the same set of files for messages containing
97 the string "brother" in the "To:" field.

98 =head1 AUTHOR

99  Jeffrey S. Haemer, <jsh@boulder.qms.com>

100 =head1 SEE ALSO

101 elm(1), mail(1), grep(1), perl(1), printmail(1), Mail::Internet(3)
102 Crocker, D. H.,
103 Standard for the Format of Arpa Internet Text Messages, RFC822.

104 =cut
```

has guaranteed that one of these flags has to be set. Sure it has. We put stuff like this in because experience tells us it always saves us a lot of debugging time.) Whew.

Now, if you look back, you'll see that most of what we've done so far is really just argument handling. We've tried to do things sturdily, so that when the code gets this far, it's likely to look for what we think we are asking for. Moreover, we've tried to do things professionally enough that if the code *doesn't* get this far, it fails cleanly. Even so, it's taken us only 45 lines of code and comments.

But what about the real work? Oh, you mean the remainder of the program: lines 46 and 47. Line 47 uses Perl's built-in `grep` function, which searches an array of lines for a Perl regular expression, to impose selection criteria on each message, for example, the `xor` implements the `-v` flag. Line 46 uses one of the mail-message methods to print any selected messages in RFC 822 format. Done.

Lines 50 through 104, more than half the total number of lines in the file, are documentation. Even though we've designed this so that you shouldn't need to look at a man page very often, that doesn't keep us from writing one. As is usual for Perl utilities, the documentation is in POD (plain old documentation) form. Not only does POD documentation live in the same file as the code it describes–it's normally ignored by `perl`–but tools that come with the standard distribution let you transform such code-documentation chimeras into a variety of attractive documents, including flat text, UNIX man pages and Web pages. The CPAN even has a module that will let the code part use the documentation part to generate runtime usage and help messages.

And that, gentle reader, is that. We'll be back next month with more amazing programmer tricks. Until then, happy trails. ⊸

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.

RAID Array Offers 'Cool Swapping'

LAND-5's new ICEbox Ultra SCSI disk array subsystem is designed to operate at temperatures 50 degrees cooler than other RAID products. It accomplishes this through multiple fans (up to four per system), a reverse air cooling system and a chassis that creates a "wind tunnel" effect to draw cool air across heat-generating components, the company says. The net effect is an ability to swap components with the power on, while maintaining a cool temperature–or "cool swapping," in LAND-5's parlance.

The ICEbox system features remote monitoring and an incremental, LED temperature read-out that shows operating temperature in three-degree increments. It also has a dual-host design that is said to support server clustering to minimize system downtime.

A maximum capacity of 16 TB is supported by daisy-chaining systems. The systems come with 24, 54 or 81 GB of capacity, and can accommodate up to 18 drives in a compact enclosure (17.25 by 28 by 10.5 inches).

ICEbox systems support RAID 0+1 (striping plus mirroring), RAID 0 (striping), RAID 1 (mirroring), RAID 3 (striping plus parity) and RAID 5 (rotating parity). Multiple RAID levels can be supported on a single unit, the company says.

ICEbox is designed for medium to large LAN servers requiring high-capacity, rapid data access and continuous availability, and is said to be ideal for storage-intensive applications such as Web servers, database management, digital video and imaging. It is compatible with a number of operating systems, including Solaris, UnixWare, HP-UX, Digital UNIX, AIX and Windows NT. Pricing starts at $10,095.

LAND-5 Corp.
9747 Business Park Ave.
San Diego, CA 92131
http://www.land-5.com
Circle 101

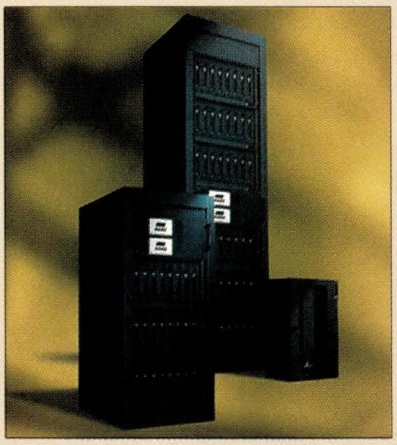
New, Improved Travan Tape Drive

Tecmar Technologies has announced a tape drive solution that is said to deliver up to 20 GB of data at 2-MB/s for half the cost of comparable tape products. The Travan NS 20 drive is specifically designed for the capacity and performance requirements of network storage environments, the company says.

Key to extending Travan NS technol-

Web-Based RAID Management

A new line of RAID subsystems from Cybernetics, called CY-RDA, features an interface that allows administrators to manage their systems via a Web browser or over an Ethernet connection. Because the management software is embedded in the CY-RDA RAID system, no host device drivers or proprietary user interfaces are required. The embedded management controller also provides proactive monitoring and analyses of drives, power supplies, temperature, fans and SCSI bus termination, the company says.



CY-RDA offers storage capacities ranging from 32 GB to 378 GB, and an Ultra SCSI data transfer rate of 40 MB/s. Three models, for eight, 24 or 42 disk drives, are available, and all three models feature cable-free drive enclosures, an intelligent SCA backplane and RAID levels 0, 1, 0+1, 4 and 5. The drives are hot-swappable, and the system components are said to be redundant and isolated to localize failures.

In other news, Cybernetics has announced the release of its CY-TL4 line of automated libraries for DLT7000 tape drives. The libraries come with up to four Cybernetics DLT7000 drives, and up to 30 tapes offering storage capacities of 525 GB to 2.1 TB. Libraries configured with two drives and Cybernetics' Advanced SCSI Processor can transfer data at up to 40 MB/s in striping mode, the company says. In addition to striping, the Advanced SCSI Processor provides mirroring, and independent and off-line copy/verify modes for added speed and functionality.

An optional multihost interface reportedly allows users to consolidate backup operations for more than one host system to a central CY-TL4 library. One library can effectively serve up to four systems, with predefined drives and tape slots reserved for each host.

Pricing was not available; contact Cybernetics for details.

Cybernetics
111 Cybernetics Way
Yorktown, VA 23693
http://www.cybernetics.com
Circle 100

ogy from the 8-GB to the 20-GB level are the thin-film magneto-resistive (MR) heads, supplied by Read-Rite Corp. The NS 20 includes read-while-write data recording capabilities and hardware data compression features that are said to increase overall performance and enhance data integrity.

The NS 20 features a standard 2-MB data buffer to maximize data throughput, while Tecmar's innovative tape flash firmware technology reportedly allows the drive to be upgraded with future software enhancements by simply loading a Travan cartridge. The NS 20 also includes built-in, industry-standard hardware data compression, which the company hopes will eliminate the proprietary formats that are common with software-based compression solutions. The Travan NS 20 costs $649.

Tecmar Technologies Inc.
1900 Pike Road
Longmont, CO 80501
http://www.tecmar.com
Circle 102

Archiving, Compression for Solaris

PKWARE has announced that its archiving and compression utility, PKZIP Version 2.5, is available for SPARC-based platforms running Solaris 2.x operating systems.

PKZIP for UNIX includes the ability to view and extract from TAR, GZIP, UUencode, XXencode, MIME and BinHex file formats, as well as create UUencoded `.ZIP` files. In addition, `.ZIP` files can be compressed or extracted using the PKZIP 2.04g compression method, while retaining and restoring standard UNIX file permissions such as user and group IDs, time of last file access and time of last modification information, the company says.

Other features include creating self-extracting archives for various platforms, including Solaris, DOS and Windows 16-bit, and a new command set that is reportedly easier for new users to understand and for experienced users to customize, through the use of more configurable parameters. Files are said to be viewable within an archive without extracting individual files, and corrupt `.ZIP` files can be compressed, extracted and fixed, the company says.

PKZIP 2.5 for UNIX is available only for Solaris and is priced at $189. PKWARE plans to support additional UNIX-based platforms and operating systems in the future.

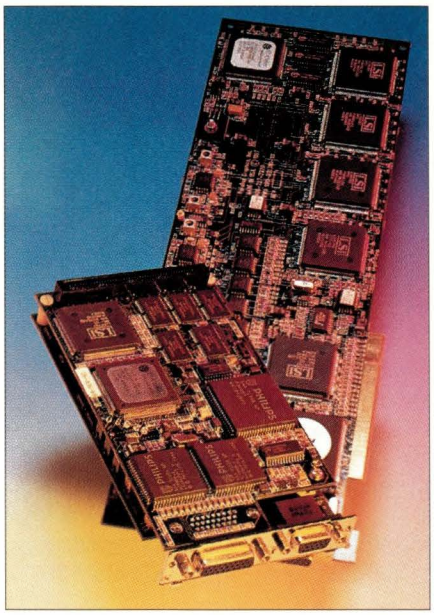
PKWARE Inc.
9025 N. Deerwood Drive
Brown Deer, WI 53223
http://www.pkware.com
Circle 103

Digital Video Card for Sun PCI Bus

Parallax Graphics' expansion of its XVideo Xtra product line now includes a new PCI Bus digital video card with compression to support Sun's new PCI Bus workstations. XVideo Xtra for PCI allows applications to be fully compatible without any porting or recompiling, the company says.

XVideo Xtra is compatible with Sun's PCI Bus workstations, including the Ultra 30, Creator and Creator 3D Series 2 graphics cards, and with Sun's standard displays, including the HDTV monitor.

XVideo Xtra costs $7,995. Price includes video card, cables, software drivers, VideoTool and MovieTool software applications, and Video Development Environment API.



Parallax Graphics Inc.
2500 Condensa St.
Santa Clara, CA 95051
http://www.parallax.com
Circle 104

Secure App Toolkit Out

Pretty Good Privacy has introduced the PGPsdk toolkit, which is designed for building security into any application, without the need for expertise in applied cryptography, the company says. The toolkit reportedly allows developers to integrate the strongest cryptography commercially available–no less than 128 bits–into their applications.

Secure cryptographic routines include encryption, decryption, digital signature and verification. The product offers an easy-to-use, cross-platform C/C++ language API for rapid application development, as well as a wide selection of royalty-free ciphering and hashing algorithms, the company says.

The software is available for Solaris, Linux, Macintosh and Windows 95/NT. The PGPsdk toolkit costs $895.

Pretty Good Privacy Inc.
2121 S. El Camino Real, Ste. 902
San Mateo, CA 94403
http://www.pgp.com
Circle 105

Solid-State Disk Uses DRAM Technology

Quantum has announced the latest addition to its Rushmore family of solid-state disks, the Rushmore Ultra SSD. Using DRAM technology, the disk is said to offer some of the fastest access times to time-critical data stored in mid- to high-end server applications such as database transactions, real-time video streaming and RAID.

Performance statistics for the Rushmore Ultra SSD place the disk with throughput of 8,000 I/O requests per second and access times of less than 60 msecs. With its SCSI-3 interface, the Ultra SSD can attain data transfer rates of up to 30 MB/s. In addition, the drive offers a capacity of 1.6 GB, the highest in the industry, Quantum says.

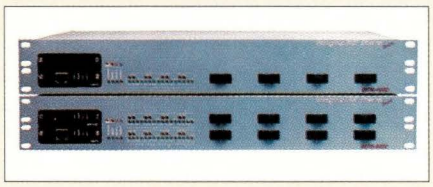
The Rushmore Ultra SSD is available in standard 3.5- and 5.25-inch form factors, with storage capacities ranging from 134 MB to 1.6 GB in nonvolatile configurations (effectively 536 MB to 804 MB in volatile configurations). Pricing starts at $6,750 for a 134-MB drive.

Quantum Corp.
500 McCarthy Blvd.
Milpitas, CA 95035
http://www.quantum.com
Circle 106

100-Mb/s Fast Ethernet Switches

Telebyte Technology has introduced two high-performance, fast Ethernet switches that bring 100-Mb/s operation to the desktop over fiber-optic cable.

Models BFW-4002 and BFW-8002 are four- and eight-port versions, respectively, with 100BaseFX ports and Web management capabilities. The individual workstation ports are said to provide independent full-duplex links to the desktop or to other switches. Because multimode fiber supports distances of up to 2km, a network created using these



switches is no longer restricted to 100m, the company says.

Both the BFW-4002 and BFW-8002 process data at 1 GB/s, with 100% nonblocking at full fiber speed, on all ports simultaneously. The store-and-forward feature provides immediate response to packets in error and helps prevent performance degradation. Also included is an active back pressure algorithm to manage flow control and overcome traffic loads, the company says.

When equipped with the optional SNMP module, a standard Internet browser can allow either local or remote management access via the SLIP protocol. A unique built-in monitoring agent is said to provide comprehensive and effective feedback, including simultaneous monitoring of every port for effective traffic analysis.

The switches are packaged in 3.5-inch rack-mount enclosures. Model BFW-4002 costs $4,800, and Model BFW-8002 costs $7,800. A 10/100BaseT uplink module is standard, and a fiber 100BaseFX uplink port is available for an additional $480. The optional SNMP module costs $600.

Telebyte Technology Inc.
270 Pulaski Road
Greenlawn, NY 11740
http://www.telebyteusa.com
Circle 107

Radius Remote Access Management Servers

Livingston Enterprises has unveiled Radius Authentication Billing Manager (ABM), a family of remote access management servers designed for Internet service providers. With Radius ABM, users can construct a remote access management system that coordinates technical processes, such as authentication and session accounting, with business processes like customer billing and network trend analysis, the company says.

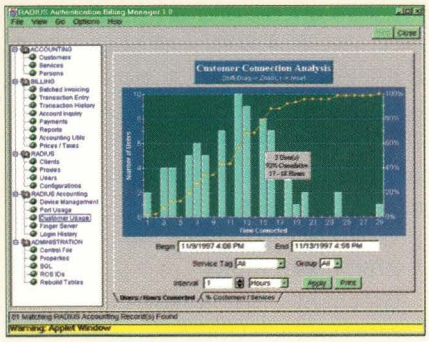
Radius ABM is a software package designed to deliver bulk outsourced dial-

Upgrades, Enhancements, Additions...

➤ Sites using PacketShaper bandwidth-management software from Packeteer may want to consider upgrading to Version 3.0. New features include a so-called Traffic Discovery capability, which allows the device to detect the presence of all traffic types on the enterprise WAN. With this information, PacketShaper can suggest appropriate service-level policies to relieve chronic WAN congestion, the company says. Also, PacketShaper 3.0 now manages IP Class of Service (IP precedence bits); supports the TN3270 and TN3270e terminal-to-mainframe protocols; and offers enhanced measurement statistics. Version 3.0 runs on the original PacketShaper 2000 (priced at $7,250); the 4000 ($14,500); and the new 1000 ($3,450). **Packeteer Inc.**, 307 Orchard City Drive, Ste. 305, Campbell, CA 95008, *http://www.packeteer.com*. **Circle 108**

➤ In its latest release, Asset Insight from Tangram incorporates the ability to locate Year 2000-related vulnerabilities at the client/server desktop level. Included in the release are a Risk Assessment report that identifies Y2K exposure and analyzes risk distribution by department; a Risk Correction Analysis, which aids in determining how much it will cost to upgrade the noncompliant desktops; and Risk Management Analysis, which helps Y2K administrators meet their Year 2000 deadline, the company says. Asset Insight supports leading client/server and LAN environments, including Solaris, AIX, HP-UX, SCO Open Server, OS/2, Macintosh, Windows NT/95/3.1 and NetWare. Prices range between $30 and $50 per node. **Tangram Enterprise Solutions Inc.**, 11000 Regency Pkwy., Ste. 401, Cary, NC 27511, *http://www.tesi.com*. **Circle 109**

➤ Intelliguard Software has announced several enhancements to its backup and retrieval software BudTool Version 4.5. Prominent among the new enhancements is the addition of Network Data Management Protocol (NDMP) Version 2 support. BudTool is said to provide centralized data management for NDMP-compliant systems. In addition, if BudTool is used for the backup procedure, data can be retrieved using native commands even if BudTool is not stored on the systems, the company says. This latest version of BudTool is said to be able to track all files backed up to tape and to maintain an online database. To help in the area of tape handling, BudTool provides bar code support, which allows users to list the tape content and access tape volume statistics. BudTool can be hosted on (or libraries can be locally attached to) SunOS, Solaris, AIX, HP-UX and IRIX. **Intelliguard Software Inc.**, 6200 Village Pkwy., Dublin, CA 94586, *http://www.iguard.com*. **Circle 110**



up services, scalable transaction performance, meshed fault tolerance as well as proxy support and SNMP-verified simultaneous log-in control.

Radius ABM runs on Windows NT Server 4.0, Windows 95, Solaris 2.6, AIX, HP-UX and Linux. The software is offered in two packages: Radius ABM Professional, which comes with a 5,000-user license; and Radius Premium, an expandable version that allows optional modules to be added for an unlimited number of users. Pricing starts at $1,500.

Livingston Enterprises Inc.
4464 Willow Road
Pleasanton, CA 94588
http://www.livingston.com
Circle 111

CSW Management System Release

Cambar Software has announced the latest version of its client/server warehousing (CSW) management system. The company says that CSW Base 110 comes out of the warehousing and distribution market's need for increasingly automated solutions.

CSW Base 110 features several new capabilities: Work Order Maintenance is said to allow the system to receive fabrication and conversion work orders from the host system; with internationalization of both the GUI and for radio frequency (RF) devices, the system can reportedly choose which interface to use based on a language code associated with the user ID; Value-Added Processes can reportedly either be sent to CSW when a sales order is transmitted or generated locally; and Dock Door Scheduling is said to allow CSW to manage the scheduling process for both inbound and outbound shipments, tracking carrier and vendor information such as loading and unloading times, or the number of trailers per appointment.

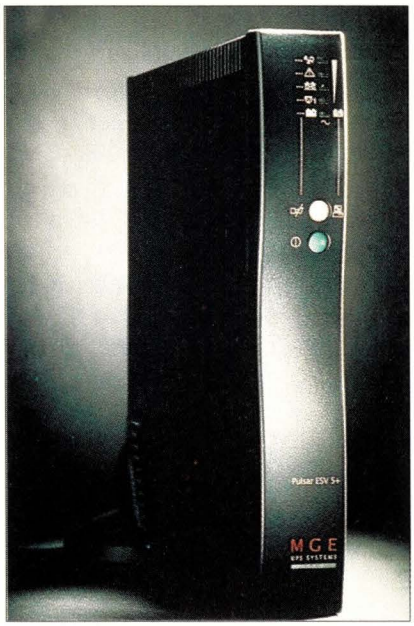
Pricing for CSW Base 110 starts at $150,000. It runs under Solaris, AIX, HP-UX and Windows NT. Clients include PCs and RF devices. In addition, CSW supports Oracle Corp. and IBM Corp. DB2 DBMSs.

Cambar Software Inc.
4975 LaCross Road
Charleston, SC 29406
http://www.cambarsoftware.com
Circle 112

UPS Protects Against Downtime

A new line of uninterruptible power supply (UPS) products, the Pulsar ESV+ series from MGE UPS Systems, is said to offer up to 45 minutes of protection during power outages and interruptions to enterprise-class servers and critical devices. In addition, the line interactive design of the higher power ESV+ systems (ESV8+, ESV11+, ESV14+ and ESV22+) lets the UPS provide voltage regulation, allowing computers to continue operating without depleting the battery, as is typical with most off-line UPS systems, MGE says.

There are five models in the Pulsar ESV+ line, ranging from 480VA to 2200VA. Features include smart battery management; MGE's own Solution-Pac 97 software, for power management, safe shutdown of protected devices and paging and emailing capabilities; configurable operating parameters, offering individual control of UPS output receptacles and programmable load shedding; and user-replaceable, hot-swappable batteries.



The Pulsar ESV+ series includes the ESV5+ (480VA), which is slated for hubs and routers, and lists for $309; the ESV8+ (780VA), which is suitable for Novell Inc. IntraNetWare and Microsoft Corp. Windows NT server protection, and lists for ($409); the ESV11+, ESV14+ and ESV22+ (offering 1080VA, 1400VA and 2200VA, respectively) are designed to protect UNIX host and multiserver environments, and list for $589, $699 and $799, respectively.

MGE UPS Systems Inc.
1660 Scenic Ave.
Costa Mesa, CA 92626
http://www.mgeups.com
Circle 113

WAN Adapters Offer Routerless Connectivity

SBE's wanXL WAN adapter product line is targeted at providing connectivity for wide-area networks, virtual private networks, Internet access and application sharing.

The product family consists of three PCI-based cards that are said to provide high-performance routerless server connectivity: the wanXL 400, a four-port WAN adapter; the wanXL 200, a two-port version; and the wanXL 100, with one WAN port and an optional Ethernet port.

Each of the wanXL products has an on-board CPU that handles many of the demands of a network connection, thus offloading the server from most of the burden of a remote connection, SBE says.

All three products support Solaris, SCO UNIX, UnixWare, BSDI, FreeBSD and Windows NT 4.0. Pricing ranges from $649 to $1,575, depending on the number of ports.

SBE Inc.
4550 Norris Canyon Road
San Ramon, CA 94583
http://www.sbei.com
Circle 114

Correction

In "Turbocharging Object Projects" (January 1998, Page 44), the correct address for Iona Technologies should have been 60 Aberdeen Ave., Cambridge, MA 02138.

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SOFTWARE	LIST	OURS
WordPerfect 7.0 1st user	495	395
Netscape SuiteSpot	4995	4495
VSI*FAX Gold Fax Software	2395	1995
VSI*FAX Gold Windows Client 10-user	590	520
FrameMaker 1-user (floating license)	2500	2225
Adobe Acrobat 1-user	295	245
Informix On-Line Dynamic Server 1-usr (min. 10)	1500	call
Informix On-Line WorkGroup Server 1-usr (min. 5)	295	call
Informix 4GL Development 1-user (min 3)	900	call
Term Communications Software	695	595
LP Plus Print Manager/Spooler 4-printer	695	575
SoftWindows MS-Windows Emulator	549	475
Spatch alphanumeric paging SW 4-user	499	425
DoubleVision Remote Support S/W	795	665
Uniplex II+ (20-user)	5500	4695
Disk_Pak Disk Optimizer/Defragger	1495	1230
Cheyenne Arcserve/Open Backup S/W	1995	1495
Legato Networker Backup S/W	2500	1995
Hummingbird PC X-Server Win NT/95	545	425
Hummingbird Maestro NFS Server - Win NT	195	169

HARDWARE	LIST	OURS
HP Laserjet 5Sinx 24ppm, 4MB, ENET	3449	2895
Mannesman Tally MT-661 800lpm Line Printer	7999	6795
HP 8GB External 4mm DAT Tape Drive	1370	1175
HP 24GB External 4mm DAT Tape Drive	1819	1540
HP 40GB External DLT Tape Drive	5723	4925
Exabyte Eliant 820 Ext. 14GB 8mm Tape Drive	2495	1795
Exabyte Mammoth Ext. 40GB DLT Tape Drive	5295	3995
Tandberg 2.5GB 1/4" External SCSI Tape Drive	969	870
Seagate Cheetah 9.1GB Ext. Ultra SCSI HD	1995	1375
Plextor 12X External CD-ROM Drive	595	365
Digi PortServer II 16-port Terminal Server	2395	1890
Digi 16 port Serial I/O card/concentrator	2395	1890
Central Data SCSI Terminal Server - 16 ports	1295	1095
Multitech 33.6 External FAX/DATA Modem	269	145

Other Platforms: SCO, SUN X86, WIN NT, DEC, SGI, DG

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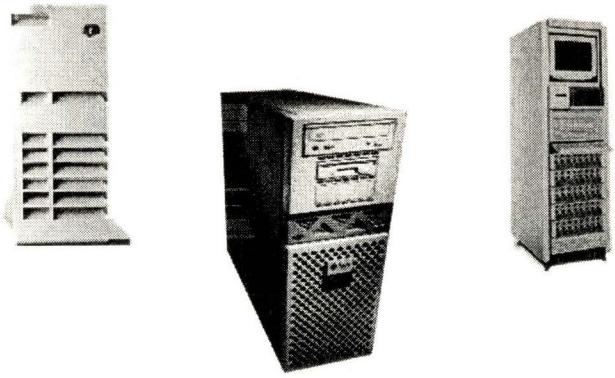

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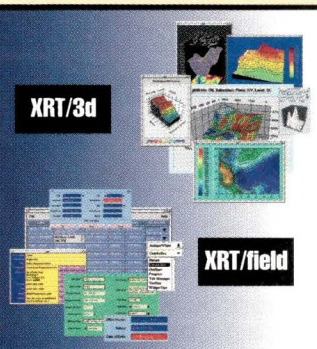

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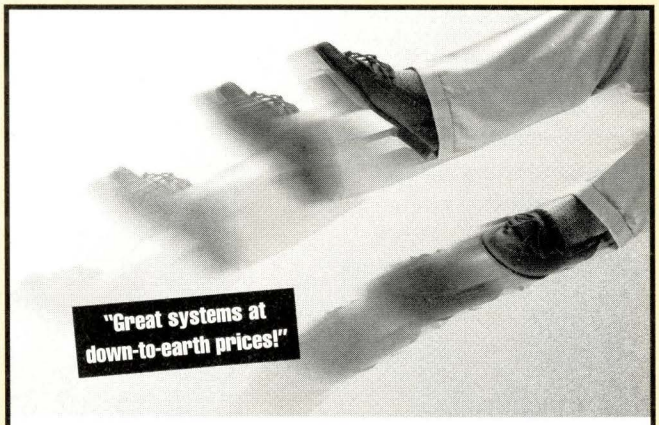
Circle No. 376



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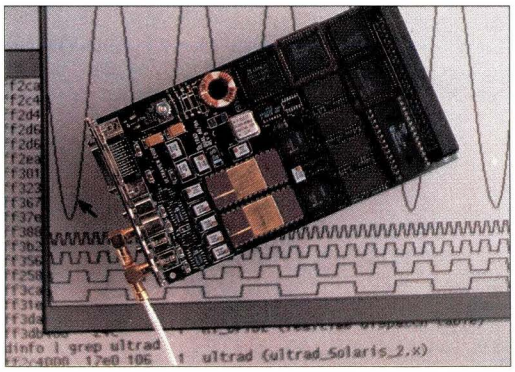

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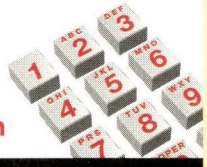

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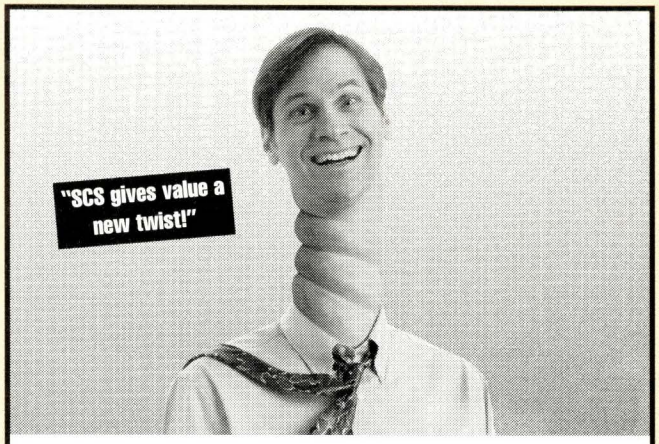

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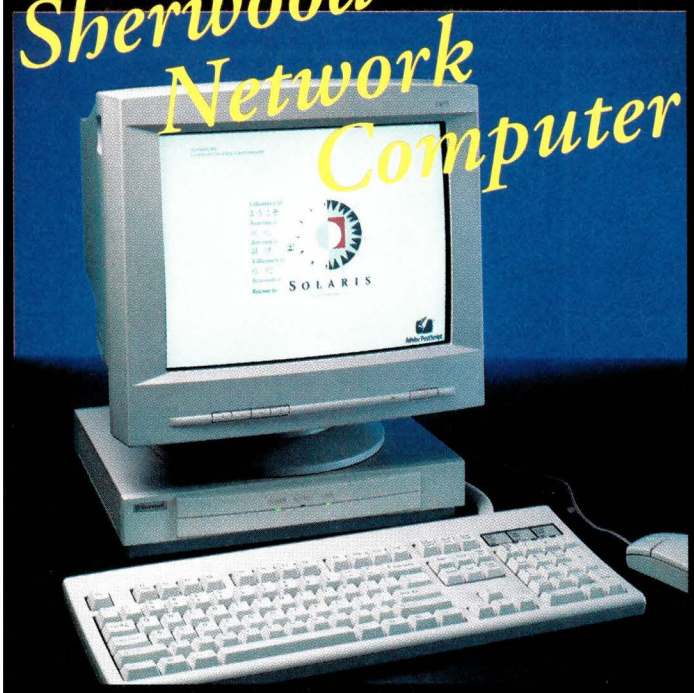

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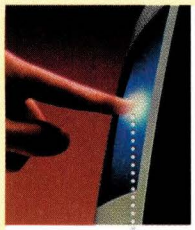

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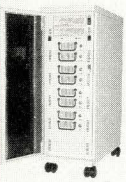

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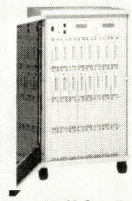

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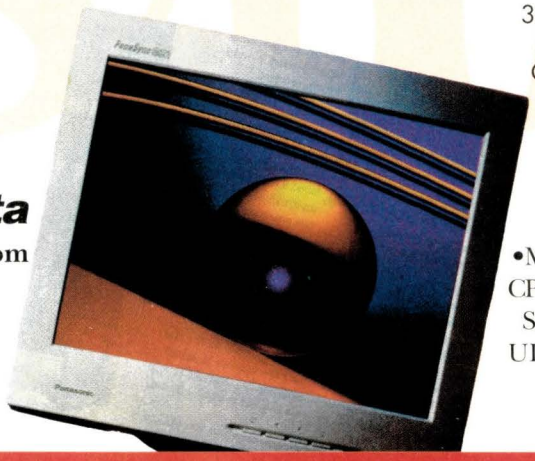

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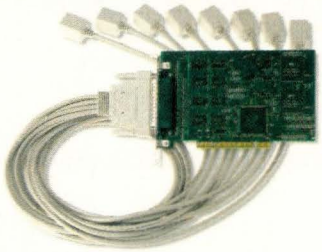

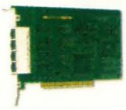

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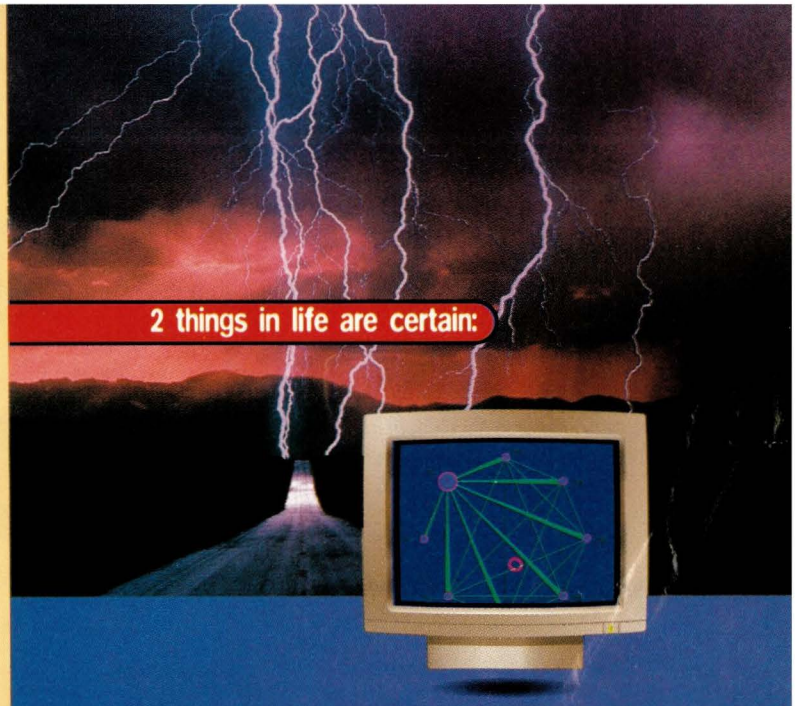

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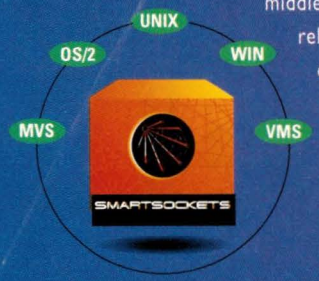

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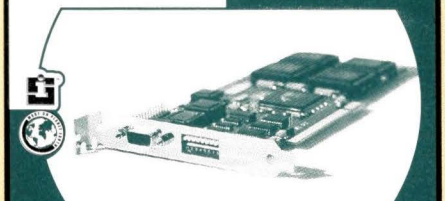

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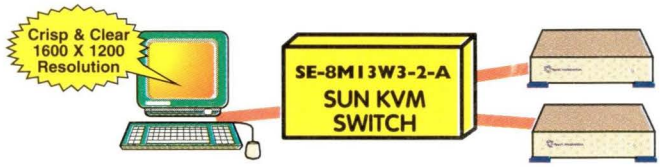

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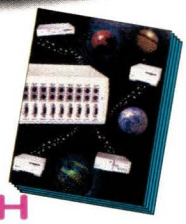

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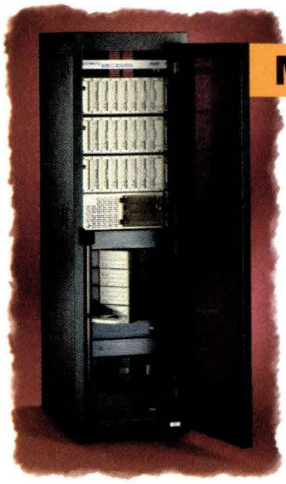

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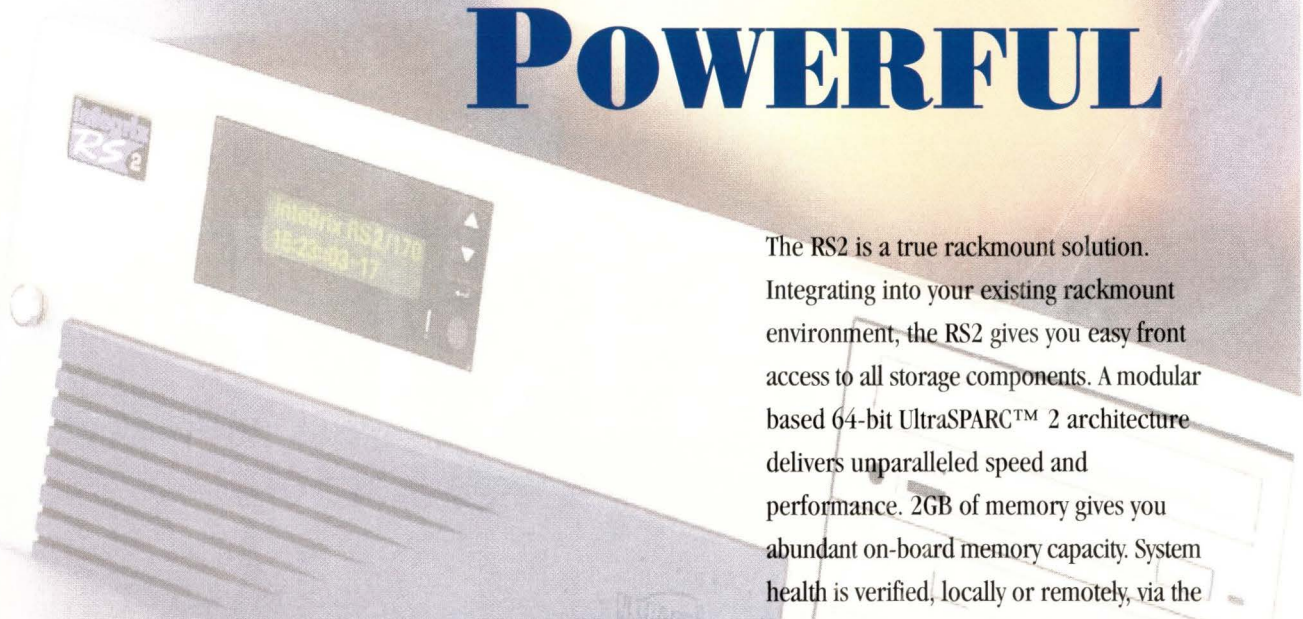

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