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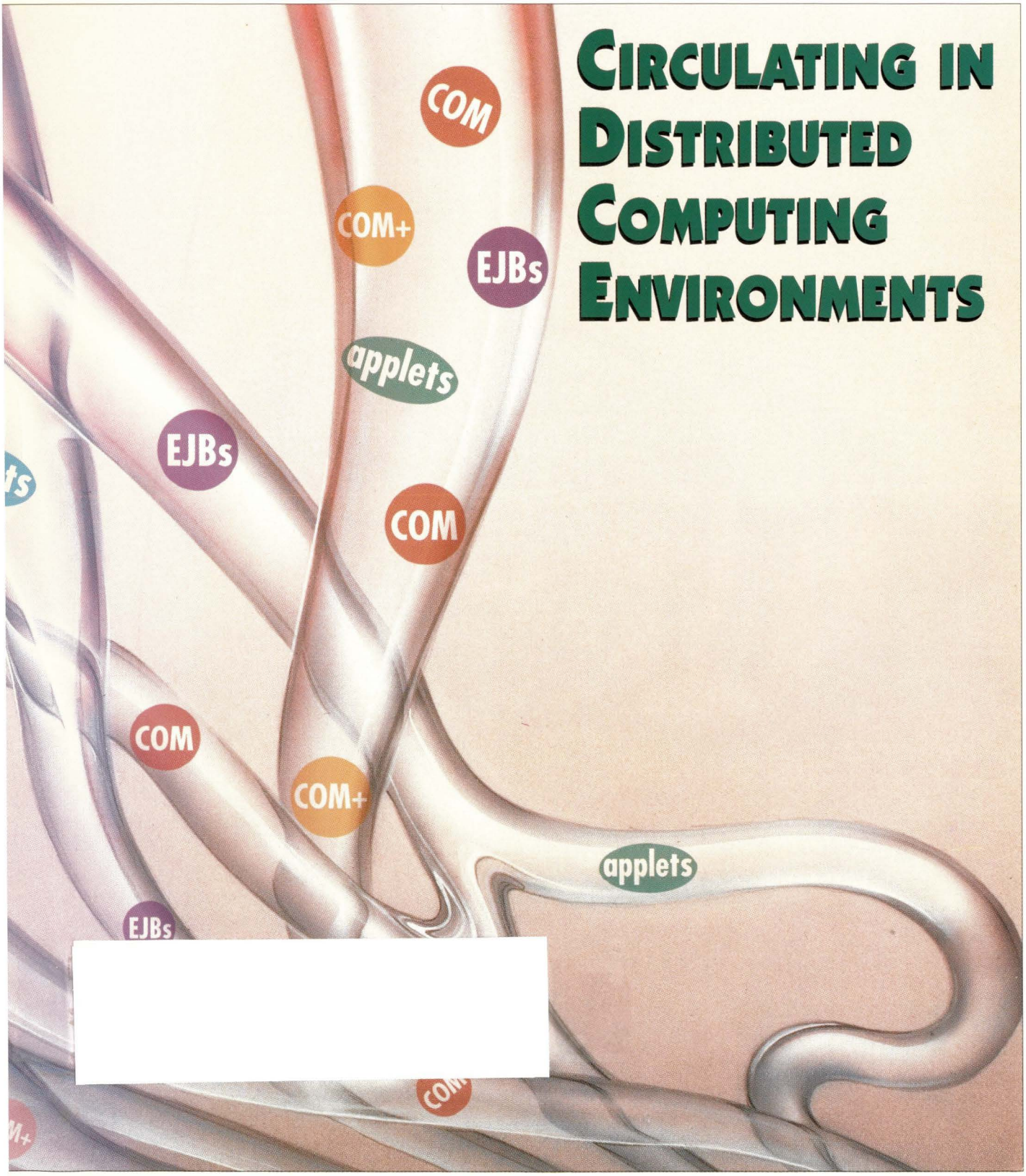
The Server/Workstation Magazine



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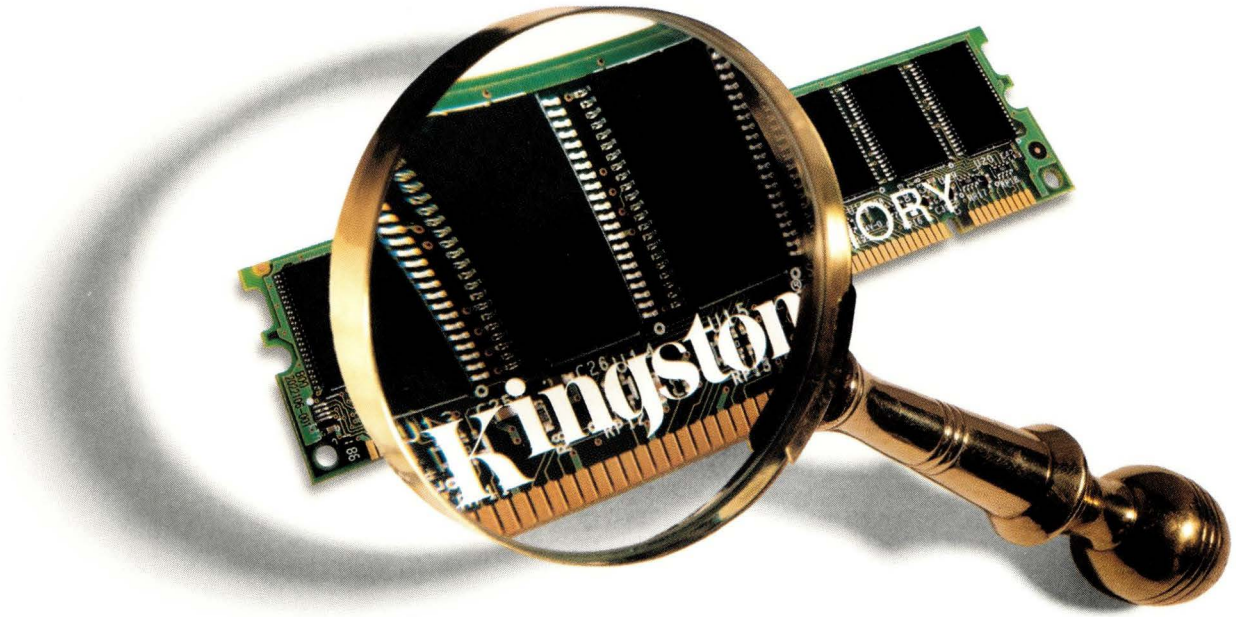

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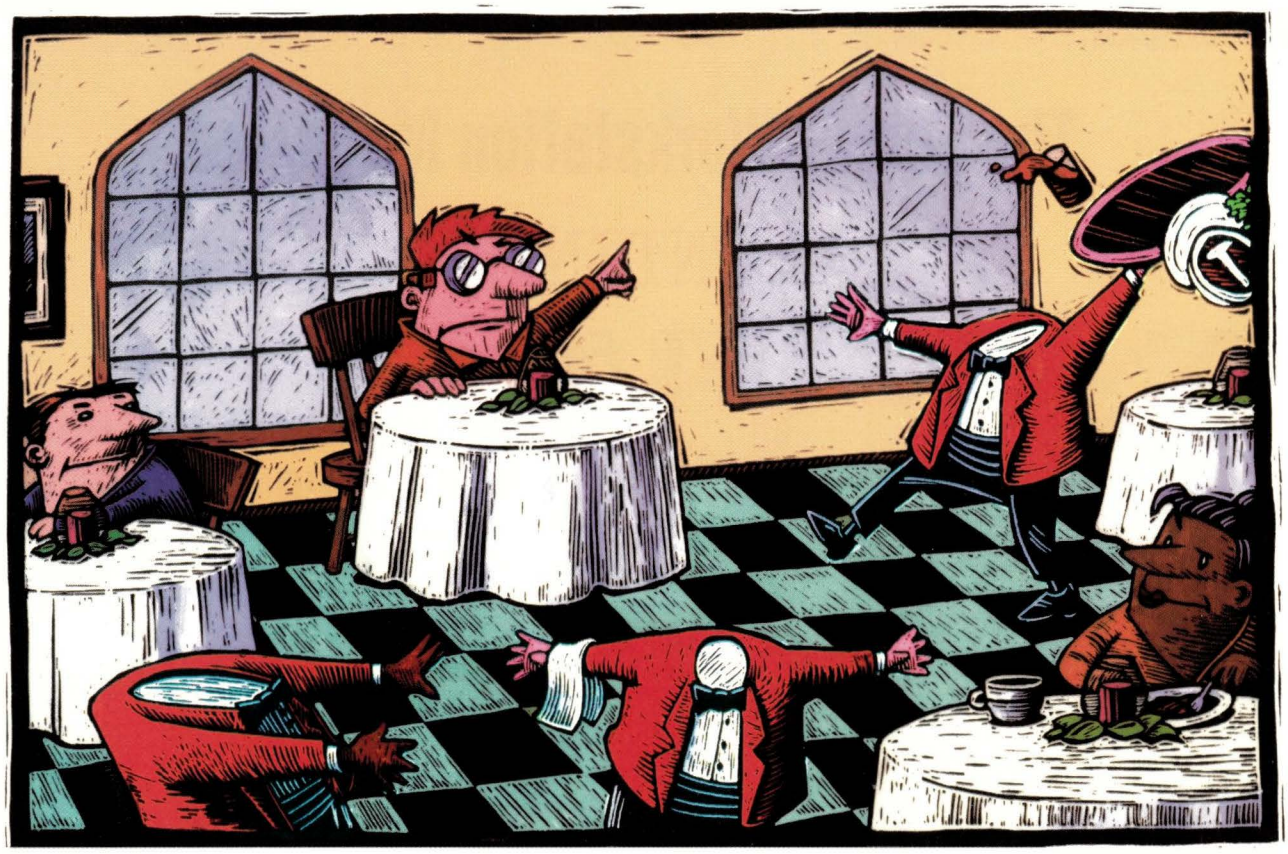

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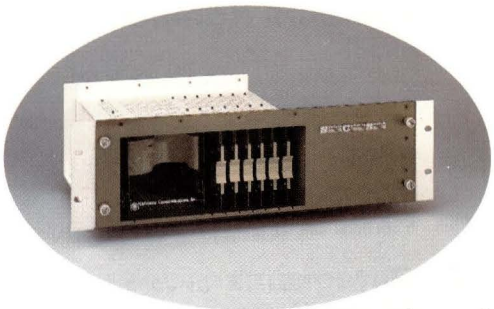

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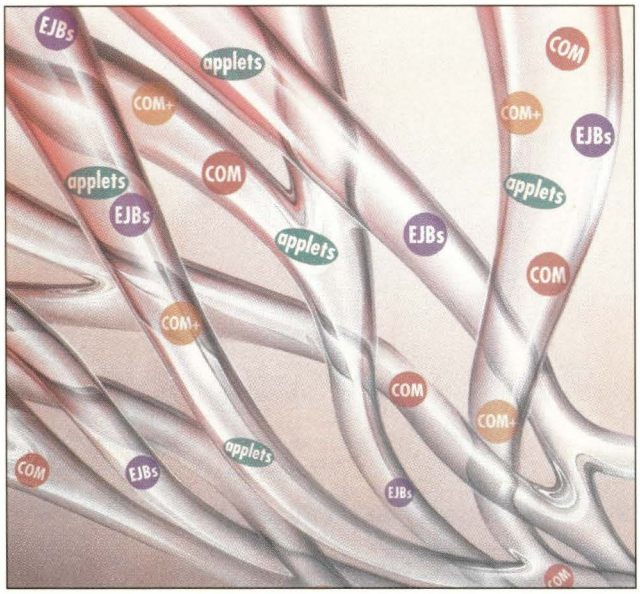

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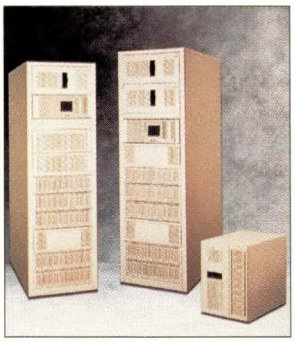

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EDITORIAL

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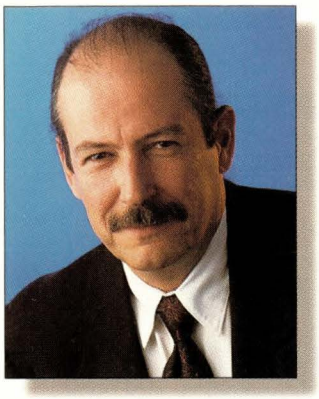

We're Not in Kansas Anymore

"Yes, in the best of all possible worlds, employees would all use identical hardware running a single operating system–with the latest service pack applied, of course–and run the same development and/or office suites. Any upgrades would be deployed simultaneously worldwide. Our ideal organization would run standardized server hardware, a single version of a single vendor's database, have a single enterprise-wide data warehouse and so on. There would be no such thing as 'legacy' hardware or software," says David Clements, a programmer/analyst for the Sheet Products Division of U.S. Steel in Fairfield, AL. And click the heels of your ruby slippers three times and you're home again in the bosom of your loving family.

Everyday IT environments are just a bit more helter-skelter and the swirling winds of change are still blowing. Although distributed computing is old hat if you trace it back to terminals and timesharing, today's architectures are a veritable web of operating systems, repositories, operational databases, legacy data, data warehouses, distributed objects, intelligent agents, middleware and e-commerce. And that's not to speak of the networks that weave it all together: local-area networks, wide-area networks, virtual private networks, storage-area networks and the biggest network of all, the Internet. That's the subject matter of Karen Watterson's cover story, "Circulating in Distributed Computing Environments," page 50.

According to Karen, "Depending on your perspective, distributed computing is getting both easier and harder, but one thing's for sure, it's here to stay and it's probably going to cost you." For more discussion of just how, take a look at her article.

If you're wondering why we chose the word circulating for the head, you can examine the cover illustration. It suggests that components, objects and middleware may be the lifeblood of healthy systems of the future. As usual, let us know what you think. Meanwhile, keep in mind: There's no place like `/home`.

Doug Pryor

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Workstation Prices Tumble

As PC prices continue to fall, so do those of Sun Microsystems Inc.'s Ultra 5 and 10 workstations, positioned as UNIX alternatives to Microsoft Corp. Windows NT workstations. Another round of price cuts and performance upgrades to Sun's low-end machines puts them within spitting distance of competing Intel Corp.-based options.

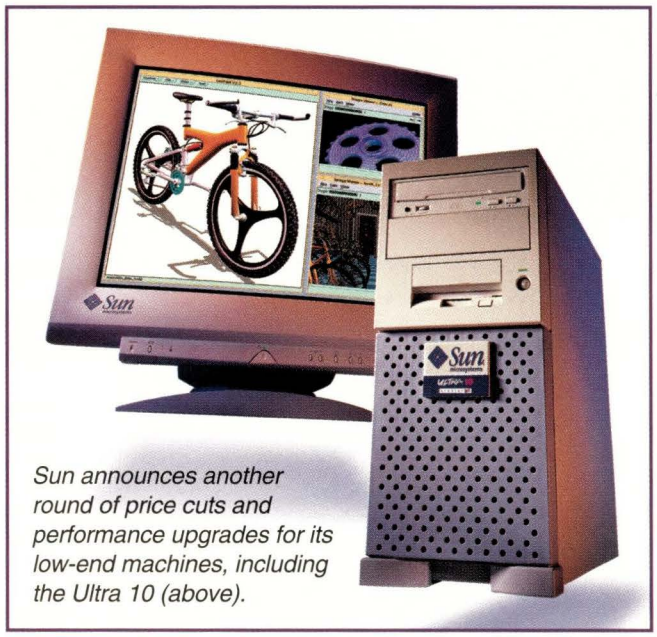
Sun's biggest price cut occurred on the Ultra 10 "Hot Box" model, which dropped from $9,995 to $7,995. The "Hot Box" model–now called the Ultra 10 Model 360–also received a number of performance upgrades, including a 360-MHz UltraSPARC-IIi processor, a doubling of RAM to 256 MB, an increase in storage capacity from 4.3 GB to 9 GB and a boost in hard drive speed to 7,200 RPM, as well as the addition of 24-bit graphics on the motherboard.

The basic Ultra 10 model, formerly a 300-MHz machine with 0.5-MB cache, 128-MB RAM and 4.3-GB, 4,500-RPM hard drive, is now called the Ultra 10 Model 333. Model 333 comes with a 333-MHz chip, 2-MB cache, 128-MB RAM, 24-bit graphics and a 9-GB, 7,200-RPM hard drive. It costs $4,295.

Sun also announced a new version of the Ultra 5–Model 333–with a 333-MHz UltraSPARC-IIi chip, 2 MB of cache, 128 MB of RAM, 24-bit graphics and 9-GB hard drive for $3,695. The entry-level Ultra 5 with a 270-MHz chip, 0.25-MB cache, 64-MB RAM and 4.3-GB hard drive will still cost $2,495, but will now come with 24-bit onboard graphics and a 5,400-RPM hard drive.

The Ultra 5 and Ultra 10, first introduced a year ago, were originally priced at $2,995 and $6,395 for an entry-level Ultra 5 and Ultra 10, respectively.

"They've taken a very popular platform and upgraded it to the most recent processor technology and 24-bit graphics. It's right in-line with what they needed to do," says Dan Dolan, analyst with Dataquest Inc., a market research firm based in San Jose, CA. Dolan says Sun's share of the UNIX workstation market grew from 46.5% in second-quarter 1997 to 55.1% in second-quarter 1998 (the Ultra 5 and 10 workstations accounted for 55% of Sun's workstation shipments during that quarter). "[Those workstations] have been going gangbusters since their introduction," says Dolan, who says the new price cuts will help Sun maintain its market share by giving existing customers a good reason not to migrate to Intel-based products.



Sun announces another round of price cuts and performance upgrades for its low-end machines, including the Ultra 10 (above).

The upgrading of the basic graphics capabilities from 8- to 24-bit graphics on the motherboard should also help make the Ultra 5 and 10 more competitive with Intel products, according to Peter ffoulkes, principal analyst at Dataquest. The addition of 24-bit graphics is a fairly minor improvement, says ffoulkes, but one which most PC users already enjoy. "It's pretty standard on a PC these days to have 16-bit or better graphics," ffoulkes says.

Improvements in chip performance, now and in the future, will also be a key competitive advantage. According to Sun's recently released UltraSPARC chip road map (see "The Future of UltraSPARC," *SunExpert*, November 1998, Page 10), 400- and 440-MHz UltraSPARC-IIi processors should be hitting the market sometime first-quarter 1999, with 600-MHz UltraSPARC-IIIi processors not far behind. "As we head into the next generation of UltraSPARC processors–the UltraSPARC-III–we'll see them move ahead of Intel processors again," ffoulkes says.

As part of the Ultra 5 and 10 announcements, Sun also unveiled lower price tags on its monitors: the 17-inch monitor dropped from $710 to $480, the 19-inch monitor fell from $1,100 to $790 and the 21-inch monitor was reduced from $1,650 to $1,500.

The price tags on Sun's optional graphics accelerator boards also fell. The entry-level Creator3D was reduced by 13% to $1,195, while the Elite3D m3 graphics accelerator was discounted by 25% to $3,395 and the high-end Elite3D m6 by 31% to $4,995.

"We've been seeing a lot of customers move toward 3D solutions," says Bob Mitton, product line manager for workstation products at Sun. "We're offering these huge price reductions on the 3D options to allow them to use 3D graphics in places where it didn't used to be affordable."

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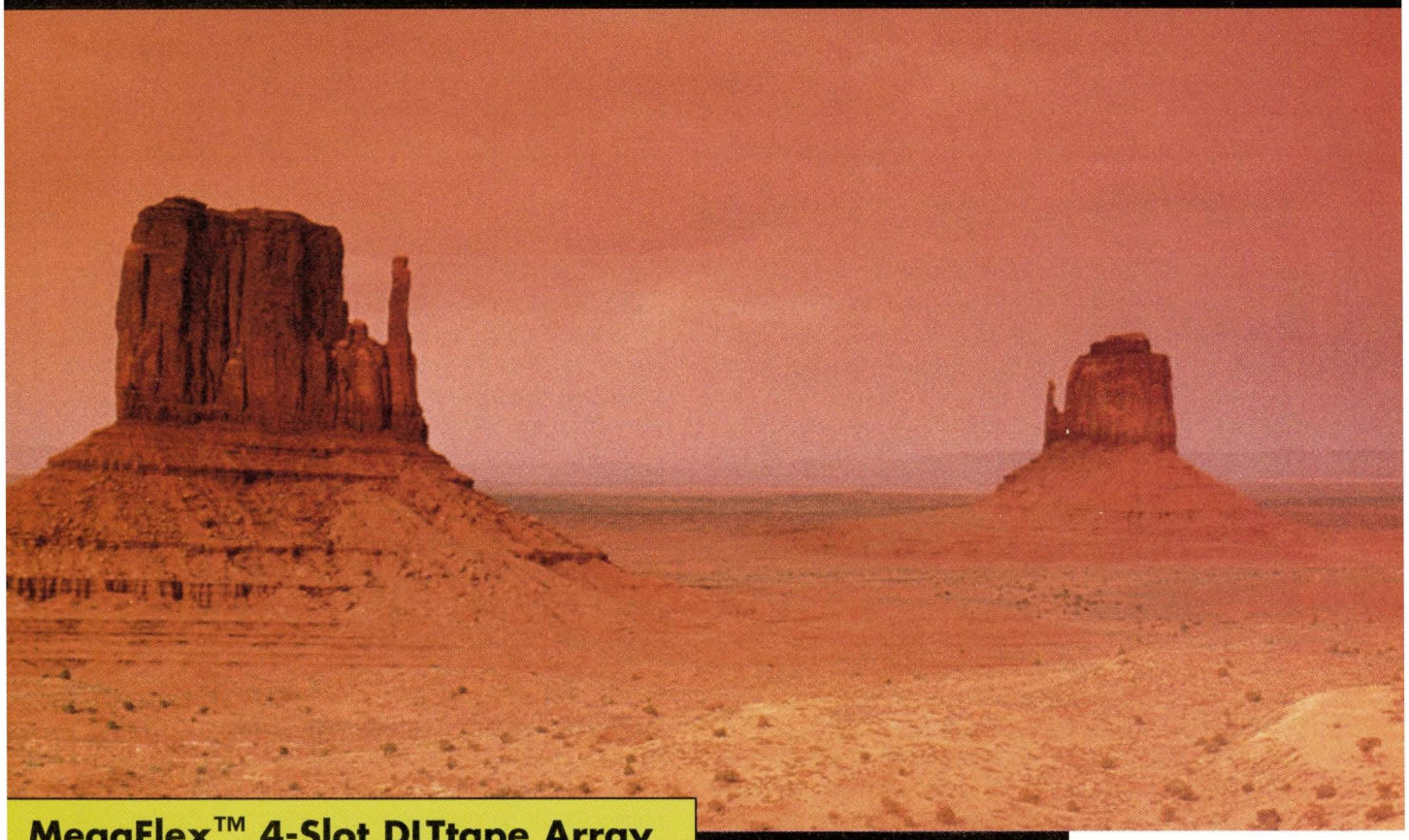

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boards, as well as improved performance, gives customers more flexibility in configuring their systems without hiking up the price, says ffoulkes. "They're taking into account the fact that some people don't require whiz-bang graphics but do need a really fast system, while others want high-end graphics on a relatively low-cost system. Sun has basically made its product suite more flexible and, therefore, able to match a wider variety of individual user's needs."

In conjunction with the Ultra 5 and 10 announcements, Sun's Enterprise 450 workgroup server received a speed boost. The Enterprise 450 is now available with a 400-MHz UltraSPARC-II processor. A 400-MHz Enterprise 450 server with 128 MB of RAM, 4.2 GB of disk storage and Solaris 7 sells for $21,400.–*sjh*

Sun, HP Wrangle for Control of Java

Sun Microsystems Inc., Palo Alto, CA, may claim the moral high ground over alleged monopolist Microsoft Corp., but some vendors in the embedded systems market say that when it comes to Java, Sun is no better than Microsoft.

"A lot of people in this industry believe that Java should be a single standard, offered by multiple vendors," says Mal Raddalgoda, senior technology analyst with QNX Software Systems Ltd., Kanata, Ontario, a real-time operating system (RTOS) vendor.

In fact at November's Embedded Systems Conference in San Jose, CA, a group of Java standardization advocates, led by Hewlett-Packard Co., Palo Alto, CA, reportedly threatened to bring the work they were doing on Java Real-Time Extensions under the National Institute of Standards and Technology (NIST) up for standardization by a major standards body, without Sun's approval. Sun, though, apparently got wind of the group's plans and quickly announced EmbeddedJava 1.0, taking

Syntax Slams Project Cascade

Last September, Sun Microsystems Inc., Palo Alto, CA, announced plans for a product that promised to help keep the number of Windows NT servers from mushrooming out of control. Project Cascade, Sun explained, would enable administrators to move NT administrative functions such as file and print serving off NT servers scattered around the organization and on to fewer, more reliable Solaris servers.

Some analysts and resellers are enthusiastic about Project Cascade, but according to Roger Franklin, president of Syntax Inc., Federal Way, WA, maker of TotalNET Advanced Server (TAS), Cascade is a misguided product that will prove both bad for the company and bad for the customer.

Cascade, Franklin says, is based on AT&T Corp.'s Advanced Server for UNIX, or AS/U, a product which AT&T wrote with NT source code licensed from Microsoft Corp., Redmond, WA. As such, AS/U duplicates a Windows NT Primary Domain Controller (PDC), which lets Windows clients log in and authenticate directly through the AS/U server. But a recent lawsuit brought by AT&T against Microsoft calls into question whether AT&T will secure the right to license future versions of NT source code, notably Windows NT 5.0. Cascade could therefore, by Franklin's account, be a real dead-end for customers.

On the other hand, Syntax's latest release of TAS, Version 5.4, announced in November, implements a reverse-engineered version of a Windows NT PDC, the Syntax Primary Domain Controller. TAS is insulated from future Windows NT version changes because it does not rely heavily on licensed source. Syntax is reportedly the first company to reverse engineer and market a Windows NT PDC.

AS/U is poorly thought out from an architectural standpoint as well, says Franklin. For one, it is limited in platform support; it can only support Windows clients. TAS, in contrast, runs on Solaris, HP-UX, AIX and IRIX, and can integrate Windows, Macintosh and Novell NetWare clients. Also, Franklin finds fault with AS/U's practice of segmenting a section of disk as an NT file system, instead of storing NT data on a common file system that can be accessed and integrated by other platforms, as TAS does.

"It's true that technology comes and goes, but data accumulates and becomes more valuable," says Franklin. "It stands to reason that data should be available, secure and shareable regardless of the platform." This argument takes on a strategic dimension as well. "If Solaris is really to be the most strategic operating system, then why would Sun want to give up the data management function to Microsoft?" Franklin says.

But AS/U's kiss of death is its reputation for scaling poorly and being buggy–a situation that won't change if AT&T stops receiving source code updates. "My condolences to anyone who's planning on using AS/U," says Jerry Knowles, systems project leader for the Jacksonville Electric Authority (JEA), Jacksonville, FL. "AS/U is just not ready for big systems." In particular, Knowles, who was using an AS/U implementation from Hewlett-Packard Co., Palo Alto, CA, complains of the way AS/U handles access control lists (ACLs) and its inadequate maintenance tools.

Cascade may be bad for consumers but it's clearly bad for TAS, which is Syntax's only product offering, and has received considerable sales volume through the Sun channel. TAS will continue to ship with new Sun servers, but will understandably receive less attention from Sun sales people as they try to promote their own product. That said, TAS has been around since 1985 and has withstood other UNIX vendors licensing AS/U, notably HP, Digital Equipment Corp., Maynard, MA, and The Santa Cruz Operation, Santa Cruz, CA. So for JEA's Knowles, it's not TAS that he worries about, it's the Cascade users.–*ab*

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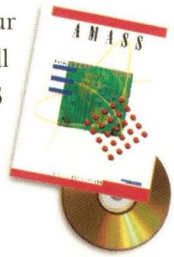

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the wind out of the group's sails, an informed industry insider reported.

As it stands, HP did announce Version 2.0 of ChaiVM, a reverse-engineered implementation of the Java Virtual Machine (JVM), which is targeted at memory-constrained embedded devices running RTOSs, and ChaiServer, which sits on top of ChaiVM and lets devices make use of URLs and HTTP to identify and access devices and applications.

HP also announced the Chai Developer Kit for building so-called "Chailets," which is free to developers through February 2 from HP's Chai Web site (`http://www.chai.hp.com`); a Chai Certification Program for vendors, which has already certified Japanese firm Aplix Corp. and The Open Group Research Institute, Cambridge, MA; and a Chai licensing deal with Enea OSE Systems AB in Täby, Sweden. HP has already licensed ChaiVM to other prominent RTOS vendors, including the aforementioned QNX, Integrated Systems Inc. (ISI), Sunnyvale, CA, Lynx Real-Time Systems Inc., San Jose, CA, Microware Systems Corp., Des Moines, IA, and Microsoft.

For Vicki Shipkowitz, Sun's product line manager for embedded Java environments and technology, HP's behavior at the Embedded Systems Conference was a thinly veiled attempt to spin a disagreement over Sun's licensing practices as a technological, standards issue. "HP tried to leverage the group working around real-time issues to pressure Sun to change its business model. They used real-time extensions as a red herring for their branding position."

But HP is rather forthright about its stance on Java licensing. "Two years ago when we were making a make vs. buy comparison on Java Virtual Machine technology, we did an analysis on such criteria as 1) is the technology available? and 2) if so, is it available under viable terms and conditions?" says Byron Ryono, director of marketing for HP's embedded software operation. "At the time, the answer to both of those questions was no," Ryono adds. "If Sun were to become more reasonable, we would still want to write our own version of the virtual machine but we would be able to use the 'Java' brand."

Sun, however, is in no mood to relinquish control of either the Java standardization process or, for that matter, the Java brand. "Sun cares about two things with respect to the Java platform: security and write once run anywhere," says Sun's Shipkowitz. Security has been hard to implement, she says, and "if there's no conformance to the spec, there's no guarantee that your code will run anywhere." Not to mention the fact that "you don't just give away your brand. As the developer and shepherd of the Java platform, that just wouldn't make sense," she says.

There's growing resentment among Java licensees that their efforts in promoting the Java platform are not being recognized.

However, there's growing resentment among Java licensees that their efforts in promoting the Java platform are not being recognized. "Java licensees have given Java a lot of credibility and money, but the market just hasn't been there for us in return," says QNX's Raddalgoda.

Analysts are pushing for Sun to loosen its grip on Java for the good of the market. "If Sun maintains absolute control of Java, the government will not stand for it," says Ray Alderman, president of the Embedded Software Association, a membership organization for the embedded software community based in Scottsdale, AZ. "On the other hand, if Sun relinquishes some control, it may lose some licensing royalties but the market will grow much faster." For Sun, it comes down to a choice between owning all of a very small market or going to the street and competing for its fair share of a much, much bigger market, Alderman says.

Analysts fear that if Sun does not relinquish some control of Java, it risks becoming hopelessly fragmented by warring factions. "This kind of maneuvering between HP and Sun is bad for the little people, the RTOS vendor, the kernel guy. When elephants dance, it's the ants that get crushed," Alderman says.

"No one wants to see what happened to UNIX happen to Java," says QNX's Raddalgoda. "It got split into five different versions and, in the end, Microsoft won."–*ab*

Stepping Up Support for Linux

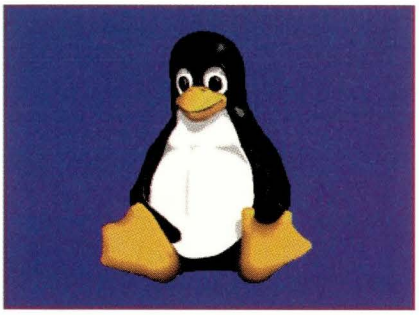
Linux developers celebrated the New Year with the release of the first official Java Developer's Kit (JDK) for Linux. This version is unique in that it is not only the first Linux port of Sun Microsystems Inc.'s newly released JDK 1.2 but the first to have passed Sun's full suite of Java compatibility tests.

"Now we can certify our implementation as 100% Java-compatible, which is a big, big step," says Steve Byrnes, a former Sun Java programmer who is now the point person for the JDK port and principal engineer with FreeGate Corp., an Internet servers vendor based in Sunnyvale, CA. "It really legitimizes the Linux port for commercial developers."

The agreement means that Sun will provide access to the source code as well as the 16,000 tests that make up the Java Compatibility Kit (JCK). In the past, developers had to wait until Sun publicly released a JDK before starting work on a Linux port and had to create their own compatibility tests–meaning the Linux versions lagged other operating system ports by several weeks. That, says Byrnes, led many developers to feel reluctant to deploy Java applications on Linux. "Our test suites are kind of ad hoc and don't really cover all of the bases. There are people who have held back because they've run into problems that we didn't catch."

Linux, a freeware, UNIX operating system originally developed for the Intel Corp. platform but now ported to SPARC, DEC Alpha, Macintosh and several others, has recently received an outpouring of support from commercial vendors. Mountain View, CA-based

Netscape Communications Corp., for example, announced it would release directory and messaging servers for Linux by the end of 1998, with other server products to follow this year. Last June, Corel Corp., Ottawa, Ontario, released NetWinder DM (Development Machine), a Linux development product, and, last October, Corel announced it would provide free downloads of WordPerfect Personal Edition for Linux. Also in October, Oracle Corp., Redwood Shores, CA, released Oracle 8 and Oracle Application Server on the Linux platform. Many other companies have also announced Linux products or versions of existing products.



For the past couple of years, in fact, Linux has been growing more rapidly than any other operating system except Micorsoft Corp. Windows NT, according to International Data Corp. (IDC), a high-tech research firm based in Framingham, MA. IDC reports that sales of commercial Linux licenses grew 20% from 1996 to 1997 and were again expected to increase by 20% in 1998. These figures, of course, do not include the vast numbers of freeware Linux installations. Red Hat Software Inc., a commercial Linux vendor based in Research Triangle Park, NC, estimates there are between five million and 10.5 million active Linux users worldwide.

Fred Bennett, president of I-Link Inc., Laurel, MD, is one such Linux user. Bennett's company sells a turnkey Intel/Linux Web server, as well as software and Web site development services based on Linux. Bennett likes the fact that the freeware operating system is an open-source platform that has been collectively developed by hundreds of Linux programmers. He also likes its relative stability. "It rarely ever crashes,"

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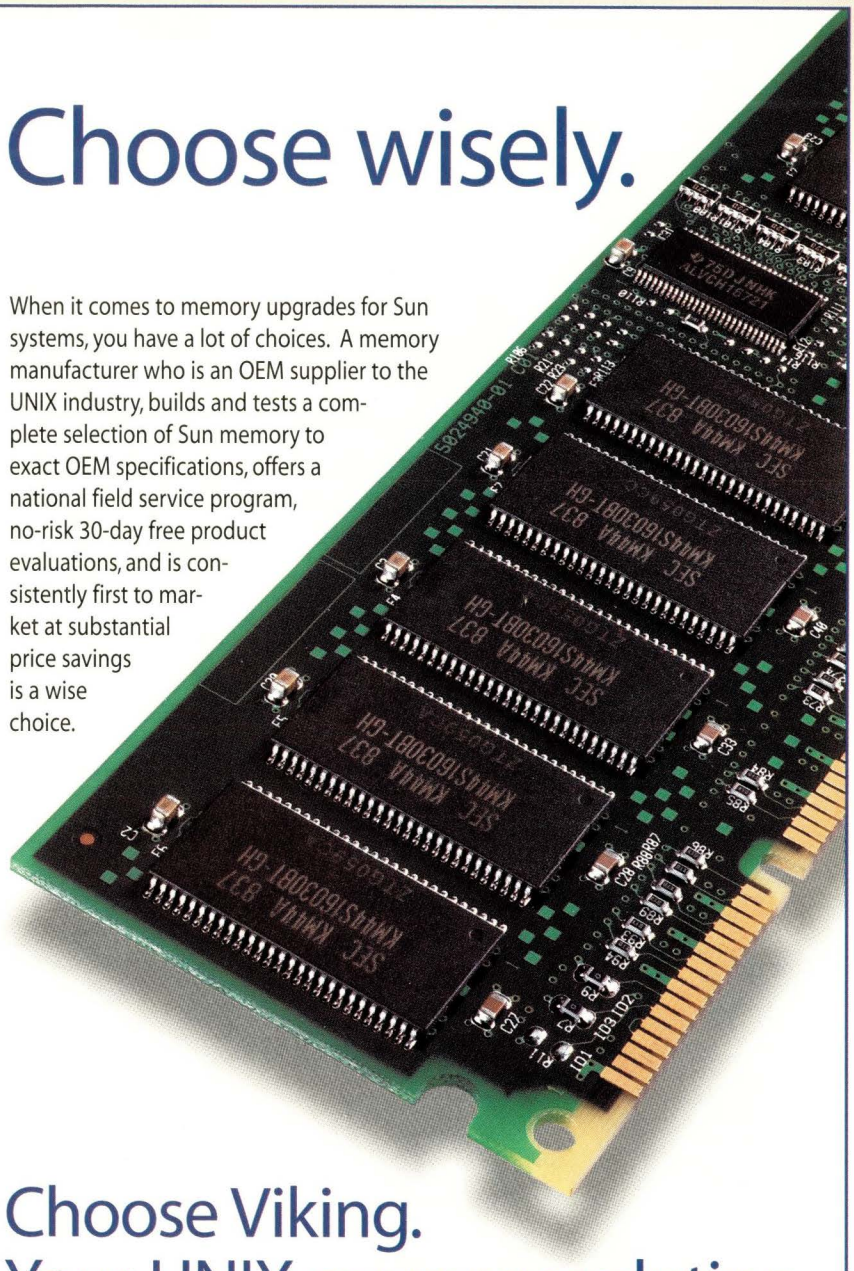

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says Bennett, who says he's looking forward to using the new Linux database products from Oracle and Informix Corp., Menlo Park, CA.

Another Linux fan is Michael Applemans, manager for research and development at Agility Inc., a Brecksville, OH-based software development and consulting firm for the manufacturing industry. While Agility currently supports a mix of platforms, Applemans says he particularly likes Linux because it's a stable, low-cost, open-source platform. Agility is in the process of porting its OS/2 and NT applications to Java for future deployment on an intranet running on NT and Linux servers. "We're using Linux now for development and to test our application portability, but I expect we'll find more of our customers wanting to deploy our applications on it, especially in warehouse or manufacturing environments with dedicated applications," Applemans says.

Because of the rising popularity of Linux, some industry observers have suggested it has the potential to unseat Windows NT.

Because of the rising popularity of Linux, some industry observers have suggested it has the potential to unseat Windows NT. Two widely circulated memos, apparently leaked internal Microsoft memos concerning the Linux threat, have lent credence to that notion. The memos, dubbed the Halloween Document (see `http://www.opensource.org/halloween1.html` and `http://www.opensource.org/halloween2.html`), discuss the threat Linux and other open-source software pose to Windows. (An interview with Ed Muth, enterprise marketing group manager for Microsoft, found at `http://www.microsoft.com/ntserver/highlights/editorletter.asp`, confirms the document is an internal Microsoft memo circulated in August 1998.) Some of the virtues of Linux over NT cited in the memo include reliability, customizability and interoperability with a vast range of open (and proprietary) protocols.

Kimall Brown, chief analyst with Dataquest Inc., a research firm based in San Jose, CA, says Sun and other UNIX vendors ought to capitalize on this increased interest in Linux by taking an

In Search of Device Independence

Writing applications that take advantage of storage devices such as tape or CD library changers can be a developer's worst nightmare. For every device that an application might want to take advantage of, you need to write a device driver.

Microsoft Corp., Redmond, WA, plans to address this issue in Windows NT 5.0, currently in beta and to be renamed Windows 2000, with the Microsoft Removable Storage Management (MRSM) service, an extension of the Win32 application programming interface (API) that lets application developers write to a single API and automatically support any Windows NT-supported storage devices.

MRSM technology was developed by HighGround Systems Inc., Marlborough, MA, which it markets simply as RSM. In November, IBM Corp., Armonk, NY, announced that it too had licensed HighGround's RSM, which it plans to incorporate into future versions of AIX. "[RSM will] ease the challenges customers experience in managing removable storage resources in today's multiplatform environment," says Duane Dueker, IBM director and business line manager for storage management software.

By licensing RSM, IBM hopes to fill the UNIX world's need for a standard way for applications to share storage resources. Mark Nicolett, research director of storage management strategies for Gartner Group Inc., Stamford, CT, says two companies in the UNIX space have already proposed this type of technology–Legato Systems, Inc., Palo Alto, CA, with SmartMedia, and Veritas Software Corp., Mountain View, CA, with the Veritas Media Librarian technology, or VML. Device vendors, in turn, tend to support one technology or the other, but there does not appear to be any real momentum behind either one. RSM, on the other hand, has Windows NT 5.0 on its side. "From there, IBM is hoping that application vendors will simply port the work they did for NT over to UNIX," Nicolett says.

And with the widespread adoption of storage-area networks (SANs) just around the corner, the need for an RSM-like technology has become all the more urgent. SANs link together multiple storage devices onto a single network, and applications will soon want to connect to those multiple devices. This, however, "outstrips the capabilities of current software," says Nicolett. "To exploit this new environment will require new improvements in storage resource management technology."

Whether RSM is really the technology for the job is up for debate. "The HighGround architecture is still pretty flawed," says Ed Cooper, corporate director at Legato Systems. "It does not allow multiple systems to share a single tape drive...and that's fundamental of what a SAN needs and why you need advanced media management software," Cooper says.

"RSM also only addresses Windows NT 5.0, not NT 4.0, the NetWare question, or any of the UNIX systems out there," Cooper says. Legato's SmartMedia, on the other hand, is a platform-independent standard that anyone can use.

Cooper also doubts IBM's commitment to HighGround's technology. "IBM has licensed various media management technologies in the past," he says, "and to date has done nothing with them." IBM's most recent foray into this space was to license Veritas' VML. Plus, says Cooper, "Legato is also talking to IBM. The door is by no means closed on what IBM will do."–*ab*

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"embrace and extend" approach, treating Linux as a low-level operating system on which to run different UNIX middleware applications. "If the UNIX guys could all get together on the basic plumbing–a common kernel like Linux–and compete against each other with their middleware, the UNIX market could take off and crush Microsoft," Brown says.

However, Linux has a long way to go before that can happen. Whatever the potential for Linux down the road, the market for the Linux operating system and applications has, until now, been a low-end one, consisting mainly of university students, scientists and researchers on limited budgets, small consulting and systems integration firms and small Internet service providers (ISPs). In contrast, larger organizations seem to prefer the commercial UNIX operating systems.

Dan Kusnetzky, director of operating environments at IDC, says Linux will have a difficult time competing with Windows NT and the other UNIX platforms unless it can overcome several key obstacles that prevent it from being fully competitive with commercial platforms. "For those people who have the bravery to take it on, it's a very effective operating system. But it's not for the timid," says Kusnetzky. "It suffers from a lack of device support, lack of user-friendliness, lack of applications, lack of much consulting support and a lack of any major hardware vendor saying they're going to do something with it."

The lack of application support, at least, seems to be one obstacle that is fast disappearing. Currently, a number of database vendors, tools vendors and office suite vendors offer Linux versions of their products. So far, no enterprise resource planning (ERP) vendor has stepped forward with a Linux port, although that could soon change. "I've spoken to some of [the ERP vendors], and I wouldn't be surprised," IDC analyst Bill Peterson says.

For the flow of commercial applications to continue, vendors must solve the dilemma of how to price their expensive products for a freeware market. Offering Linux customers cut-rate or free versions of the software is not likely to wash well with customers who have paid full fare, says IDC's Kusnetsky, nor is raising the price of Linux versions a good solution. "Are people going to pay $15,000 for a database that runs on a $55 operating system?" he asks. "That's something none of the vendors have yet addressed."–*sjh*

Interix Makes NT UNIX

Now Windows users can have certified UNIX thanks to a combination of Softway Systems Inc.'s Interix and Microsoft Corp. Windows NT.

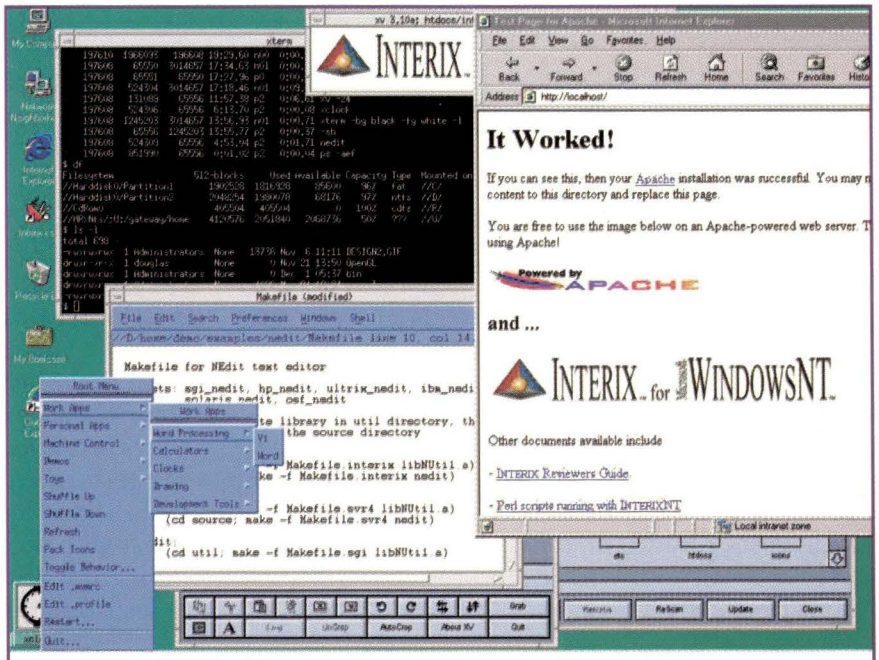
Interix, which allows UNIX applications to run in a Windows NT environment, has been branded a UNIX operating system by The Open Group, Cambridge, MA, a certification organization and holder of the UNIX name. This means that the combination of the two systems conforms 100% to The Open Group's specification that defines UNIX. So just like the UNIX flavors offered by Sun Microsystems Inc., IBM Corp. and Hewlett-Packard Co., Interix with NT is now considered UNIX.

"What this effectively does is certifies NT as a real UNIX operating system," say Douglas Miller, chief executive officer of Softway Systems, San Francisco, CA. "This is a fairly interesting development in the competitive marketplace because right now UNIX and NT are at each other's throats for getting mindshare in the enterprise as an enterprise operating system."

Interix was built under contract by Software Systems for Microsoft. In addition to providing UNIX compliance, the contract called for the company to deliver technology that conforms to the Portable Operating System Interface for UNIX (POSIX.1 and POSIX.2). POSIX is a standard that defines an interface between programs and operating systems, including Windows NT and UNIX.

Although NT can call itself UNIX with the help of Interix, it doesn't mean it has the scalability and robustness of more traditional UNIX. Moreover, analysts see this certification as a reflection of the popularity of NT and the need for NT to work with UNIX.

"People are adopting Windows NT very rapidly and it has a totally different development paradigm, totally different set of interfaces and a totally different approach to development," says Dan Kusnetzky, director of operat-



Together, Windows NT and Interix–terminal emulation software that runs on top of the NT kernel–have been granted UNIX certification by The Open Group.

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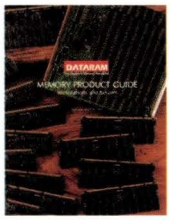

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1999 Sun Expert Buyers Guide

ing environments and serverware at International Data Corp. (IDC), a Framingham, MA-based market research company. "Organizations that are bringing this in that have a strong UNIX expertise could be helped a great deal by this software, making it easy to develop software for both [NT and UNIX]."

That's one of the benefits Softway Systems is pushing. The company says developers who work in both NT and UNIX environments will no longer need two workstations, but could run one desktop to do both NT and UNIX development instead .

While there will be the convenience of having both an NT and UNIX environment on one workstation, IDC's Kusnetzky sees the two operating systems as still having different roles in an organization–that is, even though NT with Interix can be called UNIX it won't replace traditional UNIX for certain jobs. According to IDC research, NT is most popular as a file and print server, while the number one role for UNIX is to support databases.

"The word UNIX doesn't mean anything anymore because The Open Group has effectively destroyed the word from having any intrinsic value," Kusnetzky says. "[NT and UNIX] are serving different missions. You wouldn't replace one with the other."

This means organizations will be using both operating systems and that will make a product like Interix invaluable. With Interix, developers will have the flexibility of working in both environments from a single workstation.

Interix works as a subsystem server that runs directly on top of the NT kernel as a native implementation of UNIX. Basically, it allows UNIX to run side by side with Windows. To run a shrink-wrapped UNIX application, it's necessary to recompile the application the same way one would going from Solaris to HP-UX. Interix provides standard UNIX libraries as well as support for OpenGL, Open Database Connectivity (ODBC), X Window and Motif. "We don't provide binary emulation," says Softway Systems' Miller. "When you recompile the application you end up with a native NT binary that executes directly on the NT kernel through our enhanced UNIX subsystem."

Currently, Interix 2.2 is available for Windows NT 3.51 and 4.0. Softway Systems plans to release an NT 5.0 version around the same time Microsoft delivers the operating system. Softway Systems also provides a full UNIX multiuser model so multiuser applications, such as X Window, can run natively on NT.–*ptc*

New UNIX for Intel Promised

The world should have a new version of UNIX to look forward to thanks to a Dr. Frankensteinesque development approach being jointly employed by IBM Corp., The Santa Cruz Operation Inc. (SCO) and Sequent Computer Systems Inc. The three companies will offer different pieces of their own technology to build a monster UNIX operating system designed specifically for Intel Corp.'s next-generation IA-64, as well as existing IA-32, chips.

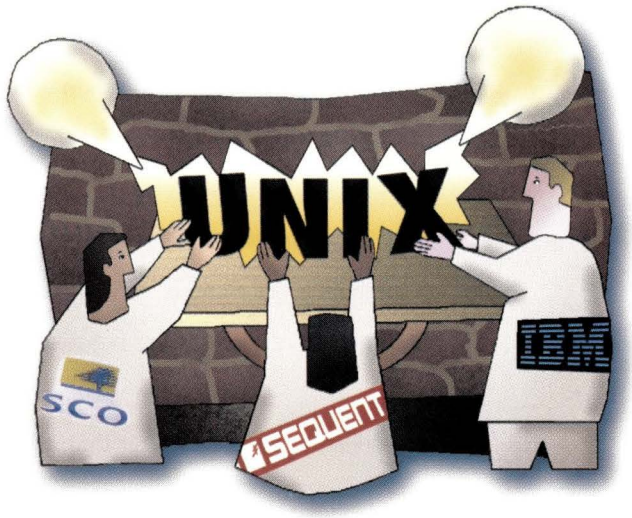
"This UNIX operating system will be developed using IBM's AIX enterprise capabilities complemented with technology from SCO and Sequent," says Bob Stevenson, senior vice president of IBM, Armonk, NY. "The result will be a UNIX that runs on IA-32, IA-64 and IBM's POWER architecture for systems ranging in size from the desktop to the supercomputer."

Douglas Michaels, chief executive officer of SCO, Santa Cruz, CA, adds, "Each of our companies offers a unique contribution to this relationship." AIX, Michaels says, brings its strong enterprise capabilities to the table. Sequent will offer its nonuniform memory access (NUMA) technology, while SCO will provide UnixWare's market leadership on the Intel-32 platform.

Meanwhile, Intel plans to provide marketing and technical support. Intel and IBM say the two companies have contributed tens of millions of dollars to establish an ISV fund to promote the migration of tools and applications to the IA-32 and IA-64 platforms. Already, 19 ISVs have announced their support of the new UNIX initiative, including BEA Systems Inc., San Jose, CA, Novell Inc., San Jose, CA, PeopleSoft Inc., Pleasanton, CA, Progress Software Corp, Bedford, MA, and Rational Software Corp., Cupertino, CA.

If all goes well, the new UNIX operating system will be available within 16 months. No decision has been made on a name for the new operating system, and for now it is being developed under the code name Project Monterey.

IBM has promised to make a UnixWare-enhanced version available on its POWER architecture as well as Intel. "It is not a replacement for AIX," says Miles Barel, program director of AIX marketing at IBM, "nor are there separate products that continue to exist. It's one product line, one version that runs on the POWER processor family, with one version on the Intel 32-bit platform and one version that runs on Intel 64-bit platform."



BRAD DILLMAN

Barel goes on to say that this is a unique opportunity to provide standardization of UNIX on the Intel platform. "We never had the opportunity to do this within the UNIX industry before," he says. "We were all running our UNIX on our own proprietary

platforms. The fact that we're going to be running on a common hardware platform presents a lot of new opportunities to unify the UNIX community."

Not all UNIX operating system vendors have joined in. Sun Microsystems Inc., Palo Alto, CA, and Hewlett-Packard Co., Palo Alto, CA, still plan to deliver their own UNIX on IA-64. While there isn't unity across the entire UNIX world, the companies involved with Project Monterey have extended an invitation to all operating system manufacturers. "Any vendor that would like to be a part of the Project Monterey is more than welcome," Barel says.

AIX Takes Honors

Apparently Intel and Sequent aren't the only ones that feel Big Blue's UNIX operating system has strong enterprise capabilities. In November, D.H. Brown Associates Inc., a research company based in Port Chester, NY, announced the results of tests that it performed on enterprise class operating systems from Compaq Computer Corp., Sun, Silicon Graphics Inc., HP and Microsoft Corp. The tests examined reliability, availability, serviceability, scalability, systems management and Inter/intranet capabilities. Based on D.H. Brown's criteria, AIX 4.3.2 was the top-rated operating system, beating out Digital UNIX 4.0E, Solaris 7, IRIX 6.5, HP-UX 11.0 and Windows NT Server 4.0 Enterprise Edition, in that order. Specifically, AIX received strong marks for its strength in systems management and Inter/intranet functions.

AIX 4.3.2 received strong marks for its strength in systems management and Inter/intranet functions.

The report also noted the significant strides Sun has made with its Solaris operating system. In 1997, Solaris 2.6 placed last among UNIX systems, according to D.H. Brown. With the release of Solaris 7 (see "Will Seven Prove Lucky for Solaris Users?" *SunExpert*, November 1998, Page 6), Sun's operating system improved its ranking. Solaris 7, offering full 64-bit capability, moved into third place overall in 1998. "In past studies, there were some deficiencies [with Solaris] compared to the competitors," says Tony Iams, senior analyst with D.H. Brown. "Sixty-four bits was one."

The move to 64 bits is being heralded by industry watchers as a strong step for Solaris (it is the last major operating system to offer this capability). In addition, companies like Computer Associates International Inc., Islandia, NY, believe it will improve the performance of their products that run in the Solaris environment. Ken Farber, senior vice president of strategic business alliances at Computer Associates, says that will be the case for his company's flagship product the Unicenter TNG enterprise management architecture. "That [64-bit support] shouldn't be understated," Farber says. "For us, that's probably the biggest thing in terms of features and functions that Sun is providing to our customers."

Iams also believes that Sun has made improvements in its latest release of Solaris with the addition of an integrated journal filing system, which was previously only available as an add-on. Furthermore, Iams says, the dynamic reconfiguration features now available in Solaris 7, as well as its capability in the realm of SMP scalability, are positive improvements to Sun's operating system.

Tom Wilson, partnership manager at Tivoli Systems Inc., Austin, TX, maker of the Tivoli Enterprise management software, says Solaris 7 signifies a highly reliable, scalable operating system that fosters cross-platform environments. "Those types of features are very important to our joint customers," he says. "The new features in Solaris have augmented Solaris' ability to do those things."

D.H. Brown has posted the results of its operating system study and plans to update its results on a regular basis. The results can be found at `http://www.dhbrown.com/pdfs/osscorecard.html`.–*ptc*

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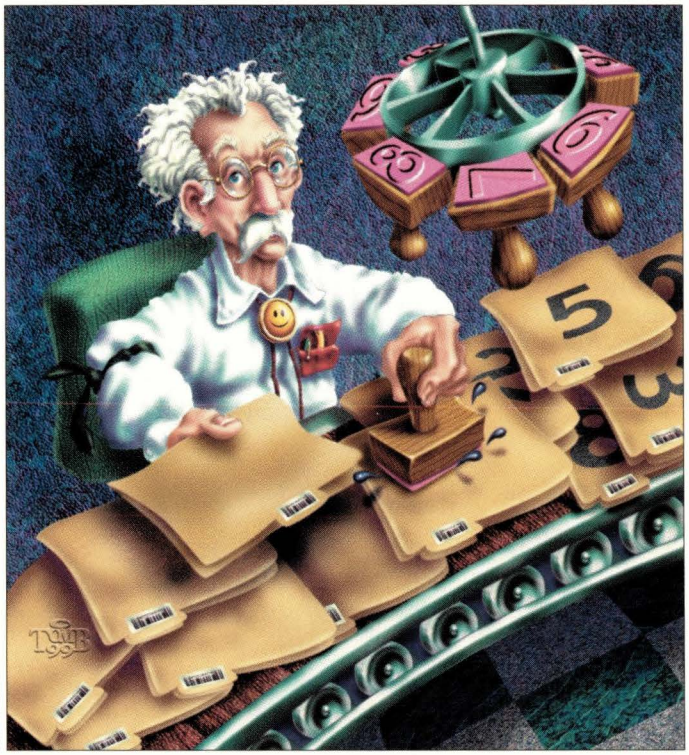
Circle No. 9

by Michael O'Brien



TOM BARRETT

"IANA houses the many unique parameters and protocol values necessary for operation of the Internet and its future development."
– `http://www.iana.org`

"I need a port number for a new graphical conferencing system we're developing for the Navy. If it works, we expect they'll deploy it."
"OK, take port 53. Let me know if the time comes when you don't need it anymore."
– An exchange with IANA circa 1979

"Goodbye, Jon."
– Whoever's wise

The Numbers Czar

Q: *Look here. You're always rabbiting on about SMTP and port 23 (and getting that part wrong). This is all very silly. You seem to imply that these services are tied up somehow with all these arbitrary numbers. So who gets to say that SMTP is port 25, anyway?*

A: Jon Postel, that's who. It should come as no surprise that the Internet, like everything else involving computers, is based on numbers. It therefore follows that someone's been keeping things straight since the earliest days of the ARPANET. What most people don't know is for that entire time, one person has been responsible for assigning numeric values wherever they were needed, from the top of the Internet to the bottom.

Specifically, where do the numbers come in?

Mr. Protocol is glad you asked. It turns out there are a lot of them. Just about every action you can possibly take on the Internet involves translating something humans can either do or understand and converting it to numeric form for transmission over the Internet. There are a few exceptions, but even some of the exceptions are hybrids.

Consider the Web. The basis of the Web is the URL, or Uniform Resource Locator, which is the gobbledygook that usually starts with `http:` (which stands for Hypertext Transfer Protocol). Ever wonder why they say that? I mean, what follows is always a host name. Why not just connect to the host and see what you get? HTML is pretty easy to recognize, and it sure doesn't look like FTP gobbledygook.

The reason is that without the initial `http:`, your Web browser wouldn't know enough to make the connection with a foreign host. It takes two pieces of information to make an Internet connection: the IP address of the other machine and a port number to connect to. In fact, the whole connection consists of four numbers: the IP address and port number on your end, and the IP address and port number on the other end. These four numbers are the connection. There can be only one connection for any such four numbers. So how can you have multiple Web connections open to the same server on the far end, from the same machine on your end? The answer is that each connection differs in one number: the port number on your end. On the far end, you have to know the port number in advance to make the connection. HTTP servers (that is, Web servers) all use a well-known port, either port 80 or port 8080, so you must connect to one or the other. On your end, though, you don't care what port number you use, so your local system pulls one out of a hat. So although you may have several apparently identical Web connections open to the same server, they differ in their local port numbers.

The Web is a fairly recent invention as far as the Internet goes, although it is the service that really made it take off commercially. Still, someone had to say

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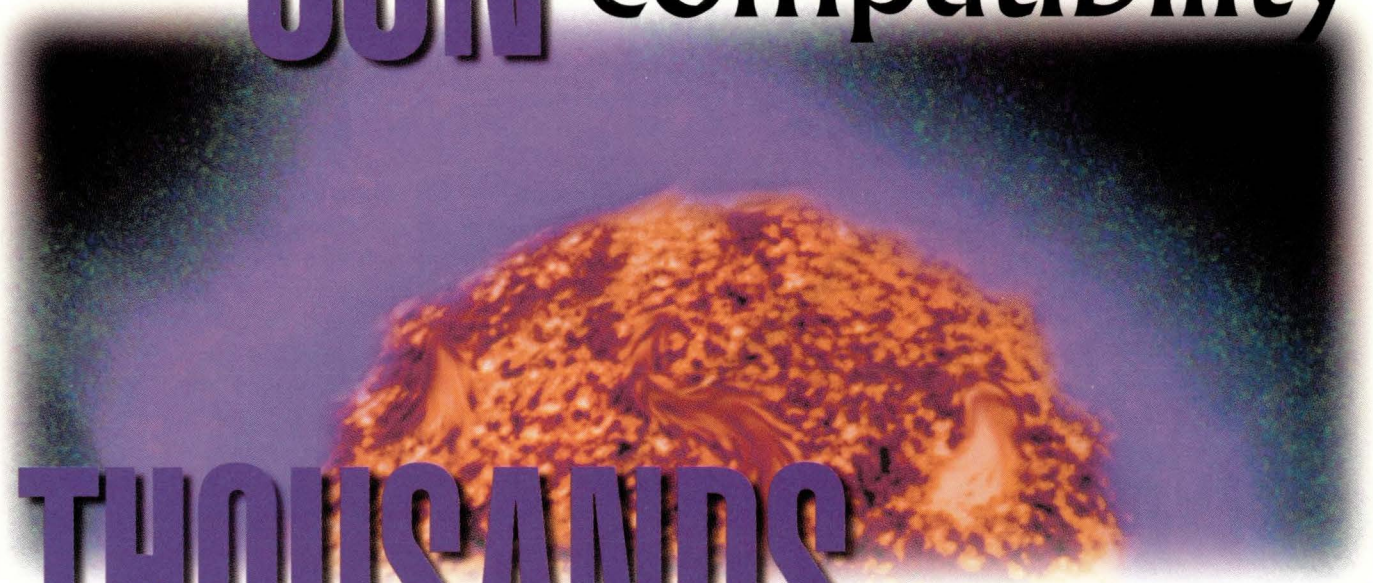

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that it was all going to go over either port 80 or port 8080.

That same someone has been saying such things since the Internet's earliest days. The Internet's problem with port numbers arose from the ARPANET's problem with socket numbers. ARPANET sockets, unlike Internet TCP connections, were half-duplex affairs. You could tell the gender of an ARPANET connection by looking at the socket numbers on each end. Data flowed from even numbers to odd numbers. This meant that all servers were on odd socket numbers, that is, all "well-known" socket numbers were odd. Telnet was 1, FTP was 3 and so on. In order to establish a full-duplex Telnet connection, two connections were needed, one flowing in each direction. Experience showed that the only half-duplex connection anyone ever made was the data connection in an FTP transfer. This observation caused TCP to be designed with full-duplex connections. With the advent of TCP, socket numbers became port numbers, and because "gender" was no longer an issue with full-duplex connections, well-known port numbers could be either odd or even. The ARPANET legacy lives on, however, because all of the well-known port numbers of older services are odd. In fact, HTTP is almost the only major service with an even number. Even numbers invariably represent newer services, most of them special-purpose and not widely deployed. (Attention all you entrepreneurs and media flacks out there reaching for the "Mail" button: Go away! You are not a major service. [Attention Kerberos: OK, OK, maybe you are.] [Attention Gopher: You're dead, and Halloween is over.])

In the earliest days of the ARPANET, the researchers who were designing the services for the new network realized that if these well-known socket numbers were really going to be well-known, someone had better keep track of them. A young researcher named Jon Postel volunteered, and he kept the job for the rest of his life.

Number Cruncher

Jon's job as Assigned Numbers Authority was originally a bookkeeping one. Jon was the right person for the job because he had an eye for detail (after all, he *did* volunteer), and because he understood the books he kept. SMTP is a good example. This is the protocol universally used for exchanging mail on the Internet. As Mr. Protocol has mentioned in the past, email started out as a wart on the side of the FTP server, known as the `MAIL` command. When the ARPANET was turned into the Internet some cleanup was done and email was split off as a separate service. The urge to clean house was considerable, because the FTP `MAIL` command represented one of the ugliest parts of the network. Everybody stuck his oar in, and the Mail Transfer Protocol was born...and promptly died. The spec was the most horrendously bloated mess the network implementers created. It couldn't even be advanced to a standard because the number of working implementations hovered somewhere between zero and one.

In response, Jon created the Simple Mail Transfer Protocol, which quickly became a done deal. Although mail has continued to be something of a bugbear, and although the SMTP spec has been extended, expanded and generally mashed on considerably, the framework has remained intact.

With chops like that, Jon had no trouble hanging onto the job of "Numbers Czar." In the late 1970s, his job allowed a great deal of informality, and getting a new port number or protocol number amounted to sending email to Jon explaining what your protocol was and why you thought it would be around long enough to need a number. Things became somewhat more formal when the Internet became larger and the Domain Name System (DNS) was added to the Assigned Number Authority's coordination load. At this point, the office became the Internet Assigned Numbers Authority, or IANA. Still most people had never heard of IANA or Jon.

The number of things now coordinated by IANA is surprising. It doesn't begin at the deepest level, but it comes close.

Steve Deering, architect of the next generation of IP and several other things, likens the IP protocol suite to an hourglass. There are many application-layer protocols, all carried by a few transmission protocols, which are in turn carried by the lone Internet Protocol, IP. To get IP over a particular physical connection, it must usually be encapsulated in some protocol specific to the medium, and there are many possible media, from Point-to-Point Protocol (PPP) for dial-up users to the Ethernet protocol.

In most cases, IANA is not involved in coordinating the numbers used in low-level media protocols because, in most cases, these protocols were not developed by the Internet architects but by private companies. Ethernet protocols fall under this category. So, while IANA does carry a list of "magic numbers," such as protocol ID numbers that occur in Ethernet packet headers, it does not control or coordinate them. But in the case of PPP, which is an Internet protocol, IANA does keep a list of all the assigned values of the numeric fields used in PPP. And if you take a look, you'll find there are dozens of these.

In the IP protocol itself, there are several fields that IANA controls, including the biggie: protocol ID.

What does all this mean? The general answer is simple.

Pretend that you've had a horrid day and have decided to be reincarnated as a protocol stack. Basically, cockroaches have a better life. Packets, packets, packets, all day long and all night long. Might as well have been reincarnated as a stamp vending machine. Packets in, packets out. Here comes one now.

This is an Ethernet packet. Has to be, it's coming from an Ethernet card. So we know in advance what its header has to look like. Ho hum, yes, that's our 48-bit Ethernet address, checksum is OK, might as well deal with it. Time to crack it open and look inside. The Ethernet packet has a header part and a data part. I know what the header part looks like, so I can pick that apart, but the data part could be anything. I have to know in advance what's in there before I can make sense of it. The only way I can find this out is if the Ethernet header tells me what's in there. There's an "Ethertype" field in the Ethernet header which contains a number. That number tells me what kind of packet is contained in the data field. Knowing that, I can take the contents of the data field as a packet and read the header of that packet. The Ethertype field in this Ethernet packet contains the number 2048, so I know the data part of the Ethernet packet contains an IPv4 (aka "plain vanilla") IP

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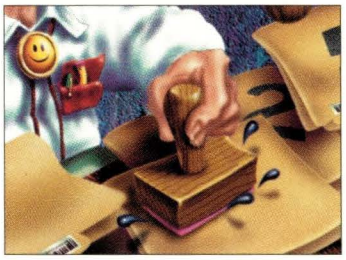
Circle No. 11

packet. Looking at the header of that IP packet, I see the number six in its "Protocol" field. This means that the data part of the IP packet contains a TCP packet.

There is no Protocol, Ethertype or IPtype number in TCP packets. That's what the destination port number is for. It's up to the particular service that is bound to that port number to make sense of the data part of the TCP packet.

A pattern emerges here. Each packet has a field in its header describing the contents of the data portion of the packet. This is the thread that is followed to traverse the layers of the network stack. The Ethernet driver sees from the Ethertype field that this is an IP packet and passes the data section to the IP stack. The IP stack sees from the Protocol field that the data portion should go to TCP and passes it on up the line. TCP looks at the destination port number and figures out who gets the data.



By the way, it would be a mistake to figure that the difference between something like a Protocol field and a destination port number implies that the one belongs in an operating system kernel and the other belongs in user space. In a small system there is no such distinction. An Apple Newton, for example, passes things around just fine, handling everything from IP to HTTP in various "packages."

This trail of numbers is handled by IANA. The numerical assignments that bind services to integers are built into the code in a fairly straightforward fashion. Each list at IANA typically becomes a C header file in some vendor's software repository. More important, each list at IANA becomes a set of C header files in *every* vendor's software repository so that the software will interoperate.

Of course, there's more to life than making sure all the numbers match. But when you're reincarnated as a network stack, there's not much more to life. Interpretation of what to do when various conditions arise remains a gray area, and is responsible for those delightfully nerve-racking events known as "connectathons," when the technical types at different companies all show up in some hotel function room somewhere with a bunch of gear and put it all on a common network to iron out the wrinkles. The Interop show started out life as the world's only connectathon, but too many suits started showing up trying to make brownie points so now Interop is another sales lovefest designed to show how well things all work, the real labor having been performed at private, unadvertised connectathons dedicated to ironing out the kinks and killing anybody who shows up in a suit.

Once IANA became a going concern keeping the numbers straight, all sorts of other things came under its purview. You can see the whole array at `http://www.iana.org/numbers.html`. In days of yore, the assigned numbers were listed in a document, which was issued periodically as an RFC. The last such RFC was RFC 1700. It is now out of date, and no more will be issued. The Web has subsumed this function, and the Web site given above is now the final arbiter of which numbers mean what.

Some things contained at IANA aren't even numbers. The various forms of compression one might find on a Web page (all three of them), for example, appear to be an IANA-maintained list now. Other text lists, as well as numbers, are to be found at the IANA site.

There are two other big things IANA handles. One is the assignment of blocks of IP address space. This used to be nothing much until addresses got tight, and now they require three Our Fathers, three Hail Marys and a sincere act of contrition to get a class C network block. Class B requires reconvening the College of Cardinals and Class A requires canonization and the signatures of the Pope, the Dalai Lama and the Metropolitan of Moscow. This is why IPv6 is needed. When IPv6 finally becomes widely deployed you can give a block of five billion addresses to your electric razor and no one will care.

The other major responsibility of IANA, and the one that has caused the most trouble, is oversight of the DNS. This is one of those nonnumerical lists. Network Solutions Inc. has the contract to administer the `.com` domain and a couple of the other biggies, but the (nameless) root domain and all the root servers are subservient to IANA. Now that the Internet name space has become a big political mess, various proposals are being bruited about by various governmental and nongovernmental entities, most of whom seem to think that the root domain name space is theirs to dispose of. Actually, all of the current root domain name servers are being run by volunteers under the direction of (the original) IANA, which in turn operates under the (very loose) control of the U.S. government, at least for now.

The real winners in the "root wars" will be those who can convince the majority of people to use them as root domain name servers. Several competitors are already on the air but with vanishingly small followings. IANA has created a not-for-profit corporation to take over the function of IANA and has proposed this solution to the U.S. government. It will be interesting to see what transpires.

One unhappy thing has already transpired. On Friday, October 16, Jon Postel died of complications following heart surgery. The Internet has lost one of its founders. To those who have benefited from Jon's quiet work over the decades, as well as from his astute editorial skills as the official editor of the RFC series, the loss is profound, all the more so because it was unexpected. In a very real way, Jon was the center of the Internet. He will be sorely missed. ⊷

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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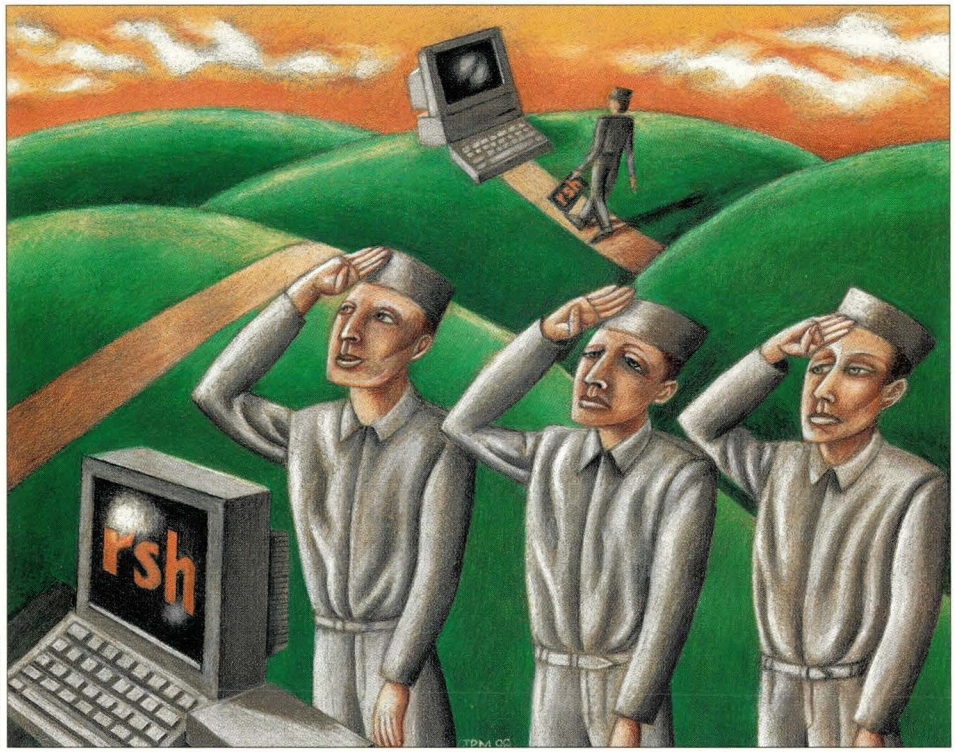

JANE MARINSKY

Those 'r' Commands

As often happens when I sit down to write this monthly missive, last month's column started off in one direction and ended up wandering into somewhat different territory. About halfway through the composition process, I changed the title of the piece to more accurately reflect the contents of the emergent article. In case you missed it, the column looked at `rlogin` and how it works (see "The rlogin Program," December 1998, Page 22). My original idea was sparked by email from Mark Hale (of the Georgia Institute of Technology) who suggested that I talk about another of those "r" commands, `rsh`. Well, to be more precise, he suggested that I discuss the authentication mechanism that underlies the "r" commands: `rlogin`, `rsh` and `rcp`. Let's look at the `rsh` command first, so we can understand the problems it solves and those that are solved by the authentication system.

The `rsh` command allows you to run an arbitrary command remotely on another machine. To find out who is logged into a remote machine, for example, you can say:

```
$ rsh machine who
```

The `rsh` command looks up the name of the machine in the name service to get an IP address and connects to the appropriate remote machine. On the remote machine, a daemon is started to handle the connection. The daemon is called `in.rshd` on SunOS and Solaris. (In this article, I'm going to stick to BSD practice and ignore Sun Microsystems Inc.'s renaming of this daemon. I will call it `rshd`.) The daemon is passed the command (`who` in the above example) and runs it. The `who` command will generate output on its standard output channel. This data stream is captured by the remote `rshd` and sent back to the local `rsh` program so it can be displayed on your screen.

The intermachine connections between `rsh` and `rshd` are TCP/IP connections. The `rsh` program is designed to handle programs that take data streams as input and write data streams as output. It's really intended for use with noninteractive programs, or pipelines of commands that process data. If you want to run an interactive program on a remote system, then you need to use `rlogin`.

Within these constraints, the `rsh` program tries to follow the maxim that I stated last month: It wants to work with no surprises. The `rsh` program attempts to arrange things so that typing the command, preceded by `rsh` and a machine name, will behave in exactly the same fashion as if the command was being run on the local machine.

Working with no surprises means we need to provide more than one data stream from the remote machine to the local machine. A UNIX command can write data to its standard output channel and emit error messages to its standard error channel. The channel split needs to be reflected back on the local machine

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Circle No. 13

that's running rsh because the user may use the standard UNIX shell redirection mechanisms to divert the standard channels to separate destinations.

To handle a UNIX command, we need to provide a standard input channel that runs from the user, across the network and into the remote command. We need to provide a standard output channel that takes data from the remote command and sends it back to the local rsh program. These two channels can share the same TCP/IP connection. We now have the problem of handling the additional error channel that's needed to move error responses from the remote process to the local rsh.

One option might be to multiplex the data across the TCP/IP connection. We will tag each piece of data that is being sent with a channel value and decode the tagging information before writing it to the appropriate local destination. Tagging the information means that we are creating a protocol. I suspect that when the system was designed it was felt that multiplexing information was fraught with recovery and sequencing problems. It's easier to provide another connection. So the first piece of information the rsh program sends to rshd is the port number of the TCP/IP connection on which it expects to receive error messages.

Context

The who command is a good initial example because it simply interrogates the contents of log files residing in a known place in the file system and prints the result. But what about a common command like ls? What should the following command do?

```
$ rsh machine ls
```

Well, we'll make the same connection to the remote machine and run the command. Again, it will generate output on the standard output channel and send it back to the invoking system for printing on the screen. However, UNIX makes considerable use of implied context when commands are executed. Each command is run in a particular directory, the current working directory, and so when rshd is run it needs to be placed in the file system where it will cause minimum surprise to the user. By default, the rshd program will change into the user's home directory, so the above command will always list the file names in the user's home directory on the remote machine.

Incidentally, if you send the ls command to a remote machine, you may get a surprise. The output from the ls command is displayed one file per line and not the column output you see when typing the command on the local machine. This is because the ls command looks to see if it is talking to a terminal and will only generate column output when it is sure it's doing so. When running remotely using rsh, the ls command sends output to a network connection and will default to its standard behavior of sending one file per line. Some people feel that creating a program that behaves differently depending on its environment is a bad thing.

Finding the user's home directory implies that the rshd that is started on the remote machine knows who the caller is–that is, who is running the command–and, therefore, its password file can be interrogated to obtain the home directory information. Actually, I've also ignored the context of the command itself. When you type a command like ls, the shell has to find the binary of the ls program to be able to run the command. The PATH environment variable is used as a search list to locate this binary. If you use csh or one of its derivatives, then the path variable is used to determine where the command lives. Either way, we will need to run the user's shell before we can run the command because the PATH/path variables are usually established in the shell start-up files for the user.

Sometimes you'll find that the contents of shell start-up files inhibit the correct use of the "r" commands. It's especially important not to place commands that establish terminal state into the shell start-up file that's run whenever a shell is initiated. They should be put into the file that's executed when you log in and nowhere else. Coding your start-up files so that they distinguish between interactive and noninteractive access can have a positive effect on the speed at which rsh commands are executed.

Checking Identity

Knowing the identity of the caller is also a good thing for security reasons. We want to impose the same security model on any command that a user may issue from a remote machine that we apply to commands issued locally. It's not much use having controls on whether I can look at a specific file if I can just go to a remote machine and execute a command that will circumvent the security.

By default, the rsh command sends your local login name to the rshd process. For flexibility, two names are sent: the name on the local machine and the name on the remote machine. Solaris 2.6 documentation detailing the order of sending these names is incorrect. It says the names are sent in remote machine, local machine order. However, on my BSDI system, where I can look at the source, the name on the local machine is sent first. Nevertheless, the systems interwork. Using the snoop program proves that the Sun documentation is incorrect.

The two names are sent as null terminated text strings. Two names are used because there are legitimate situations where you may wish to execute a command on a remote machine as "someone else." It's usual to have the same user name across a site, but there are situations where this is not the case. One common scenario is when you are superuser on one machine and wish to execute a command using your "real" user identity on another. Most of the "r" commands have a -l (*ell* not *one*) option that allows you to specify the user you wish to be on the remote machine. If this switch is not given to the command, the remote name is set to the same value as the local name.

You'll notice there is no provision for sending a password. The remote machine believes what you tell it. The original thinking on the security aspects went like this: A UNIX program can be trusted to send the correct information because we program it appropriately. However, we need a way to ensure that the standard UNIX program is being run and not some version that a user has coded to break security. Theoretically, a normal user cannot become a superuser, so setting the setuid bit and running

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Circle No. 14 Code SE2

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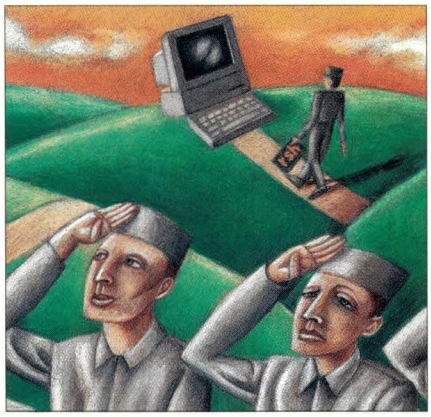
the local rsh program as superuser should be enough to guarantee the correct program is being run.

We now need some kernel interlock that will insist that the rsh program *must* be run as superuser and will cause the connection to fail when a mortal user attempts to program their own version. The TCP/IP implementation on UNIX allows the superuser and no one else to obtain port numbers between zero and 1023. If a remote machine is sent a connection from a port number in that range, then it knows that the superuser is running the correct program at the local end. The situation is now secure and the remote machine can believe what it is told.

However, the use of trusted port numbers was not the total solution. The authentication system recognized that, on the whole, machines operate in groups. When a connection is made over TCP/IP, the server end of the connection can see the IP address of the originator of the message and can translate that IP address into a machine name. This knowledge is used by an access control file called /etc/hosts.equiv. This file contains one machine name per line. When a connection is made to a server, it checks the name of the client machine in the hosts.equiv file. If the name is present, the server trusts the client and believes what it is told about the local and remote user name. The theory here is that the creation of an access control list in /etc/hosts.equiv allows the systems administrator to specify a set of machines that are to be regarded as trustworthy.

One problem with this system on Sun machines is the /etc/hosts.equiv file is maintained by NIS, and the standard system is distributed with the file containing a single "+." This is the magic NIS character that matches any name in the NIS table, so the vanilla system trusts everyone who wishes to connect with rsh. Removing this "+" is the first task when installing a new Sun system on a network.

There are other situations where it seems desirable to permit the user to nominate a remote machine that is permitted to access the local machine as that user. In addition to the /etc/hosts.equiv file, each user can create an access control file in their own home directory: the .rhosts file. Again, this generally contains one machine name per line. When the user sends rsh from a machine that has its name present in the file, then that machine is trusted to send the correct user information. In addition, the user can also supply a user name along with the machine name. This allows the .rhosts file to say: "It's OK to be *me* when using an 'r' command from *this* machine as *this* user."



The .rhosts file needs protection by the file system. For instance, if I can come onto your machine and edit your .rhosts file so that it contains my machine and my user name, then I can retreat back to my machine and use rsh to run commands as you. So the rshd program refuses to use the contents of an .rhosts file unless it's owned by the user who is trying to access it, and its file permissions only permit access by that user. In fact, forgetting to check and set file permissions on the .rhosts file is the largest source of mysterious failures when attempting to use an "r" command.

Incidentally, the root user on any machine is treated somewhat differently by the authentication system. Superuser must permit access to the machine via an .rhosts file on their home directory (conventionally the root of the file system). Any entry in /etc/hosts.equiv does not apply to superuser. This is done because systems may be administered by different people and we are unable to determine access rights from their name. They are all using root as a login name.

Security

What I've described above is the vanilla implementation of the authentication system. If you take a look at the Sun documentation you'll find that many frills have been added over time, for example, the .rhosts file can *deny* access to specific machines.

The fundamental problem is this system relies too much on the security supplied by the UNIX kernel. When PC systems appeared on the local Ethernet, they had no definition of a user, and certainly no superuser. It is possible for a PC system to be programmed to send connections to rshd from a low-numbered port number and lie about who the local user is. The notion of "trusted port numbers" flew out the window very quickly.

Once a UNIX system is compromised, an intruder can easily rush around the local network using .rhosts access to move from machine to machine. On November 2, 1988, .rhosts files were exploited by the Internet Worm, a program whose task was to replicate itself as it moved from machine to machine across the Internet. Its urge for life was somewhat too strident because it overloaded its target machines, making them unuasable. I suppose some good did come from this. The incident did raise the whole problem of security on the Internet, turning the issue into a hot topic.

In general, users are unaware of security when they wish to get a specific job done and will leave unwanted contents in .rhosts files. The basic problem is the .rhosts file puts security control in the hands of the users who are often unaware of the dangers. Of course, every systems administrator knows that their job would be much easier if there were no users.

Finally, the system depends on the integrity of the name service because it's doing a reverse lookup on an IP address to determine the name of a machine. If the name service can be spoofed into thinking that a specific IP address belongs to a different machine, then the system is compromised.

Many system security texts suggest that users are dissuaded from using .rhosts because it's too open to abuse.

The systems administrator has no real control over what systems are entered in a user's `.rhosts` file and, therefore, doesn't know where logins and remote execution requests are coming from. One solution has been to use Kerberos to provide trusted validation of machines at a session level so that the validation only lasts for a small period of time and depends on a login made using a password at some point during the user's session.

The reason alternative solutions have been sought is because it's convenient to use `rsh` and its friends. Security is always a compromise between usability and the need to keep the bad guys out. Firewalls have become a popular way to allow lax security inside a network while providing a secure gateway to the outside world. This is probably not good thinking. Maintaining a good level of security across a site can help if a firewall is breached.

I don't have a firewall. I rely on the security systems on all my machines to prevent unwanted access from the outside world. This works because my site has a small number of users and we are aware of the security aspects of what is done on the site. I also use packet filtering on my router to prevent external sites from connecting to any `rshd` daemon on any machine. Of course, this means that when I am away from home and want to `rlogin` into one of my machines, I cannot and I am forced to use `telnet` and give a password.

One real alternative for remote access over the Internet is `ssh`, this system behaves like the `rlogin` command but uses encryption over a single connection from the client to the server.

Finding Out More

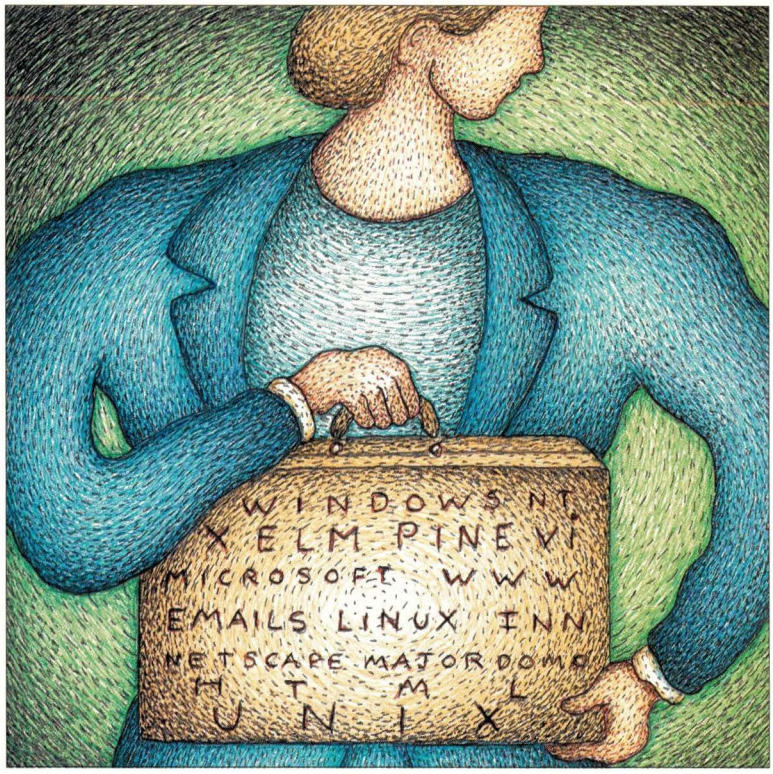
Most of the information in this article can be found in the standard issue manual pages that are supplied with your system. Pages of interest are `rshd` (for a Sun system, it is in Section 1M, and for a vanilla BSD system, it is in Section 8), which describes the authentication protocol in detail; and `rhosts` (Section 4 on a Sun, Section 5 on a BSD system), which contains information on the valid contents of the `/etc/hosts.equiv` and `.rhosts` files.

If you want to find out more about security there are several books on the topic. However, many of them tend to dismiss the "r" commands with a "just say no" statement. One book that does suggest practical help is *UNIX System Security* by David A. Curry (published by Addison-Wesley Publishing Co., 1992, ISBN 0-201-56327-4). This book also has a good section on the Internet Worm. You can find out more about `ssh` from `http://www.ssh.fi/sshprotocols2/index.html/`. ➸

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

Circle No. 15

by S. Lee Henry



DAVE RIDLEY

Hired!

A couple of months ago, I wrote about the painful experience of being fired (see "Fired!," October 1998, Page 36). Since then I've received a pile of encouraging messages, been given a lot of good advice and told tales that made the circumstances of my firing pale in comparison.

A common element of the email I received was the optimism the writers offered me. One writer congratulated me. Another went so far as to say that anyone who hasn't been fired probably isn't trying hard enough or being properly challenged. Some have learned hard lessons from their firings. Some still get chills when they think about it. Almost every message predicted that I'd end up with a better job and admonished me to be as selective and circumspect in my job search as I would be if I were in a secure job that I enjoyed rather than heading for the soup line.

By the time the email started pouring in, I was already enjoying a new job. Still, the messages helped to wrap up an extraordinarily difficult intermission in my career and shored up my attitudes for the long haul (or the next ax). Surprisingly, some of the best advice for getting a new job is also good advice for making the most of the one you're in. I've learned some important strategies for both.

If you take being fired as an opportunity to sift through the variety of positions available, you will probably find that your options include more money, responsibilities more closely aligned with your skills and interests, more trips or trade shows and other options that might be tossed into the deal. If you're a skilled systems administrator or network specialist, you'll likely find many interesting opportunities that will meet your expectations and maybe even raise them.

The Black Day

Being fired is always traumatic. Some of the people who wrote me were fired more than once and told me that one experience doesn't prepare you for the next; each is its own tragedy and requires its own recovery. Several suffered the humiliation of being marched out of their buildings by security guards–not because they had committed a crime against the company, but because it was policy or because those instigating the action wanted to insulate themselves and this expediency seemed to fit the bill.

One writer's black day started when he noticed that his root passwords were not working. Soon after, his pager went off and he was summoned to the director's office, stripped of his gadgets and IDs and escorted out of the building.

Loyalty Schmoyalty

It's hard to resist the temptation to turn your office into a second home and the office crowd into a kind of extended family–at least it is for people like me with a high "affiliation factor." What I do from nine to five (or seven to seven, as the case may be) is a good portion of what I do with my life. It isn't "just work." Still, the relationship between employee and employer is a fragile thing;

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Circle No. 16

you shouldn't take it too seriously or fail to tend to it. For many, as was true in my case, being fired brought a sense of betrayal. I was fired by a friend (at least he was when he hired me). One wonderfully articulate gentleman who wrote to me was fired after 22 years of "busting (his) oevos" for his company. This hit home–my first marriage lasted 22 years. I can't imagine that my divorce and his dismissal didn't have some important things in common. Twenty-two years is, more or less, half my life and is probably half his as well. It's hard to strike the right balance between trust and caution.

Another correspondent was reinstated 45 days after being suspended. It was too late; the damage had already been done. The fragile bond of loyalty had been deeply gouged from the employer's side. He left after a month or so for a new company and a fresh emotional slate. Another man wrote from a company that I used to work for in Virginia. I remembered meeting him there. It shook me up to think of my former employer treating this employee coldly. I felt an unwelcome conclusion nipping at my heels: You can only expect so much from an employment contract. Identify with your profession, not with your employer.

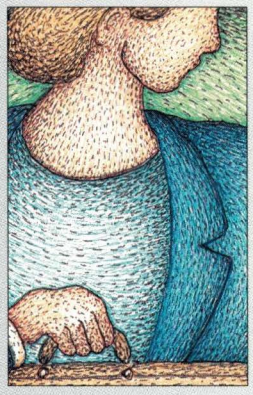
A number of you suggested I consider consulting–good pay, little or no office politics and pick-and-choose jobs. I don't have room in this column to talk about the pros and cons of a consultant's way of life, but it is a solution that keeps a lot of people pretty much in control of their careers and doing interesting work.

One correspondent suggested that we should never stop "looking" for another job. Even if you love your job, you should always be on the lookout for the next. This is a good strategy for two reasons. First, if you are suddenly axed, you will have some carefully considered ideas about where to shop your résumé. Second, looking helps to keep you in a mode of assessing your skills and realistically determining your worth.

The Rules

One of the best pieces of advice I received was to continuously hone my skills. There are certain skills that any serious sysadmin ought to have or should be acquiring whether or not they're required by our current jobs–just as any physician needs to keep up with the newest diagnostic techniques and drugs. Today, any sysadmin who doesn't know Perl and at least one "standard" shell is putting himself at risk. The following is a list of recommendations for you to consider:

1. Avoid nontechnical leadership positions.
2. Maintain the attitude that specialization is not bad but avoid becoming "overly" specialized.
3. Learn anything associated with Internet technologies and services, including, TCP/IP, Usenet news and `sendmail`.
4. Keep your C programming skills sharp.
5. Keep your Perl scripting skills sharp.
6. Keep your scripting–`sed`, `awk`, `csh`, `sh` and regular expressions–skills razor sharp.



I felt an unwelcome conclusion nipping at my heels: You can only expect so much from an employment contract. Identify with your profession, not with your employer.

7. Emphasize open technologies, such as X Window, TCP/IP, SMTP, SNMP, POP, IMAP, elm, tin, pine and so on, especially those with published source code and standards. Any closed technology is apt to be limiting. Don't exclusively learn or overemphasize any of these.
8. Get to know `vi` or `emacs` intimately. Learning `vi` is a good investment because it exists on every UNIX system known to man.
9. Boot up Linux for personal use. Use it, love it or hate it, but keep it up. The experience will sharpen your UNIX skills and running a Linux system in your garage or den will buy you a membership in a very special "serious techie" club.
10. Download and build every piece of public software you

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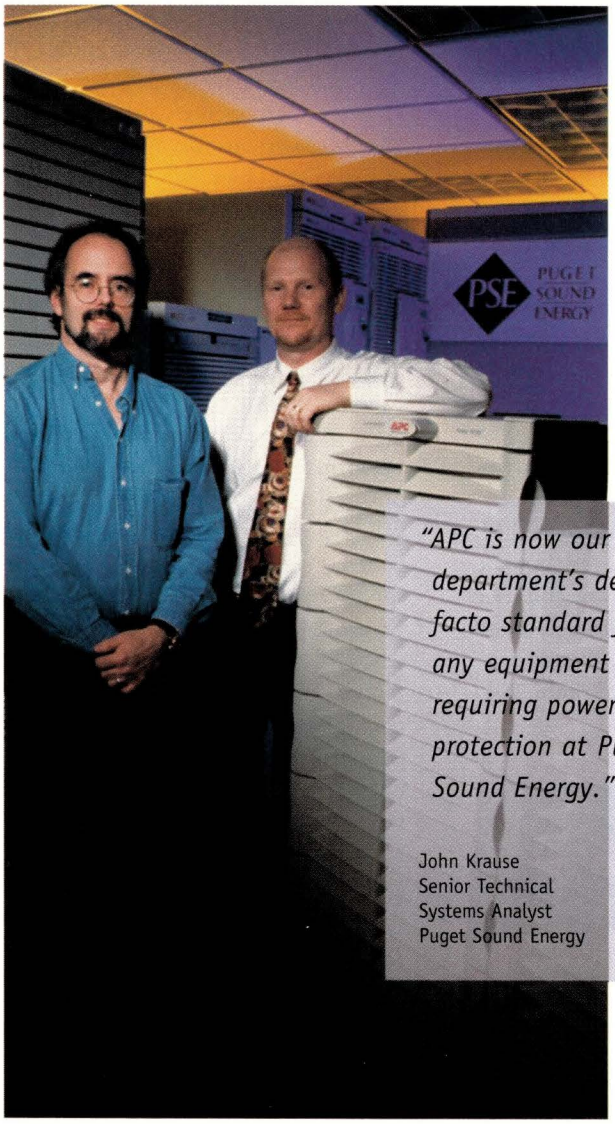

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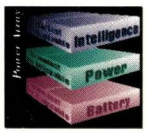

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can get your hands on, for example, GNU, X, elm, pine, tin, mutt, Netscape, Majordomo and INN. Even if you never use any of the tools you build, the experience of understanding, debugging and troubleshooting your software installations will be invaluable.

11. Avoid reliance on GUIs. Use `telnet`, `xterm` and command mode as much as possible. Don't lose touch with the commands you are invoking when you click buttons. Don't avoid window managers–OpenWindows and CDE make it wonderfully easy to do the 12 things at once required of us–just use them wisely.

12. Do not become so loyal to an operating system that you fail to learn some level of competence in others. Even if your workplace supports only one platform, learn as much as you can about other vendors' offerings. Today's networks are increasingly heterogenous. Your next job, or the next challenge in your current position, might require you to work cross-platform.

13. Learn enough Microsoft Corp. software (begrudgingly or not) to be able to work comfortably in a heterogenous network. Know how to set up TCP/IP on Windows systems. Learn Word and Excel. Learn PowerPoint. Work with the Windows NT Registry. Learn 95% of what an MCSE knows without taking the exams. Being able to integrate Microsoft "stuff" in an open environment might one day save your butt.

14. Create your own Web page and do it with `vi`! Don't use a Web editor, code the HTML by hand.

15. Keep up-to-date on hardware. Don't upgrade your PC every day but make sure you know what's hot and what's not. Be as familiar with what constitutes good performance (from a CPU and a throughput standpoint) as you are with your children's bedtimes.

16. Cultivate the ability to RTFM. You don't need to know every innocuous command and protocol. You need to know how to find information and solve problems. Practice, practice, practice your research and problem-solving skills.

Words of Wisdom

I was fired for good reason. I made a bad decision–to work for a company with no customers without personally assessing the company's product or strategy. Though my ex-boss could have paid my salary for decades, my 15 years of experience working with Sun Microsystems Inc. systems was of little use to him. When I started with InCap, there were two employees. When I left, there were none. Those of you who predicted that I'd find a better job were certainly right.

There were so many good pieces of advice in the email I received that I cannot include it all here, but I will offer some of the highlights. The people who wrote me had some wise and very practical advice about how to recover from being fired, looking for work and cultivating your current job. One correspondent, Charles Pervo, suggested that we try to be optimistic and persevere when things seem bad, yet cautious and modest when they seem good. Another person suggested that we make our own employment safety nets–by promoting ourselves within our organizations to remind our bosses and others why they hired us. A third suggested that we carefully question our interviewers during interviews–we don't want just any job, after all. We could end up with stupid bosses who have no idea what we do and what it's worth. We could wind up facing the ax once again. My favorite was this advice from one reader's father who said of being fired: "The best revenge is to live better!"

Decide to make every work experience, good or bad, a lesson learned. Allow every new experience to bring improvements in your skills and your beingness. Taking the job at InCap was a bad decision, but I am now wiser and in a job that I love. I am living better.

S. Lee Henry *lives better on a sailboat with her stephusband and stepdaughter. She works as a Webmaster and systems administrator for Web Publishing Inc. in San Francisco, CA, and spends a lot of time honing her UNIX skills. You can reach her at* `slee@cpg.com`.

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Circle No. 19

by Æleen Frisch

LYNNE CANNOY

User Report: Interix 2.2

This month, I'll be taking a look at Version 2.2 of the Interix software package from Softway Systems Inc. This family of products provides a UNIX-compatible user interface and program development environment under Windows NT 4.0 (Service Pack 3 is required). Previously known as "OpenNT," Interix is available in many configurations, ranging from a simple set of utilities and tools for a single workstation to an unlimited-user server version, which includes full X server support as well as daemons that support incoming `rlogin` and `telnet` sessions. Support for the Motif window manager and OpenGL is available as optional add-ons. Interix runs on both Intel Corp. and Digital Equipment Corp. (DEC) Alpha hardware platforms.

Installing Interix was quick and easy. The product's claims of installing in less than 10 minutes were easily met (it took five and a half minutes to install the Workstation Lite product demo). Interix includes both the Korn shell and the freely-available `tcsh` C shell, including support for user and systemwide initialization files: `.profile`, `.cshrc`, `.login` and `.logout`.

The package includes a full set of user commands and utilities. The first part of Listing 1 shows the output from its `df` command, a common pitfall for Windows NT/UNIX-compatibility services. As the output illustrates, Interix's version of this command is flawless. It intuitively translates native Windows NT information to a UNIX format. I found all of the user utilities included with the product to be excellent implementations.

The second half of Listing 1 indicates some of the mental adjustments that you may need to make if you're used to using regular Windows NT commands. Interix provides case-sensitive file names–a very good feature–but I had to do some fumbling around to figure out the correct capitalization of standard Windows NT system directories. It's also easy to inadvertently mix Windows NT and UNIX commands, which will not work as desired. By default, the Windows NT `path` is not incorporated into the Interix `PATH` environment variable.

Another great feature is the fully functional job control within the supported shells, as illustrated by the following examples:

```
$ twm &
[2] 196614
$ jobs
[2] + Running          twm
[1] - Running          xclock
[3]   Running          xterm
$ kill %1
```

These commands start a window manager, list current background jobs and kill the `xclock` process, respectively.

The most common X client programs are included with Interix. They can be started from a shell window and can be installed in the standard Start menu, provided that an X server is available. Interix includes an X server in some of its product variations. I used

Listing 1

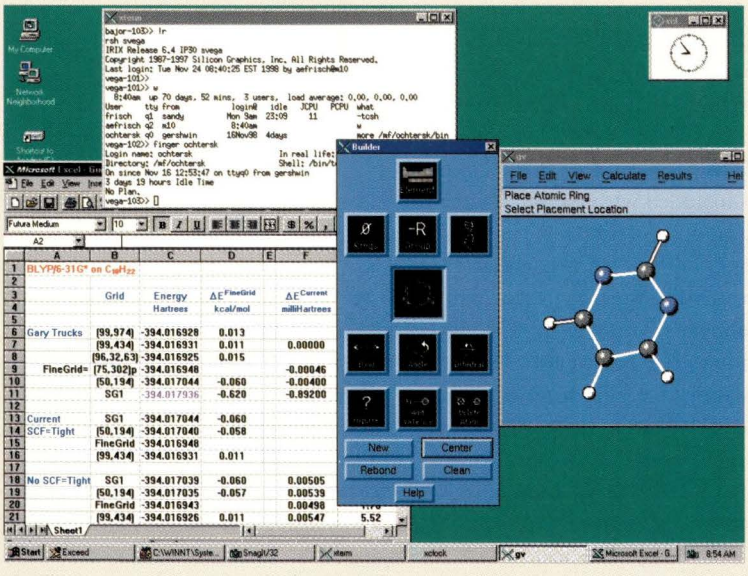
```
$ df -k
Filesystem              1024-blocks      Used Available Capacity Type  Mounted on
//Harddisk0/Partition1       612832    533798     79034     87%   ntfs  //C/
//Harddisk1/Partition1      1397622    210348   1187274     15%   ntfs  //D/
//Harddisk0/Partition3      1374880     42640   1332240      3%   ntfs  //E/
//Harddisk1/Partition2       257008    242837     14171     94%   ntfs  //F/
//Harddisk1/Partition3       449788    328728    121059     73%   ntfs  //G/
//Harddisk0/Partition2       511784    352944    158840     69%   fat   //H/
//Harddisk2/Partition3      1550334    108660   1441674      7%   ntfs  //K/
//demeter/xfer               770880    579520    191360     75%   fat   //X/

$ cd //C/temp
//K/Interix/bin/ksh.exe: cd: //C/temp - No such file or directory
$ cd //C/Temp
//K/Interix/bin/ksh.exe: cd: //C/Temp - No such file or directory
$ cd //C/
$ ls
Acrobat3                MCSESQLI                TEMP
$ cd TEMP
$ dir
//K/Interix/bin/ksh.exe: dir: not found
$ ls
arrow.bmp        junk.junk           uwin_log
```

the Exceed server from Hummingbird Communications Ltd. that came with my demo copy of Interix. This combination worked well. Figure 1 shows my Windows NT desktop while several native and X applications are running. An `xterm` session to a remote UNIX system, `xclock` and a commercial X-based molecular visualization package are all running under X, in addition to the Excel application, which is running natively.

X applications can be run without a window manager (as in Figure 1), in which case they appear in normal NT windows, or you may run any available window manager. Two freely available ones are included with Interix, and a Motif window manager is also available for an additional cost.

Figure 1. Running X Applications under Windows NT



Integration with Native NT Facilities

Interix highlights integration with native Windows NT facilities as one of its strengths. In some respects, the product does merge seamlessly with Windows NT. For example, it uses the standard Windows NT Services facility to run many of its server processes. However, other facilities are entirely stand-alone. The `syslog` facility, for example, is not integrated with the usual Error Log service, and the `cron` facility is entirely separate from the Windows NT Schedule service. In the latter case, however, the separation is undoubtedly due to the fact that the native facility is limited to administrative users while the Interix `cron` service allows any user to schedule jobs, as is the case on UNIX systems (at the cost of one `cron` daemon process per user accessing the facility).

Interix does provide full support for the NTFS file system, including all file attributes and characteristics. However, the interaction between UNIX utilities and the native Windows NT file-level security–access control lists (ACLs)–can produce some strange results. Listing 2 illustrates the effects of the `chmod` command on the UNIX-style file permissions for two sample files, and Figure 2 shows the corresponding ACLs.

The original ACL is shown on the left in Figure 2. It grants Full Control to Administrator (the file's owner) and to the SYSTEM psuedo-

Listing 2

```
$ ls -l uwin_log
-rwx---rwx  1 Administrator  Domain Users  2607 Aug 17 07:33 uwin_log
$ chmod g+rw,o=r uwin_log
$ ls -l uwin_log
-rwxrw-r--  1 Administrator  Domain Users  2607 Aug 17 07:33 uwin_log


$ ls -l arrow.bmp
-rwx---rwx  1 Administrators  Domain Users  1440054 Jan 19  1998 arrow.bmp
$ chmod g-w,o+r arrow.bmp
$ ls -l arrow.bmp
-rwx---rwx  1 Administrators  Domain Users  1440054 Jan 19  1998 arrow.bmp
```

Figure 2. ACLs Modified by the chmod Command

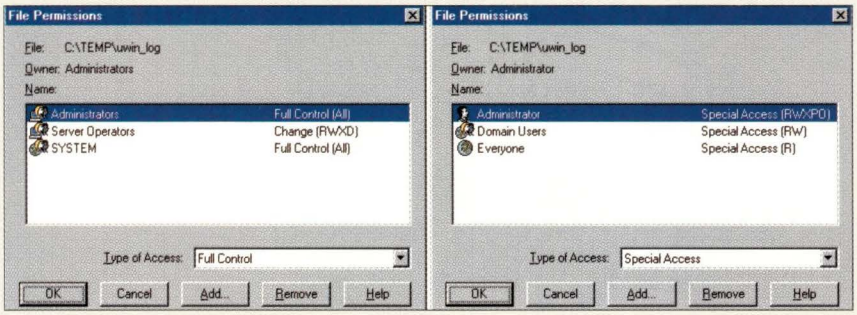
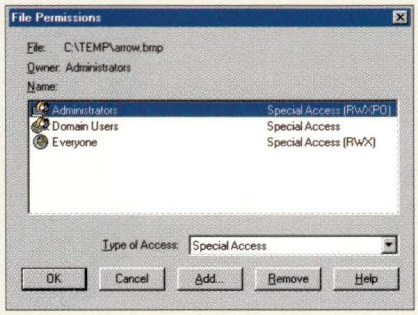


Figure 3. New Modified ACL



ıser, and Change access to the Server Operators group. After he `chmod` command, the UNIX file modes displayed by the `ls -l` command are what is expected, but the contents of the ıew ACL (shown on the right) are somewhat surprising. First, t is limited to three entries–for the file owner (Administrator), group (Domain Users) and other (Everyone) categories–all ıther entries have been removed. Second, the entry for Administrator has been modified so it includes only those Windows NT permissions that have UNIX counterparts, thus, it changes rom Full Control to RWXPO. This behavior is logically consistent and as documented, but it may not in fact be what you vant from an integrated security facility.

The second example in Listing 2 illustrates this more clearly. The initial ACL is the same as the one for the earlier file. On a JNIX system, the `chmod` command is a no-op because it does ıot change the current file modes. However, his command results in the new ACL shown n Figure 3.

Once again, extra entries within the ACL ıave been removed and the entry for Administrator has been modified to include only JNIX-compatible basic permissions. As before, ntries have been created for Domain Users and Everyone. Note that Everyone has the expected ile access, but the entry for Domain Users is mpty. The latter is correct because group permissions are all turned off, but including empty ntries in an ACL is not recommended security ıractice under Windows NT.

The entry-level price is $299 for Interix Workstation Lite and $579 for the full Workstation version (the latter includes an X server). Server versions cost $1,099 for 25 users and $1,999 for unlimited users. Contact Softway Systems for additional pricing information and optional add-on products.

What's in a Name?

I haven't seen any explanation for the name change from OpenNT to Interix (I always rather liked the former). I suppose the name Interix is designed to combine components of "UNIX," "NT" and "integration" into a single, catchy moniker. Interestingly, Interix also rhymes with Linux (as it is generally pronounced), a fact which would be less significant were Softway Systems not currently offering nontrivial financial rewards for the first person who successfully ports several widely used Linux applications to the Windows NT/Interix environment (see `http://www.interix.com/bounty.htm` for details). ⊸

Interix 2.2

Company
Softway Systems Inc.

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185 Berry St., Ste. 5514
San Francisco, CA 94107

Phone
(415) 896-0708

URL
http://www.interix.com

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by John S. Quarterman

JUDE MACEREN

Internet Outages

A couple of months ago (see "Starr Day," November 1998, Page 50), I noted that even the release of Independent Counsel Kenneth Starr's report on President Clinton had little effect on the Internet at large. This conclusion has some readers worried, who wonder, what then, would be sufficient to adversely affect Internet performance? Here are a few examples.

Earthquake

On January 17, 1994, at 4:31 a.m. PST in Northridge, CA, 20 miles northwest of Los Angeles, a magnitude 6.7 earthquake struck. In just 15 seconds, 15 people were killed and more than 9,000 people were injured. This was a major disaster. What effect did it have on the Internet?

The MIDS *Internet Weather Report* (`http://www.mids.org/weather`) was running even back then. (It began collecting data in December 1993.) It ran scans at 2 a.m. and 6 a.m. PST, thus, taking before and after snapshots of the Internet on that day. Shortly thereafter, we published IWR maps of the Internet in Southern California using those two scans (see *Matrix News* 402, February 1994). Here are some of the remarks that were made in the accompanying article:

"Comparing the two series of scans, effects of the earthquake can be seen as far north as Lawrence Livermore Laboratories, northeast of San Francisco (which shows higher latencies immediately after the earthquake), and as far south as San Diego (which shows more traffic several hours later). Ensenada in Baja California, Mexico, disappears just after the quake, but that is probably a coincidence, since the host we are pinging in Ensenada sometimes doesn't respond."

This earthquake caused hundreds of billions of dollars worth of property damage, and it did take the San Fernando Valley area off the Internet for more than one day. This and other affected areas were mostly back online after one day and completely back online after one week. The Internet as a whole was not affected beyond the immediate vicinity. By this I mean that beyond the specific nodes that were inaccessible, there was no overall effect on packet loss or latency among those nodes the IWR was pinging, and the affected nodes were such a small fraction of the total pinglist that there was no significant difference in the latency or packet loss of the Internet.

The main reason even part of the Internet was down is simple: Computers can't run without electricity. The only actual long-term Internet infrastructure damage I was able to discover was that of one router which fell over. All the others were back up once power was restored.

War

Serbia was notably absent from the Internet during the recent war in Bosnia, but popped back up immediately afterwards. Some other ex-Yugoslav states, including Slovenia, which were not directly involved in the war remained on the Internet the entire time.

Politics

Saudi Arabia is still not fully connected to the Internet, preferring instead to run the world's largest intranet, with filtering at the gateways to the rest of the world. However, it has been rumored that this year Saudi Arabia will finally connect with the mainstream World Wide Web. Maybe its citizens are already hearing enough of unwelcome foreign ideas, such as multiparty political systems, via satellite television and the like that the Internet is no longer perceived as much of a threat.

The People's Republic of China tried to keep the Internet out for a long time and now seeks to control it by registering users. Vietnam is pursuing a similar draconian approach to the Internet. Countries that make such choices have little effect on the performance of the Internet as a whole, except in slightly delaying its growth.

Bad Routing Announcements

While I was writing this column, a good example of an interesting performance problem occurred. A certain major Internet service provider (ISP), which we shall call ISP A, announced some routes that it shouldn't have. These routes were technically incorrect. Because ISP A announced these routes to a major clearinghouse for such routes, some other ISPs, in particular, the very large ISP B, believed ISP A. This led to a major outage in ISP B. Observing ISP B with our new *Matrix IQ* product (`http://www.miq.net`), we saw the aggregate packet loss of its routers go through the roof–from just ordinary noise level to 94%. That's so close to 100% that, in effect, ISP B shut down. Not for very long, only for a few hours between 8 a.m. and 1 p.m. PST on Sunday, November 8.

Latency to the few routers of ISP B actually online during that time spiked even more sharply. Measured from one of our beacons, it went from around 60 msec to more than 1,300 msec. This latency spike was brief and occurred at around 11 a.m. PST, but it was very noticeable.

We observed similar packet loss and latency spikes, centering around the same time (11 a.m. PST) and of similar magnitude, from all of our beacons that were observing ISP B. The precise shapes of the latency and loss curves from the various beacons differ but they all show the same general event. These *Matrix IQ* beacons are scattered around the Internet in various ISPs, so there is no question that this was a real event and not an artifact of our monitors.

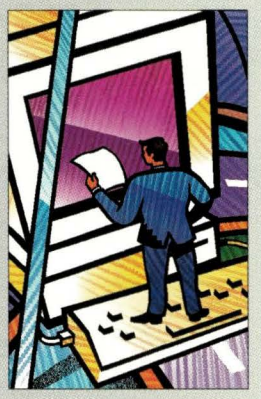
This routing confusion was a problem that was seen in the performance of the Internet as a whole. We even detected it on our larger ping lists of the Internet. There was little effect on latency in those data, but there is a marked spike in packet loss exactly at the time of the routing event. "Marked" as in about four times as high as the lowest normal packet loss that would be expected for a normal Sunday afternoon, and more than double that of a busy weekday afternoon.

So we have finally found *something* that affects the Internet as a whole! But how many of you, dear readers, noticed it? Probably not many. It occurred on a Sunday afternoon and was fixed within a few hours.

Nonevents

Back in 1996, Bob Metcalfe predicted that the Summer Olympics in Atlanta and Election Day in the United States would be the last straw for the Internet. Neither event had much effect on the Internet as a whole. Last year, the Starr report and Senator John Glenn's return to space aboard the space shuttle were thought by some to be big enough events to adversely affect the performance of the Internet. Neither did.

The release of the Starr report slowed down those Web servers most closely associated with the initial distribution of the report, but not much else (see `http://www.mids.org/press/starr.html`). The space shuttle mission slowed down some NASA Web servers, in particular, the one providing details about the mission itself, but didn't cause noticeable packet loss on that same server (see `http://www.mids.org/press/glenn`). That event had no discernible effect on the Internet as a whole.



The Starr report and Senator John Glenn's return to space aboard the space shuttle were thought by some to be big enough events to adversely affect the performance of the Internet. Neither did.

I noticed last autumn no one bothered to predict that Election Day in the United States on November 3 would cause any difficulties for the Internet, and, in fact, it didn't; not a blip.

Conclusion

Compared to an earthquake, a war, or especially compared to misconfigurations in the Internet infrastructure itself, the Starr report and other general news events were, at most, minor blips. To date, even real-world disturbances such as earthquakes have had only minor effects on the Internet. The only kind of disturbance that is really disturbing the Internet is misconfiguration among major ISPs, and even this type of disturbance has been rapidly fixed. ➸

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 coauthored 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.*

Work

by Jeffreys Copeland and Haemer

PAUL STODDARD

Reader, Part 2

Last month, we began building a reader for text files in C++. Our intention this month is to provide software that will allow you to metaphorically make annotations, mark pages you wish to double-check or bookmark where you stop reading.

As we've occasionally done in the past, this column is written using the CWEB literate programming tool, which melds program documentation and code into the same file for printing. You can pick up further information on CWEB from our Web page.

The module we'll be building this time needs some overall structure.

```
<header files>
<bookmark class definition>
<prototypes>
<global data>
<auxilary routines>;
```

We're also going to need some header files. Many of the header files will be familiar because they were used in last month's column.

```
<header files>=
#define _ALL_SOURCE
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#ifdef __MSDOS__
#include <io.h>
#include <dos.h>
#define strcasecmp stricmp
#else
#include <unistd.h>
#include <strings.h>
#endif
#include <sys/stat.h>
```

Last time, we built the source code and methods for the `Bookmark` class, which stores the location where we stopped reading our list of files. So let's backtrack a little and include the header with our class prototypes.

The class internals are simple at the top level:

```
<bookmark class definition>=
class Bookmark {
public:
<bookmark interfaces>
private:
<bookmark data>
};
```

For the data, we need to include the following. (If we had structured our classes differently, we might have included a *FileList* class containing only the list of files, and a *BookMark* class containing a single bookmark. We could then instantiate a "BookMark" for the main bookmark and one for each supplementary bookmark we used. Instead, we've decided to include all the data in a single class.)

```
<bookmark data>=
int file_count;
        // how many files
```

```
char **file_names;
       // the actual file names
ssize_t file_which, file_where;
       // main bookmark
  // next some constants
enum { BOOKMARKS=26 }; // the array sizing
enum { EMPTY_BM=-1L }; // empty bookmark defn
  // supplementary bookmarks
ssize_t bm_which[BOOKMARKS];
ssize_t bm_where[BOOKMARKS];
```

Let's add the prototypes for all our interfaces to the class definition:

```
<bookmark interfaces>=
Bookmark(FILE *fp);
Bookmark();
~Bookmark();
void Add_File(char *name);
int Find_File(char *name);
void Write(char *name);
bool Query(char c,
       ssize_t &which, ssize_t &where);
bool Set(char c, ssize_t which, ssize_t where);
void Set_main(ssize_t which, ssize_t where);
bool Set_main(char c);
```

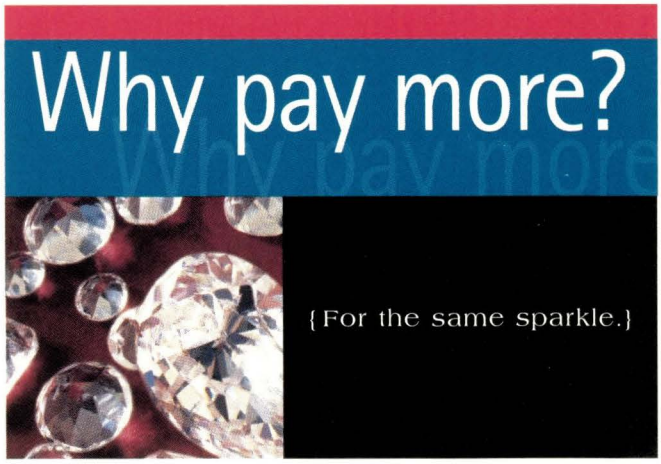
In addition, we'll add some inline routines to return data from inside the class:

```
<bookmark interfaces>=
char *
Current_File()
{ return file_names[file_which]; }

ssize_t
Current_FileNr()
{ return file_which; }

ssize_t
Current_Line()
{ return file_where; }

int
File_Count()
{ return file_count; }
```

And we need a handful of interfaces to modify data inside the class. (Exercise for the reader: Can you implement these as C++ overloaded operators?)

```
<bookmark interfaces>=
void
```

Circle No. 21



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Circle No. 20

```
Prev_File()
{
  if( file_which > 0 )  --file_which;
  file_where = 0L;
}

void
Next_File()
{
  if( ++file_which > file_count )
      --file_which;
  file_where = 0L;
}

bool
No_More_Files()
{
  return( file_which == file_count );
}
```

We need to define a global variable to tell us if we're reading a `ZIP` archive; for convenience, we'll simply save the file name of the archive if we are. (We define a macro to make testing easier.) Also, if we're reading a `ZIP`, we unfurl the current file into the current directory. This means we need to access `basename(file)` if it's a `ZIP` we're reading, otherwise `file`. We define a macro to test this for us:

```
<header files>=
#define we_are_zip ((zip_name != NULL))
#define locate(x) (we_are_zip? basename(x) : x)
```

Also, the Boolean type isn't necessarily part of the language–it has been in and out of the C++ specification so many times no one's quite sure–so we do some defensive programming:

```
<header files>=
#ifndef bool
#define bool short
#define false 0
#define true 1
#endif
```

We've discovered that in older versions of certain DOS compilers, some useful constants may be missing:

```
<header files>=
#ifdef __MSDOS__
# ifndef FILENAME_MAX
#  define FILENAME_MAX BUFSIZ
# endif
# ifndef R_OK
#  define R_OK 04
#  define W_OK 02
# endif
#endif
```

Similarly, we're going to need a file in which to save our list of files and bookmarks. We'll define its name and the name of the printed clippings file now and save ourselves some grief later. We'll also define a single string containing both names. This will save us some effort in function calls later on, as we shall see:

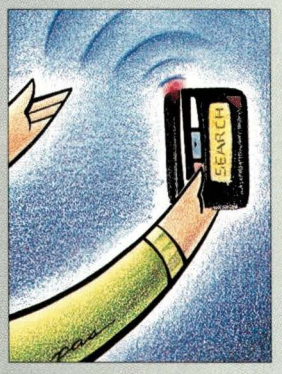
```
<header files>=
#define INDEX "___ndx__"
#define PRINT "___prt"
#define INDEX_PRINT "___ndx__ ___prt"
```

Also, we need to define global instances of the `Bookmark` class and `zip_name`:

```
<global data>=
class Bookmark;
extern char *zip_name;
extern Bookmark *marks;
```

Calling the Pager

Now is as good a time as any to remind you that we're going to adopt a modified version of `less` for the pager, which we'll call `lessrdr`. We'll use it through a local routine called `page()`. Wrapping an interface routine like `page()` around the pager provides us with a little insulation, making it easier to insert a different paging program later.



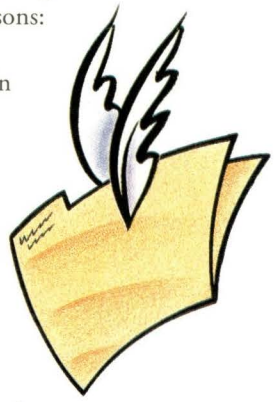
Wrapping an interface routine like page() around the pager provides us with a little insulation, making it easier to insert a different paging program later.

Notice that despite all the setup we did in the class definition for supplementary bookmarks, we'll ignore them here because we don't have room in this column to cover them. So supplementary bookmarks are this month's main exercise for the reader. (Never fear. We'll supply our solution to the exercise in the form of a `CWEB` change file and some more modifications to `less` on our Web page.)

What do we need in our `page()` routine, and how do we need to modify `less` for what we're trying to achieve? We do know that in addition to the normal complement of functions a program like `less` provides, our pager will need some extras

to deal with bookmarks. We could handle the bookmarks entirely in `page()`, but that would require calling directly into our C++ methods and require the pager to have more knowledge about the mechanics of bookmarks than we really want. Instead, we'll provide callback routines to service the reader's bookmark requests. (This will also provide further insulation of the pager from the reader body.)

Let's begin by assuming that we'll call `page()` with a file name and the normal complement of flags to `less`, such as a begin line. The user will proceed to look at this file, moving forward and back, interacting only with the code in the pager until he needs interaction with the calling routines for one of the following reasons:



- He wants to quit the program, saving the current location in the main bookmark.
- He wants to quit the program, but wants to abandon all the new bookmarks he set and does not want to set the main bookmark.
- He finishes the file and wants to move on to the next.
- He wants to return to the previous file.
- He sets a supplementary bookmark (which is part of the exercise for the reader).
- He wants to return to a previously saved bookmark (which is also part of the exercise for the reader).

We'll address each of these scenarios in the following sections.

We could define a `struct` for transmitting the file/line pair, but it will be easier to pass them around by reference. Notice, however, that the pager is going to be sent a file name and line number and return a line number; the pager won't change files without interaction from the main program. Generally, the main program will keep its notion of the main bookmark in the local instantiation of `Bookmark` as `file_which` and `file_where`, modifying it when we interact with the pager. In other words, when we're in the pager, the main program's idea of bookmarks will be wrong and we'll synchronize them when we return to the main program.

Overall, the situation is as follows:

```
<process the files>=
int x;
do {
    <special handling before ZIP text>
    <ensure that we have the file>
    <display current file returning retval>
    <special handling after ZIP text>
    x = retval & ~BOOKMARK_MASK;
    switch( x ) {
    case RDR_NEXT:  marks->Next_File();  break;
    case RDR_PREV:  marks->Prev_File();  break;
    case RDR_QUIT:  break;
    case RDR_EXIT:  break;
    default:    fatal("odd return from pager");
                break;
    }
} while(  (x != RDR_QUIT)  &&
   (x != RDR_EXIT)  &&
   !marks->No_More_Files() );
```

In last month's column, we handwaved over the above code with a single call, to wit:

```
void
process_the_files( void )
{
    <process the files>;
}
```

We also need a routine for the pager interface to tell the main program where we left off:

```
<auxilary routines>=
void
SetMainBookmark(int loc)
{
    ssize_t xx = loc;
    marks->Set_main(marks->Current_FileNr(),xx);
}
```

Now, we'll define the interface between the main program and the pager:

```
<header files>=
static char *hdrid = "$Id: rdrr.h,v 1.2 1998/11/03 \
17:08:33 jeff Exp $";
#define RDR_NEXT (0x100)
#define RDR_PREV (0x200)
#define RDR_QUIT (0x400)
#define RDR_EXIT (0x800)
#define BOOKMARK_MASK (0xFF)
#define COOKIE  "__cookie"
#define PRT   "___prt"
```

A quick and easy thing to deal with next is the special handling for `ZIP`s. We need to extract the file from the `ZIP` before reading:

```
<special handling before ZIP text>=
if( we_are_zip )
  <unzip the named file>
```

We also need to delete the file if we extracted it from a `ZIP`, lest the directory get cluttered and confused–after all, we purposely stored our reading material in a `ZIP` archive in part to help with clutter.

```
<special handling after ZIP text>=
```

```
if( we_are_zip )
  unlink(basename(marks->Current_File()));
```

For insurance, we convince ourselves that we actually have the file before we call the pager-interface routine.

```
<ensure that we have the file>=
if( access(locate(marks->Current_File()),
      R_OK) != 0 )
{
    warning("file %s in index, not on disk\n",
        marks->Current_File());
    marks->Next_File();
    continue;
}
```

Displaying the current file involves preparing a calling sequence for the pager-interface routine, `page()`. We'll assemble the `argv[]` vector that we'll pass to `page()`, which in turn will execute `lessrdr`, our modified version of `less`. (For more on the flags we're passing to `lessrdr`, see the man page for `less`.)

```
<display current file returning retval>=
#define SMALLBUF 256
int pargc;
char *pargv[30];
int retval;
char b1[SMALLBUF];
char b2[SMALLBUF];
char b3[SMALLBUF];
struct stat sb;

pargc = 0;
pargv[pargc++] = "lessrdr";
pargv[pargc++] = "-q";  // operate quietly
pargv[pargc++] = "-r";  // leave ctrl chars
pargv[pargc++] = "-e";  // quit on 2nd EOF
pargv[pargc++] = "-i";  // ignore case in search
sprintf(b1,
    "-P[%%f, %ld of %d] ?e(end):%%p\\%%. ",
    marks->Current_FileNr()+1,
    marks->File_Count() );
pargv[pargc++] = b1;
//  add the flag to get us to the right line
if( marks->Current_Line() > 1 )
{
    sprintf(b2,"+%ld", marks->Current_Line());
    pargv[pargc++] = b2;
}
//  add a flag to buffer the whole file
//     in memory, if we can
if( stat(locate(marks->Current_File()),
        &sb) == 0 )
{
    sprintf(b3, "-b%d",
        (sb.st_size + 1023) / 1024);
    pargv[pargc++] = b3;
}
pargv[pargc++] =
    locate(marks->Current_File());
retval = page(pargc, pargv);
```

The Pager Interface

We begin simply enough with a prototype for the routine we called above:

```
<prototypes>=
int page(int ac, char *av[]);
```

The pager interface must do a bunch of things with the arguments we assembled above. To wrap it up into code,

```
int
page(int pargc, char *pargv[])
{
    int len = 0, i;
    <find length of arguments>
    <assemble the command>
    <do it!>
    <read back the results>
    <store and return results>
}
```

We need to count the length of the arguments so we know how much space to allocate for the command line. We should also leave some space for possible quote marks. (We'll concede that this may be a little anal retentive of us. We could probably have just allocated a fixed, large buffer.)

```
<find length of arguments>=
for( i = 0;  i < pargc;  i++ )
{
    len += strlen(pargv[i]) + 3;
}
```

Our next step is to assemble the command into a single string:

```
<assemble the command>=
char *cmd = (char *) malloc(len+1);
strcpy( cmd, pargv[0] );
for( i = 1;  i < pargc;  i++ )
{
    strcat( cmd, " " );
    if( strchr(pargv[i],' ') != NULL )
        strcat(cmd, "\"");
    strcat( cmd, pargv[i] );
    if( strchr(pargv[i],' ') != NULL )
        strcat(cmd, "\"");
}
```

The process of invoking `lessrdr` should be pretty obvious. But we also remember to free the command buffer, lest we cause a memory leak.

```
do it!>=
system(cmd);
free(cmd);
```

When we return, we need to read back the cookie that the external reader left us; we can delete it when we're done.

```
read back the results>=
FILE *fp;
int retval, location;
fp = fopen(COOKIE,"r");
if( fp == NULL )
    fatal( "can't open cookie file!" );
fscanf(fp, "%d %d", &retval, &location);
fclose(fp);
unlink(COOKIE);
```

Those results need to be stored as a bookmark using the callback routine we developed earlier:

```
store and return results>=
if( retval == RDR_QUIT )
    SetMainBookmark(location);
return(retval);
```

When we're done and fall out of the big `do` loop above, either by finishing the last file or quitting, we need to wrap things up. We do this by writing the index file and saving it, if we're reading a `ZIP`. However, we don't write the index at all if we want to abandon all changes.

```
process the files>=
if( x != RDR_EXIT )  marks->Write(INDEX);
if( we_are_zip )
    <zip the index and print files>
```

Service Routines

We need to spend a few sections talking about service routines. We'll begin with the service routines to extract and return files to `ZIP` archives. We'll start by writing the routine to provide us, one at a time, with the list of files in a `ZIP` archive:

```
auxilary routines>=
char *
next_file_from_listing( void )

    static FILE *fp = NULL;
    static char *listname;
    static char *buf;
    char *s;
    if( fp == NULL ) {
#ifdef DEBUG
        warning( "generating listing file\n", NULL );
#endif
        <generate the listing file>
    }
    if( fgets(buf,BUFSIZ,fp) == NULL ) {
        <clean up the listing file>
#ifdef DEBUG
        warning("next_file...() -> NULL\n",
             NULL );
#endif
        return NULL;
    }
    if( (s=strchr(buf,'\r')) != NULL )  *s = 0;
    if( (s=strchr(buf,'\n')) != NULL )  *s = 0;
    if( (s=strrchr(buf,' ')) != NULL )
        s++;
    else
        s = buf;
    <special handling if s points at caret>
#ifdef DEBUG
    warning( "next_file...() -> %s\n", s);
#endif
    return s;
}
```

We need to fill in the blanks from the last routine. First, let's generate the listing file and open it. At the same time, we'll set up the transient storage.

```
<generate the listing file>=
listname = (char *) malloc(FILENAME_MAX);
buf = (char *) malloc(BUFSIZ);
<pick a zip listing file name>
<zip listing>
if( (fp=fopen(listname,"r")) == NULL )
  fatal("can't open list file just built");
```

Next, we need to clean up after ourselves. To indicate that we don't have an active listing file, we set `FILE *` to `NULL`:

```
<clean up the listing file>=
fclose(fp);
unlink(listname);
free(listname);
free(buf);
fp = NULL;
```

The name of the file for the `ZIP` listing depends on a number of factors. In particular, if we're on a DOS system and we are getting the archive off a floppy, we want to put the listing file on the `C:` drive so as to not take up space on the floppy. (Exercise for the reader: What should this code do on DOS if you're operating out of RAMDISK?)

```
<pick a zip listing file name>=
#define LISTFILE "@@@"
if( zip_on_floppy() ) {
    strcpy(listname, "C:");
    strcat(listname,LISTFILE);
} else
    strcpy(listname,LISTFILE);
```

We need to deal with the situation on UNIX where the file name in the listing is preceded by a caret to indicate "case folding," that is, in a `ZIP` archive created on DOS. We don't need to fold this into an `#ifdef` because the caret is an illegal file name character in both DOS and UNIX.

```
<special handling if s points at caret>=
if( *s == '^' )  s++;
```

Errors need their own routines, as follows:

```
<auxilary routines>=
void fatal( char *msg )
{
    fflush(stdout);
    fprintf(stderr, "%s\n", msg );
    fflush(stderr);
    exit( 1 );
}

void warning( char *msg, char *s )
{
    fflush(stdout);
    fprintf(stderr, msg, s );
    fflush(stderr);
}
```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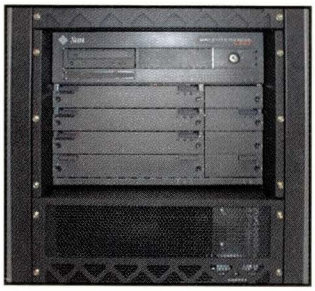

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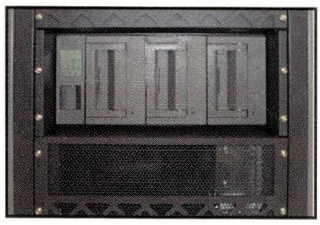

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We've also got a bunch of holdovers for handling ZIP files. We'll handle them below, but first we need a service routine to deal with them. The pksystem() service routine should handle the placement of the working file so we don't overrun the floppy, but it doesn't.

(Exercise for the reader: Fix the pksystem() routine so that it can handle the possibility that we are reading off a floppy disk.)

```
<auxilary routines>=
void
pksystem( char *cmd, char *flag,
        char *flag2, char *file )
{
    char buf[BUFSIZ];
    sprintf(buf,"%s %s %s %s %s%s", cmd,
        "-q",
        flag, zip_name, flag2, file );
#ifdef DEBUG
    printf( "%s\n", buf );  sleep(1);
#endif
    system( buf );
}
```

We also need to define the ZIP utilities:

```
<header files>=
#define ZIP  "zip"
#define UNZIP "unzip"
```

In a couple of quick passes, we'll deal with calling that service routine. Some explanation is in order: When unzipping, we use the -o flag to force the overwriting of existing files (we want to look at the file in the archive, not an old local copy), and the -j flag to ignore the directory names on extract (we want to extract the name locally, and not leave directories as debris when we're done).

Similarly, for zipping the index and clipping files back into the archive, we use the -o flag to set the archive date to the latest member (this keeps our archive dated identically with the index file, that is, with our last read) and the -m flag, which moves the file back into the archive, removing it as debris from the local playing field. For the listing, the qq appendage lists only the file lines, without headers and trailers. The one-liner for the ZIP file listing is

```
<zip listing>=
pksystem(UNZIP,"-lqq",">",listname);
```

The code for extracting the index and print files is

```
<zip the index and print files>=
pksystem(ZIP,"-o -m","",INDEX_PRINT);
```

The code statment to extract a file is

```
<unzip the named file>=
pksystem(UNZIP,"-o -j","",
    marks->Current_File());
```

And here's one last utility routine, which we defined last month:

```
<auxilary routines>=
void
unzip_index_print( void )
{ pksystem(UNZIP,"-o","",INDEX_PRINT); }
```

We need the routine to tell us if our ZIP is a floppy for occasions like the floppy overrun test we didn't add to the pksystem() routine above. (Exercise for the reader: We never assume that we're reading from a floppy, but what's the correct strategy for figuring out if we are? Remember that our current disk on DOS might be A:.)

```
<auxilary routines>=
bool
zip_on_floppy(void)
{
    return false;
}
```

We need an interface like the familiar shell basename function:

```
<auxilary routines>=
char *
basename( char *path )
{
    char *s;
    s = strrchr(path,'/');
    if( s == NULL )  return path;
    return ++s;
}
```

We also need prototypes for all these routines:

```
<prototypes>=
void fatal( char *msg );
void warning( char *msg, char *s );
bool zip_on_floppy(void);
void pksystem( char *cmd, char *flags,
        char *flag2, char *file );
char *basename(char *path);
```

Finishing Up

We're almost out of space, but we've left some information out. For example, you now have the wrapper code for the pager, but not the pager itself. The pager code is just a modified version of less, and the context differences are provided on our

Web page. But, more important, now that you have code to read text, where can you find some text? As we pointed out last time, we wrote this originally to allow us to read back issues of RISKS digests, which can be found at `ftp://ftp.sri.com:/risks`, but there are other sources of text:

- Biblomania, The Network Library, `http://www.bibliomania.com`
- U.S. Congressional Web site, which contains the text of bills introduced, `http://thomas.loc.gov`
- Open Book Initiative, `ftp://ftp.std.com/obi`
- Project Gutenberg, `http://www.gutenberg.net`

Furthermore, there is a whole list of improvements that can be made to our code. You may have noted some of them in the margins already. Perhaps you, Gentle Reader, will add one of the features below we haven't had time to build. If you do, let us know, and we'll add it to the code on our Web site.

- We'll repeat the one we've already mentioned: build the code to implement supplementary bookmarks.
- The Project Gutenberg version of *Alice's Adventures in Wonderland* is accompanied by GIF images of John Tenniel's illustrations for the original printed version. How would you display some text followed by a drawing, or even display them simultaneously?
- Can the formatting be improved from flat text? Can the open source version of a Web browser be used as the pager? How would you do the conversion from flat text input files to HTML on the fly?
- Can you think of a portable way to hide the index file on both DOS and UNIX? On DOS, a file is hidden by setting an attribute flag; on UNIX, it's hidden by beginning its name with a dot. We're not sure it's legal to have a DOS file with an empty name and just an extension.
- We haven't been very consistent in our strategy for loading text into RAMDISK on DOS. What improvements could be made?
- Can we implement an interactive index? In this mode, we would display the list of files in our current index and click on the one we want. This would allow us to skip from chapter to chapter in a book, or go backwards and forwards to chase references in RISKS.
- We need a command-line flag to print the version number.
- There are some flags in `ZIP` mode we haven't used but we might have. We used the `-o` flag so the archive retains the date of the latest file, but we could also have used the `-k` flag for Info-ZIP on UNIX to maintain compatibility with `PKZIP` files on DOS.
- When we print output into the clipping file, we should head each page with the file and line number.
- The wrapper program is fairly simple in concept. Could it be rewritten as a Perl script?
- As currently constituted, we need to keep the list of bookmarks in our head. Can you figure out a way to display and annotate them?
- Sequentially running this program in a single directory will overwrite an existing index file. Can you fix that?

As we mentioned in our November column, "A Short History of Reading," Page 58, commercial products are now available to handle the function of this code in stand-alone boxes. The most recent mentions of these products we've seen were in two wire-service stories in the *Rocky Mountain News*. In the first article (reprinted from *The Wall Street Journal*), NuvoMedia Inc. (`http://www.nuvomedia.com`), which offers the Rocket eBook, announced distribution agreements with publishers and says it expects to sell books electronically for $18 to $25. This price is close to the cost of a hardcover book, but the printing and distribution costs are essentially nil. It suggests that their marketing folks have come up with an absurd pricing model, or that the publishers–two of which are already investors in NuvoMedia–are insisting on more than 100% royalties on content. Part of the appeal of this technology is that the publishing cost is lowered; not pricing the content to reflect that difference will kill the idea.

In the other article, from Scripps Howard News Service (`http://www.shns.com`), both Martin Eberhard of NuvoMedia and Tom Pomeroy of SoftBook Press (`http://www.softbook.com`), maker of the SoftBook System, acknowledged that they are aiming their products at people who need a lot of data to be portable. Eberhard is quoted as saying, "This is designed for...the person who reads and travels a lot." We already carry a lot of hardware when we travel. Our normal mode of operation is to clear an airport with more weight in our briefcase than in our suitcase. Just thinking about adding an extra two pounds for the specialized hardware makes our shoulders hurt.

We want to issue a challenge to both companies: Because your profits are going to come from the content you're providing, why not provide reader software for your content to run on laptops? Most of those folks who read and travel a lot are already lugging around much more computing power than they need to run your applications. The real barriers to bringing your software to a general-purpose computer are security of the content and communications, but those problems are already solved with specialized hardware. If it's helpful, you can begin your laptop work with the software we provide here; we'll offer very nice royalty rates.

That's it from the Rocky Mountains for the beginning of 1999. Happy New Year and, until next time, happy trails. ⊸

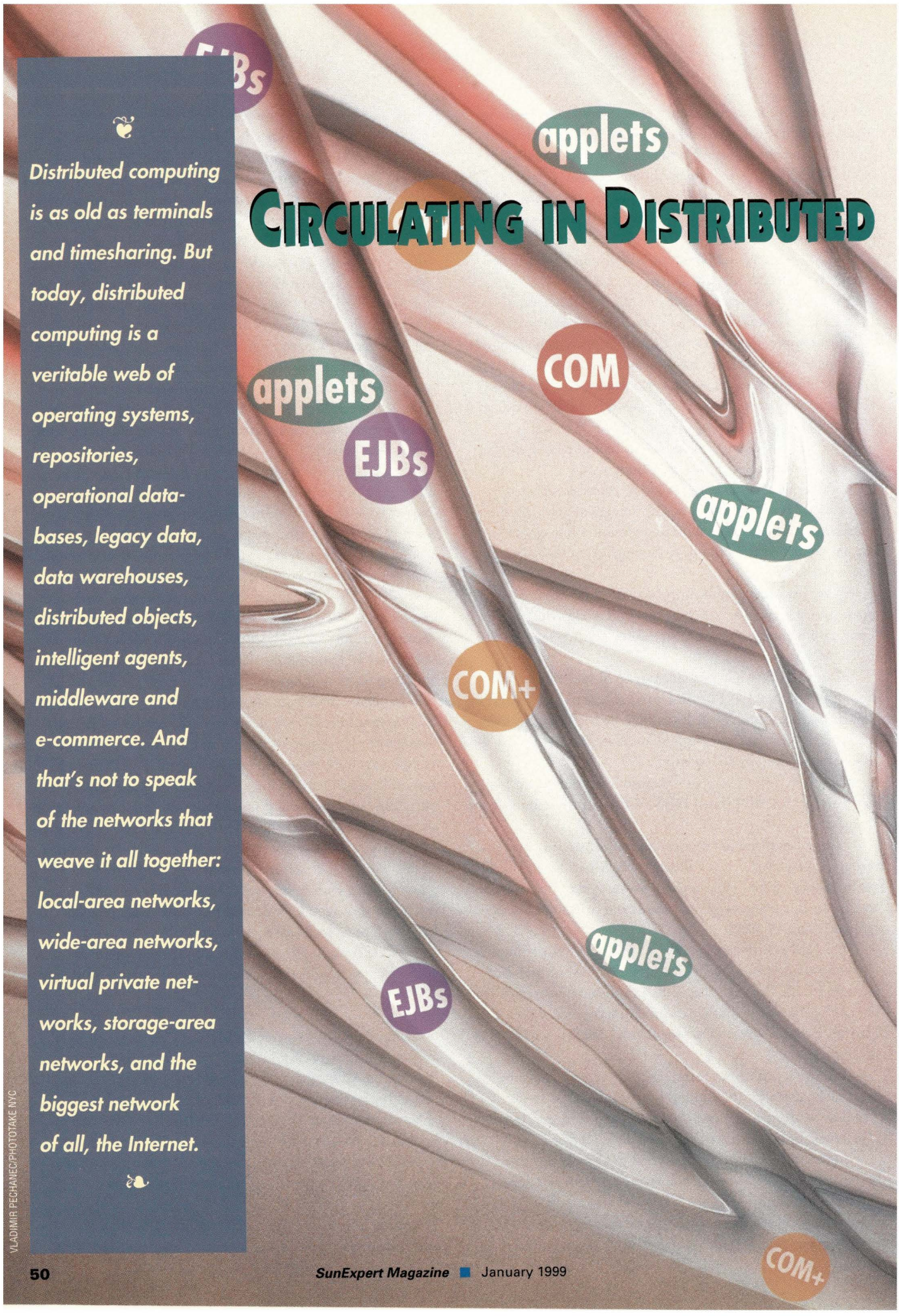
Jeffrey Copeland *(`copeland@alumni.caltech.edu`) lives in Boulder, CO, and works at Softway Systems Inc. on UNIX internationalization. He spends his spare time rearing children, raising cats and being a thorn in the side of his local school board.*

Jeffrey S. Haemer *(`jsh@usenix.org`) works at QMS Inc. in Boulder, CO, building laser printer firmware. Before he worked for QMS, he operated his own consulting firm, and did a lot of other things, like everyone else in the software industry.*

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

Circulating in Distributed

Distributed computing is as old as terminals and timesharing. But today, distributed computing is a veritable web of operating systems, repositories, operational databases, legacy data, data warehouses, distributed objects, intelligent agents, middleware and e-commerce. And that's not to speak of the networks that weave it all together: local-area networks, wide-area networks, virtual private networks, storage-area networks, and the biggest network of all, the Internet.



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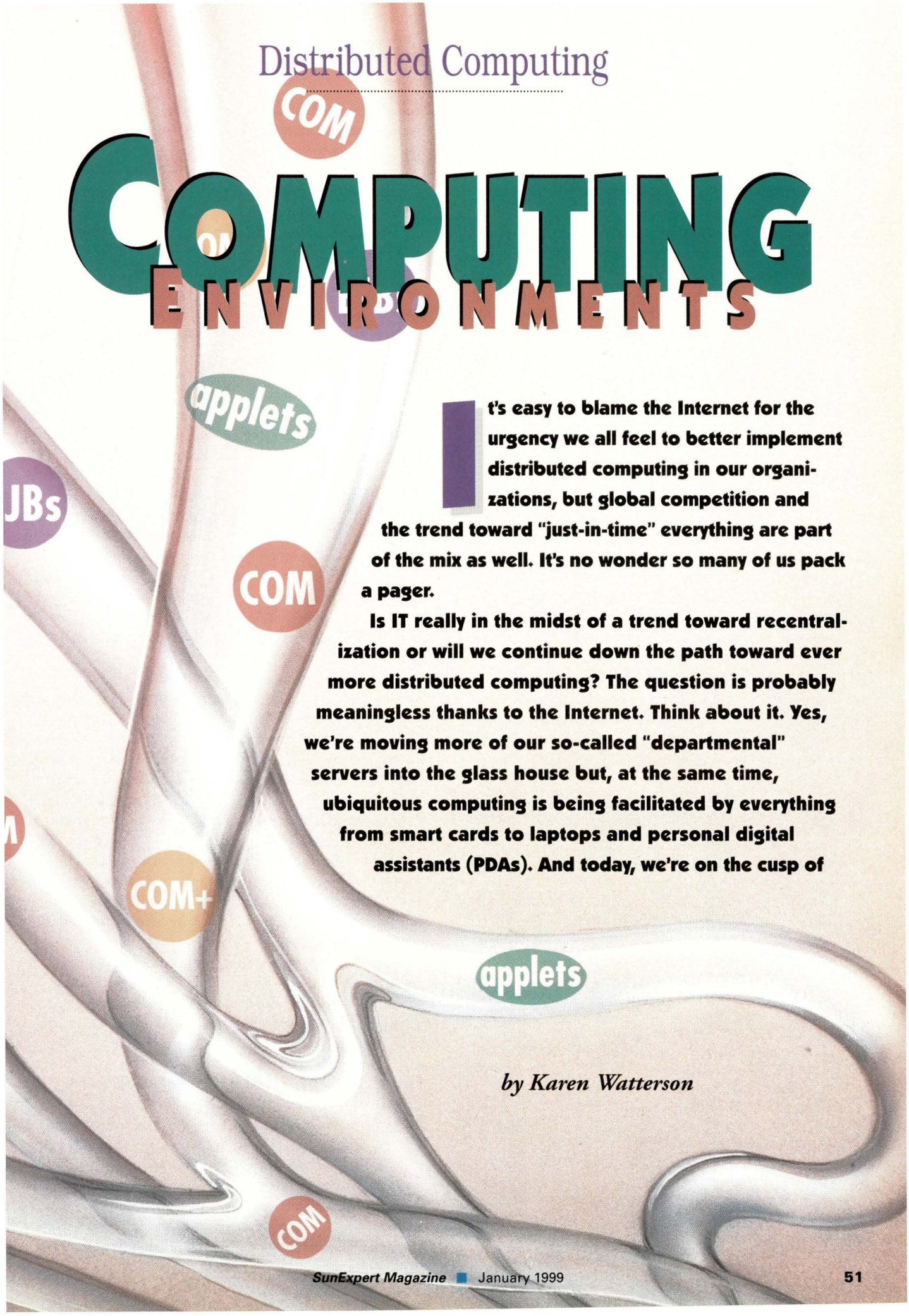

It's easy to blame the Internet for the urgency we all feel to better implement distributed computing in our organizations, but global competition and the trend toward "just-in-time" everything are part of the mix as well. It's no wonder so many of us pack a pager.

Is IT really in the midst of a trend toward recentralization or will we continue down the path toward ever more distributed computing? The question is probably meaningless thanks to the Internet. Think about it. Yes, we're moving more of our so-called "departmental" servers into the glass house but, at the same time, ubiquitous computing is being facilitated by everything from smart cards to laptops and personal digital assistants (PDAs). And today, we're on the cusp of

by Karen Watterson

what promises to be a major new trend: rental applications, sometimes called software outsourcing, and other new forms of Internet-enabled services.

Oracle Corp. Chief Executive Officer Larry Ellison has been one of the most vocal proponents for what is being called Oracle Business OnLine. But whether you call it application hosting, outsourcing or online services, it's a trend that is bound to make good business sense for many organizations.

Some organizations like Oracle and Microsoft Corp. will be offering new online services. (Steve Ballmer, Microsoft Chief Executive Officer, said in the December 1998 issue of *Red Herring Magazine*, the company "will offer [through its portal] a number of services that really build on what people do with their PC–whether that's filing services, calendaring services or backup services." See `http://www.redherring.com`.) Others, including the traditional systems integrators and Big Five firms (Arthur Andersen, Ernst and Young LLP, PricewaterhouseCoopers, Deloitte Touche Tomhatsu and KPMG International), expect to see an increasing percentage of their revenue derive from application outsourcing. Smaller "body shop" integrators will undoubtedly offer less expensive outsourcing services that are based on a set of standard templates or best practices and will require firms to change their own business practices to conform to the outsourcer's model. Niche players will provide everything from vertical expertise to forums for virtual collaboration.

How Many Distributed Applications?

According to Meta Group Inc., a research firm based in Stamford, CT, the typical Global 2000 corporation has more than 49 enterprise applications and spends 25% to 33% of its IT budget on application interoperability solutions. That represents a big pile of money (see "By the Numbers"). It's no wonder vendors and systems integrators are coming up with new strategies to win their share.

By the Numbers

- International Data Corp. (IDC), Framingham, MA, predicts that the U.S. market for outsourced network management services will reach $4.7 billion by 2002.
- IDC predicts that the U.S. business process outsourcing (BPO) market will reach $2.9 billion by 2002.
- IDC also predicts that the worldwide market for integration services and network consulting will be worth $23.25 billion by 2002 (compared with $10.86 billion in 1997), with an increasing share of revenue coming from fixed-price contracts.
- Gartner Group Inc., Stamford, CT, anticipates that by 2001, 60% of enterprises will use selective outsourcing.
- Meta Group Inc., Stamford, CT, estimates data mining to have been an $8.4 billion market in 1998.
- IDC identified San Jose, CA-based BEA Systems Inc. as the middleware market leader in 1997 (with 31% of total revenue worth $347.3 million).
- The Yankee Group, Boston, MA, forecasts that the systems integration market will grow from $99 billion in 1997 to $162 billion in 2000.
- Gartner Group estimates 75% of organizations with more than 2,500 desktop systems will have some sort of distributed asset tracking in place by 2000.

We just said there's a trend toward offering services over the Internet. But that's not the only one affecting you and your distributed applications; here are some others:

Traditional network integrators, such as IBM Corp., EDS and Digital Equipment Corp./Compaq Computer Corp. are adding application management to their portfolios of network and systems management. Others, including Hewlett-Packard Co., Unisys Corp. and Wang, are expanding their service offerings and reacting to customer demand for single vendor solutions.

Traditional transaction manager vendors such as Computer Associates International Inc. (Unicenter TNG), Tivoli Systems Inc., now a subsidiary of IBM (Tivoli TME and Tivoli Netview), and HP (OpenView) are facing growing competition from aggressive companies like BEA Systems Inc. (BEA Tuxedo, BEA Top End, BEA M3 and BEA WebLogic) and Compuware Corp. (EcoSystems, QACenter and NuMega), who are assembling comprehensive suites from the middle out. Vendors like Platinum Technology Inc. (Poems) and BMC Software Inc. (Patrol) are also developing comprehensive suites that monitor everything from operating system and database application performance to service-level agreements (SLA) and service-level management (SLM). SLA and SLM are two of today's more popular buzzwords–ones that are often associated with helping reduce the total cost of ownership.

Other data integration and data warehousing vendors are tackling the exploding market for "business intelligence" from a data staging, consolidation and distribution standpoint. They, too, are using alliances and acquisitions to assemble comprehensive, integrated suites that offer customers "one-stop shopping" for enterprise business intelligence needs. Some of these data integration and consolidation efforts involve packaged application, enterprise resource planning (ERP) and supply chain vendors such as SAP AG. You can use SAP's data warehouse or buy software from third parties that will let you include SAP data in your data warehouse. And almost all the major front-office and ERP vendors are moving toward modularizing their products to allow more support for distributed programming.

Related to data warehousing, data mining and business intelligence is the explosive field of customer relationship management (CRM). This, too, is moving into the 24x7, distributed virtual space with the help of online customer service and call centers.

Replication Provides Some Help

David Clements, a programmer and analyst for U.S. Steel in Fairfield, AL, isn't alone in bemoaning the lack of standards for distributed computing applications (see "The Only Standard Is there *Is* no Standard," Page 54).

"Large corporate infrastructures are never homogeneous," says Clements, who has a Ph.D. in physics. At U.S. Steel, there are multiple hardware platforms and multiple operating systems. "Software's even more varied than hardware," says

Clements, referring to the range of development tool suites, programming languages and database environments in existence today. "And data are even more varied still. We've got data that's input manually, typos and all. We've got data that's automatically recorded, including massive data streams from sensors." Clements goes on to list other data sources: external data, legacy data and other repositories on various media. He says he found two-way replication a useful technique for avoiding the delays that can plague diverse systems that are distributed across multiple time zones.

Unfortunately, distributed acquisition responsibility in today's typical global organizations exacerbates the general data and tool balkanization and resulting data "chaos." (How often do the programmers, systems administrators, database administrators and "network types" in your organization agree on anything?)

Another problem associated with distributed computing is the need for better Windows-UNIX integration and interoperability. Despite the best efforts of those vendors who are working with Microsoft to port the Windows APIs to UNIX, there's still a lag, specifically with advanced Component Object Model (COM) and COM+ APIs. Then there's the basic challenge of supporting a decentralized and mobile workforce. Clements' other pet peeves: how hard it is to rigorously test distributed applications; how hard it is to get programmers to document their work; and how hard it is to find good auditing tools.

Competing Object Models

In response to the demand for more simplistic, single-source solutions, many software vendors are cobbling together developer suites as well. Microsoft leads the pack with its Visual Studio Enterprise Edition. The product's major components include Visual Basic, Visual C++, Visual J++, Visual FoxPro, Visual InterDev, Microsoft Repository, Microsoft Visual Modeler, Component Manager, Visual SourceSafe and SQL Server Desktop Edition.

Microsoft's object model, COM, will evolve into COM+ under Windows NT 5.0. One notable new feature of COM+ will be the availability of built-in transaction services similar to those currently offered by the stand-alone Microsoft Transaction Server (MTS), which is shipped as part of the Windows NT 4.0 Option Pack.

Many of the other major enterprise hardware and software vendors, including IBM, Oracle and Sun Microsystems Inc., support the Object Management Group's Common Object Request Broker Architecture (CORBA) and Sun's Enterprise JavaBeans (EJB) object model. Although a variety of software "bridges" exist to literally bridge the gap between these two major object models, most organizations feel pressured to weigh in behind one or the other.

Listen to this recent post to a programmer newsgroup:

We are currently evaluating packages that do inter-application integration. What we're looking for needs to run across a global corporation, with significant operations in many countries

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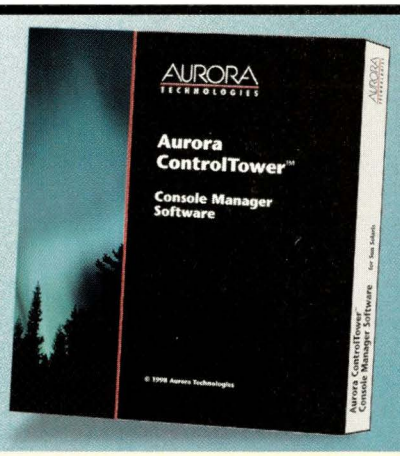

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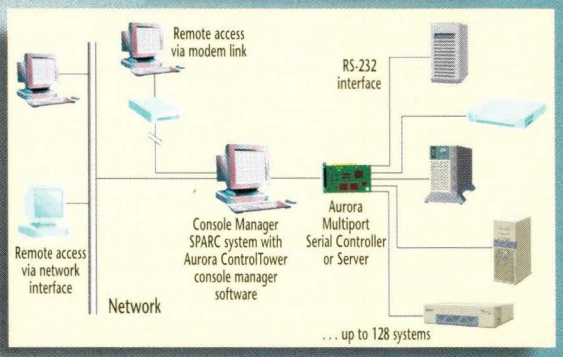

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around the world. I need to push/pull data between France, the U.S. and Singapore for starters.

What we're trying to hook up is quite the mélange of apps: UNIX, NT and AS/400 OS–manufacturing process control stuff, supply chain applications, possible future e-commerce apps, etc. Lots of stuff being moved today via FTP, and that's just not making it.

I'd like to know if anyone on the list has tried doing this with MSMQ [Microsoft Message Queue, which supports asynchronous distributed messaging] and MTS, using VB 5/6 for the components. Problems? Transaction rates? Things you'd do differently if you had it to do all over again?

Does this strike a chord with you?

Last June, James P. Kelly, chairman and chief executive officer of United Parcel Service, headquartered in Atlanta, GA, spoke at the Warehouse of the Future Conference in Phoenix, AZ. During his speech, Kelly discussed global commerce and the creation of value-based logistics solutions based on globalism, connectivity and service. Kelly said the company's ubiquitous brown trucks are becoming the rolling

The Only Standard Is there *Is* No Standard

by David Clements

Yes, in the best of all possible worlds, all employees would use identical hardware running a single operating system, with the latest service pack applied, of course, and use the same development and/or office suites. Any upgrades would be deployed simultaneously worldwide. Our ideal organization would run standardized server hardware, a single version of a single vendor's database, have a single enterprisewide data warehouse and so on. There would be no such thing as "legacy" hardware or software.

The real world, of course, isn't like that. I work at U.S. Steel in Fairfield, AL, as a programmer/analyst, and there are almost as many types of computer platforms, laguages and operating systems in use here as there are varieties of steel we produce.

Our plant is split into three major operating divisions, each with different "areas" headed by an area manager who's responsible for one or more of the mills used in steel production. Capital budgets being what they are, we don't install or upgrade all the computers in all our mills simultaneously. Today, we still have mills doing direct manual entry of production data via a dumb terminal connected to UNIX systems at our headquarters. Others are almost fully automated, running VAX/VMS/FORTRAN, and you'll even find pockets of systems running NT/SQL/Visual Basic.

In theory, the IBM installation at our corporate headquarters is the ultimate source and destination for all customer order and mill production data. In the real world, however, there are times when a query to the local "upstream" database is preferable to waiting for a message to travel to headquarters, be processed, translated to the mill's format and rebroadcast downstream. Avoiding these delays is especially useful in cases where the upstream mill isn't fully automated and any updated data might stack up in local buffers awaiting action by a human operator who won't necessarily get to it immediately. Sound familiar?

Our computing chaos is exacerbated by the number and variety of users entering, updating and/or querying the data. Every time a facility produces a piece of steel, an assortment of information records are created. We record basic process data, such as weight and dimensions, not only to help plan operations downstream but to calculate production-based crew incentive bonuses. Although these records may only be needed until the next mill is complete, or until the next pay period is over, other physical properties, such as X-ray scans, furnace temperatures, mill forces and tensions and so on, are maintained for use by Quality Assurance–and may also need to be archived for 10 to 15 years if the final product is going to carry a warranty. (How many of us still have a compatible tape drive for something archived 10 years ago?) Dates and locations are recorded for our internal "census bureau." While this data may seem mundane, it's a challenge to have crane operators, truck drivers and railroad and warehouse workers all able to access or update such data from a variety of locations.

Alas, life in the steel business is not as simple as just tracking one piece of metal from initial entry to its final destination. At various stages, pieces get welded or split or moved out of sequence if additional processing is suddenly required. A conservative estimate of the average number of identities a given piece will have during production is seven or eight, and only the final identity might be unique to the final piece.

The need to be able to track the history of a piece of steel from its beginnings in a 300-ton pot of molten iron to its emergence as five tons of 0.03-inch thick galvanized steel destined to be a microwave oven shell is the biggest justification for centralizing everything on the corporate mainframe. Keeping the mills running on tight schedules and allowing flexibility for advanced planning is the justification for local, distributed and often multiplatform data access. This is, after all, our ultimate goal in terms of ensuring customer satisfaction, on-time delivery and product quality.

Thus, we have many users, databases and platforms, with many links, keys and pointers. This is a long way from the ideal model where a) all boxes are up-to-date with the latest operating systems, office suites and browsers; b) all users are trained, adept and motivated–Prairie Home Companion-style "above average"–and careful to coordinate actions with other users; and c) all developers and database administrators have anticipated and tested every possible situation.

In the distributed computing world as we know it "zero administration" has zero probability of ever occurring, and textbook certifications are only a starting point in your employment history. Good luck to each and every one of us.

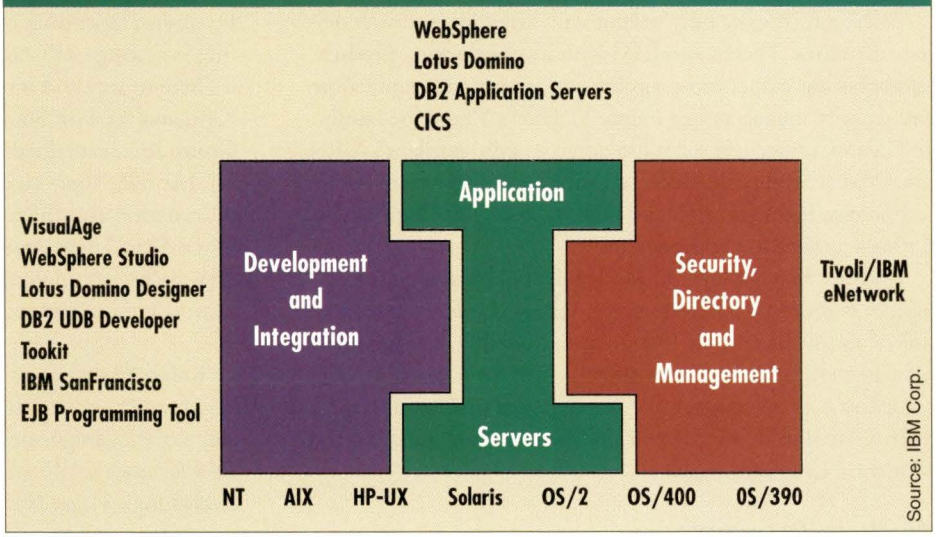
David Clements *is a programmer/analyst for the Sheet Products Division of U.S. Steel in Fairfield, AL. Prior to moving to Alabama, his computing and research experiences ranged from working with Apple machines and PDPs in Antarctica to Data Generals and PS/2s in northern Manitoba, with several other platforms and locations in between. Email:* dclements@uss.com

physical warehouses of American industry, keeping the supply chain in continuous motion. "And, of course, it must be connected by information that provides the confidence that bricks and mortar and security guards did 25 years ago."

To extend the analogy, don't you think distributed objects are a lot like UPS trucks?

As U.K.-based research firm Ovum Ltd. says, in promoting its report on component technology (*Componentware: Building it, Buying it, Selling it* by Katy Ring and Neil Ward-Dutton, July 1998), "Software vendors of all sorts–including enterprise business application vendors, middleware vendors and development tools vendors–are heavily promoting component technology that will revolutionize the way that software of all kinds is built, packaged and sold. However, the technology has been 'bubbling under' for many years, and IS managers are right to be skeptical about the current wave of hype. Moreover, it is by no means clear whether different software vendors promoting component technology are all talking about the same thing; or if their notions of components are converging or diverging."

Figure 1. IBM's E-Business Application Framework



Steven Foote, vice president of research strategy at Framingham, MA-based Hurwitz Group, agrees with Ovum's assessment that components are finally becoming mainstream. "Over the next 12 months," he says in the November 1998 issue of *Information Security* (`http://www.infosecuritymag.com`), "new business applications will be developed with separate components for each major area of the enterprise's functionality. At any time, millions of application components will be constantly

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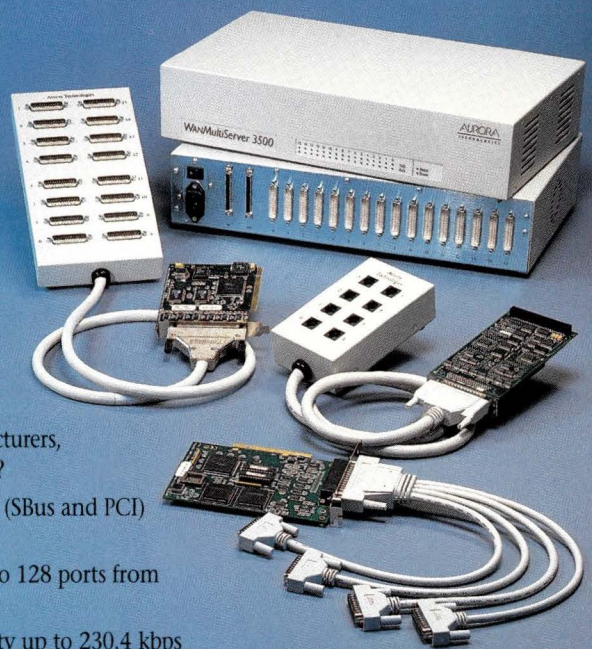

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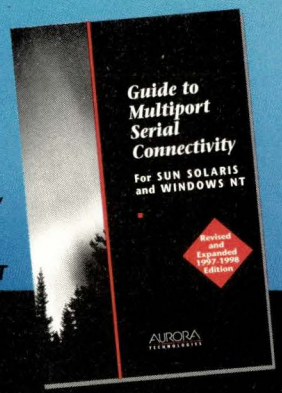

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moving around the corporate network from application servers to users' desktops, both inside and outside the company's walls."

Microsoft isn't the only vendor with attractive software development suites. There's also IBM with its interlocking product families of developer tools, application servers and transaction and security managers (see Figure 1). IBM's VisualAge family and TeamConnection is a multilanguage suite similar to Microsoft's Visual Studio, but IBM has a much stronger focus on Java technology, including EJB and its Java-based IBM SanFrancisco business application components.

Another strong player in the application developer tools market is Rational Software Corp. Rational offers an attractive line of tools that support the design, modeling, testing and management phases of distributed project development. The company is firmly committed to object technology and was instrumental in developing the increasingly popular Universal Modeling Language (UML).

Work in Progress

It's true that concepts of objects (remember Brad Cox's "software IC chips") like those of distributed computing (remember the Distributed Computing Environment?) and even repositories (remember IBM's ambitious AD/Cycle?) have been around for years. What's different today is the Internet. Depending on your perspective, distributed computing is getting both easier and harder, but one thing's for sure, it's here to stay and it's probably going to cost you. As Tammy Kirk, analyst with Stamford, CT-based research firm Gartner Group Inc., explained at a strategy forum held in Morristown, NJ, last fall, "there's a conflict between the need to distribute information and the effort to achieve economies of scale and lower costs." Kirk expects total-cost-of-ownership costs to rise, even skyrocket, in conjunction with increasing distributed computing implementations. ⊸

Karen Watterson is an independent, San Diego, CA-based writer and consultant specializing in client/server and data warehousing issues. She writes monthly columns for *DM Review* and *Windows NT Magazine*, is editor of Pinnacle Publishing's *Visual Basic Developer* and *SQL Server Professional* newsletters, and has written two books for Addison-Wesley Publishing Co.: *Client/Server Technology for Managers* and *Visual Basic Database Programming*. Her email address is karen_watterson@email.msn.com

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ALEXANDRA BARRETT, Staff Editor

Trying Out Transactions

Beneath its simple facade, online transaction processing can be inordinately detailed and complex. Increasingly, however, Web application development products are beginning to reflect the varying needs and skills of different types of Web developers in an attempt to become more user-friendly.

Illustrations by ERIN TERRY

Given the choice, few people would willingly go down to the Registry of Motor Vehicles (RMV) in person to renew their registration if they knew they could simply log on to the RMV's Web site and renew it online. The former involves waking up early on a Saturday morning and standing in line for several hours with dozens of miserable people. The latter involves sitting in front of your computer, anytime day or night, and entering your credit card number.

Which would you prefer? Those who do choose the physical over the virtual, we reason, must be either masochists or martyrs in search of singularly painful experiences to endure. The rest of us, meanwhile, are all too happy to strike the RMV from our list of annual tortures. Indeed, whether it be paying for parking tickets, grocery shopping or any other time-consuming, mundane task, consumers have latched onto self-service Web applications with considerable enthusiasm–an enthusiasm tempered, it seems, only by speed and security considerations. These applications aren't particularly exciting and they won't make you look 10 pounds thinner, but they do a fantastic job of easing the pain and frustration inherent in everyday chores.

As good as this may seem, developers are having trouble keeping up with the demand for self-service applications. The tasks these applications perform seem straightforward and logical, which implies the underlying architecture must also be straightforward and logical. But it's not always so simple. From a systems standpoint, creating self-service Web applications increasingly involves being 100% certain that the application behaves the way you would expect. For instance, when a customer's computer suddenly crashes after he or she has entered their credit card number but before they have clicked the "submit" button, does it clear out the user's shopping cart, or salvage the order for a later date? Does it know how and when to gracefully end the session, or does it just leave it open?

In IT jargon, this process is referred to as ensuring the transactional integrity of the application. This, in most cases, entails hooking into a transaction processing (TP) monitor.

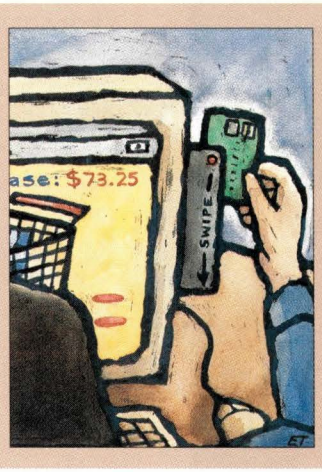
Sounds simple enough? Well, the problem is that under the surface, transaction processing can be inordinately detailed and complex. Words such as "begin," "rollback" and "two-phase commit" strike fear into the hearts of developers. Transaction processing is not to be taken lightly. Integration with commonly used TP monitors–such as CICS and MQSeries from IBM Corp., Armonk, NY, Tuxedo from BEA Systems Inc., San Jose, CA, and Microsoft Transaction Service (MTS) from Microsoft Corp., Redmond, WA–ranks high on the projects-to-avoid list of many IT professionals. "Transactions are hard," says Yafim Natis, analyst at Gartner Group Inc., a research firm based in Stamford, CT. Not surprisingly, most commercial TP monitoring systems have price tags that are correspondingly hard to swallow.

The difficulties associated with hooking into TP systems are compounded by the fact that many Web developers are

not trained in transaction processing. Familiarity with transaction processing has, for the most part, been the province of highly technical corporate IT developers. A lot of Web developers, on the other hand, are still navigating the IT learning curve, and are only now confronting the need for such robust technologies.

Case in point: Nigel Beck, program director of market management for IBM's WebSphere e-business platform, says his group has identified two distinct types of Web developer–Web Up and IT Out. "We have customers coming at this space with a great variety of needs," he says. Web Up developers, Beck explains, would like to add functionality to their Web site but do not necessarily know what technology to use. "When you tell them, 'That's called a transaction,' they say, 'Oh great, well, here's what I need it to do....'" IT Out, on the other hand, consists of corporate IT professionals who have been working with TP systems for years. "When you say transaction processing to them, they respond, 'Oh yes, but of course,'" Beck says.

Web users are much less tolerant of downtime and poor performance, knowing full well that a competitor's site is just a few clicks away.



Complexity must therefore be presented in easy-to-swallow packages if Web applications are to be successful. But while developers are demanding easy-to-use development environments, vendors have not been excused from making their systems any less robust. There's just as much demand on the Web for robust transactional capabilities, says Paul Grabscheid, vice president of strategic planning for InterSystems Corp., Cambridge, MA, maker of the transaction-aware Caché object database. "On the Web, you have the added responsibility of looking good," he says. Also, according to Sanjay Sarathay, marketing development manager for Sun Microsystems Inc.'s NetDynamics application server, "TP monitors were designed for transactions, but not necessarily for a networked environment." These days, TP monitors need to be able to scale to the needs of a huge wide-area network (WAN).

Before the Web, transactional applications were typically manned by trained operators sitting at a finite number of terminals. Today's Web developer, on the other hand, might have a hard time estimating how much traffic a Web-based application is going to generate or, for that matter, how skilled the end users will be. Web users are also much less tolerant of downtime and poor performance, knowing full well that a competitor's site is just a few clicks away.

Increasingly, Web application development offerings are beginning to reflect the varying needs and skills of different types of Web developers and of different sorts of Web applications. For example, IBM recently announced new versions of its WebSphere product line. WebSphere Standard Edition, currently shipping, caters to Web site builders who want to add logic to their pages. It does this through the use of Java servlets for connecting to back-end databases, performing database pool and connection management, session/state management and the like. But in first-quarter 1999, IBM plans to ship WebSphere Advanced Edition, which will offer back-end integration to TP systems such as its own MQSeries, CICS and Information Management System (IMS), and R/3, an enterprise resource planning (ERP) product from SAP AG, Walldorf, Germany. And in second-quarter 1999, WebSphere Enterprise Edition will ship, which, according to IBM's Beck, will enable "full-scale componentization of business logic," through integration with IBM's TXSeries and Component Broker products.

BEA Systems, known for its high-end transactional middleware systems, is another company that is working hard to scale down its product offerings to meet the needs of nontechnical Web developers. Last fall, BEA acquired WebLogic Inc., maker of the Tengah Java application server. With the WebLogic application server under its belt, BEA has formed the WebXpress business unit, which markets the WebLogic product line and acts as a sales entry point into BEA's middleware suite. "We're in the Mack Truck business, and [Web developers] are looking to start off with a Miata," is the explanation offered by Alfred Chuang, chief technology officer at BEA Systems, for his company's purchase of WebLogic.

Tons of Tools

Another aspect of easing developers into tackling transaction-capable Web applications has been to provide them with better tools. "It's not about making transactions easy, it's about making them easier," says InterSystems' Grabscheid.

Several vendors in the middle-tier application server market offer rapid application development (RAD) tools to accompany their servers. For example, Bluestone Software Inc., Mount Laurel, NJ, which markets and develops the Sapphire/Web application server framework, includes Sapphire/Developer as part of its offering. IBM's WebSphere product line includes WebSphere Studio, a content assembly tool that supports Web graphics, HTML, scripts and Web Distributed Authoring and Versioning (WebDAV). Sun's NetDynamics application server framework also features an integrated development environment, NetDynamics Studio.

"It's critically important for developers to have access to tools that support a visual drag-and-drop paradigm," says Tony Webb, an independent consultant based in New York City, "because developers are so pressured by time-to-market considerations." Webb, who consults for Prolifics, New York, NY, a vendor of enterprise-class application development tools, uses the company's Visual Server Developer GUI to help him design three-tier applications. With it, Webb says, he was able to develop a Web-based travel reservation system for Travac Tours and Charters, New York, NY, in less than six months. Without it,

he says, the project would have taken twice as long.

Also getting praise for making transactional capabilities more accessible to the average developer is Microsoft, which bundles its Microsoft Transaction Server (MTS) as part of Windows NT. "MTS is perceived as lightweight," says InterSystems' Grabscheid, "but the fact that it puts it within reach of mainstream developers is a good thing."

Packaging Connectivity

Wizards and GUIs are always welcome, but what really makes the task at hand more manageable is the ability to link into back-end systems straight out of the box. In particular, application server vendors are quick to offer canned application programming interfaces (APIs) integrated into predetermined software applications. For example, Bluestone Software's Sapphire/Web framework offers Sapphire Integration Modules, or SIMs, for different kinds of applications, including TP systems like CICS, MQSeries and Tuxedo. "We have the ability to deal with true transaction systems as an abstraction layer," says John Capobianco, senior vice president of marketing at Bluestone. "In that way, developers don't even need to know what a transaction system is."

Insulating the developer from having to know the intricacies of TP systems appears to be a common goal. To that end, the industry seems to be resting its hopes on one technology: Sun's Enterprise JavaBeans (EJB), a server-side companion to the client-side JavaBeans component architecture. "The EJB approach, while not simple, certainly simplifies a lot of connectivity problems," says IBM's Beck. "With it, you can rely on the vendors' individual EJB implementations to do the nitty-gritty."

Since it was first announced in March at the JavaOne Conference in San Francisco, CA, EJB 1.0 has been endorsed by a veritable who's who in the enterprise-class Web application server space. Bluestone's Sapphire/Web already offers EJB support, as do BEA WebLogic, Sun NetDynamics and Mountain View, CA-based Netscape Communications Corp.'s Application Server. IBM intends to support EJB in WebSphere when it ships the Advanced Edition in first-quarter 1999, and Prolifics says it is actively looking into the technology. "You're going to be seeing an awful lot of EJB action in 1999," says Sun's Sarathay.

But will all these improvements be enough to make transactions accessible to just anybody? "In the end, the real skill sets are with the people who've always been developers," says independent consultant Webb. But vendors are certainly working hard to simplify things for less-than-seasoned developers. Perhaps one day they'll have embarked on Web development projects that they never would have dreamed of. Like never again having to set foot in the RMV. ⊸

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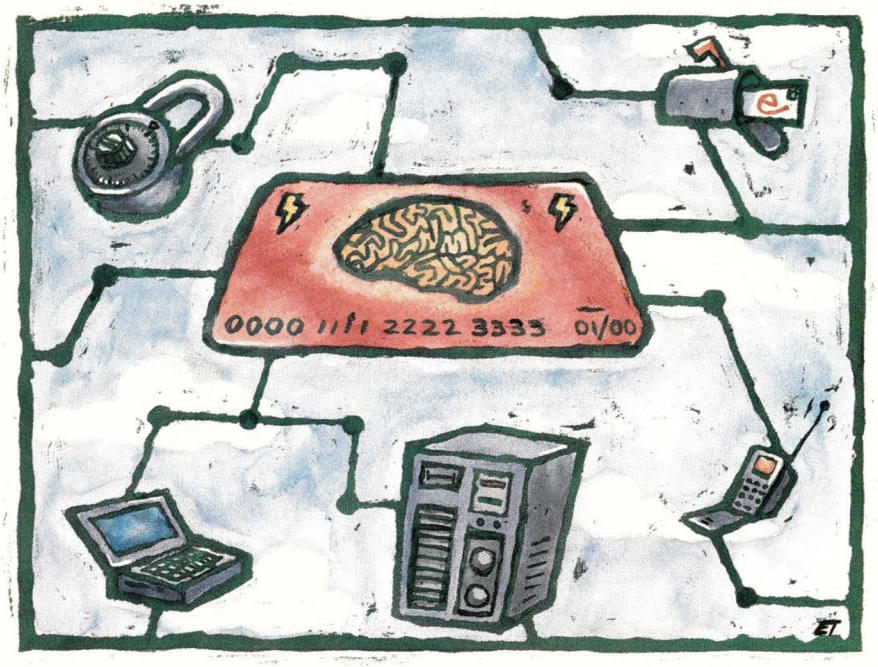
The Smart Card Is the Computer

The race to be number one in the smart card arena is well under way, and for good reason. Analysts are predicting a dramatic growth in the smart card market by early next century.



Sun Microsystems Inc., Palo Alto, CA, likes to characterize itself as a one-stop-shop for enterprise computing. Sun's slogan "the network is the computer" sums up its corporate vision. But Sun may soon find that a key component of the enterprise network is controlled by its nemesis, Microsoft Corp., Redmond, WA. Microsoft announced in October that it was entering the budding smart card market with its Smart Cards for Windows operating system. That's bad news for Sun, which has its own smart card platform, the Java Card API. Introduced in 1996, the Java Card is currently supported by a number of smart card manufacturers, as well as financial companies such as Visa International, San Francisco, CA, and Citibank, New York, NY.

Currently, smart cards are only in limited use in the United States. But Sun and Microsoft are already squaring off over the fledgling technology because of its potential value in network computing and electronic commerce.

"It's going to be a very strategic area for them," says Jonathan Cassell, senior analyst for market research firm Dataquest Inc., San Jose, CA. "Smart cards are quickly going to become the keys to the front door [of a network]. They'll be used for things like secure access to networks, electronic commerce over the Internet and other kinds of networking functions. In the future, we'll see smart cards as the means to tie together various kinds of communication–home PCs, home and work email accounts, Network Computers [NCs], digital cellular phones, set-top boxes with computer telephony."

While smart cards–essentially credit cards equipped with microprocessors and storage capacity–don't currently play a significant role in the United States, industry watchers expect that to change dramatically over the next few years. Cassell predicts that the market for smart cards will reach $4.8 billion by 2002. Consulting firm PricewaterhouseCoopers, New York, NY, is even more optimistic about the smart card market, predicting that nearly $12 billion worldwide will be spent on smart cards and smart card devices by 2000.

Smart cards are also likely to play a major role in network computing, a technology Sun has been vigorously promoting for the past four years. With a smart card, a user could not only access his or her desktop from any Network Computer, but could even carry small amounts of data around with them–sort of like a miniature hard drive. "Smart cards have been integral to the NC concept from the very beginning," says Bill Barr, chairman of the Smart Card Forum, a nonprofit organization based in McLean, VA, that was established in 1993 to promote the widespread acceptance of multiple-application smart card technology. "It's a way to provide strong, rapid authentication and identification."

The contest between Sun and Microsoft officially began on October 27, when Microsoft announced that the beta version of Smart Cards for Windows would be released in January. About 20 companies have announced their support of Microsoft's efforts, including several that also support the Java Card API, or a third platform specification, Multos, which is overseen by a consortium that includes American Express Co., New York, NY, and MasterCard International Inc., Purchase, NY. One prominent supporter of the Java API, Gemplus, a leading supplier

of smart card solutions based in Redwood City, CA, has announced plans to license the Microsoft product and also work with Microsoft to develop smart card applications. Hitachi America Ltd., Brisbane, CA, Motorola Inc., Schaumburg, IL, and Siemens AG, Munich, Germany–all long-time supporters of the Multos platform–have also announced their support of Smart Cards for Windows.

Because of its overwhelming dominance of the desktop market, Microsoft has the home-field advantage. Duncan Brown, senior analyst with research firm Ovum Inc., Burlington, MA, says Microsoft's smart card technology will offer tight integration with other Microsoft technologies. Windows NT 5.0–renamed Windows 2000–will contain smart card security features, Brown says, and the Windows card platform is supported by the Windows file manager. Brown predicts that PCs equipped with smart card readers will start hitting the market in 1999, meaning that a consumer's first experience with smart cards will most likely be a Microsoft one.

Could Microsoft gain a monopoly in smart cards the same way it has achieved near-monopoly status on the desktop? Brown and others believe Microsoft's smart card platform has an excellent chance of becoming the dominant platform for applications such as corporate network access and Internet access. "In areas where they have a strong desktop and browser presence, then I think the use of smart cards in those applications will be a natural fit for Microsoft," says Brown. "I think it will be a greater challenge for them in markets like financial services, where the Java Card has been adopted by Visa and Multos has been adopted by MasterCard."

Robin O'Kelly, a spokesman for Maosco, the London-based consortium that governs the Multos standard, says that, while it's too early to fully judge the merits of the Smart Cards for Windows platform, he doesn't believe it will offer the required high level of security to appeal to the financial community. "One of the key issues is security, and one of the key strengths of Multos is its security. Multos was originally developed by Mondex International [a London-based subsidiary of MasterCard International and a key provider of electronic cash and smart card technologies] with all of the knowledge of smart cards that goes with that. It's governed by leading companies in the smart card world. I'm not saying Microsoft doesn't have that security, but the evidence is not there yet, and it's not something you can do overnight," O'Kelly says.

One advantage of the Java API, says Ovum's Brown, is that because it's Java, it can operate on top of other platforms such as Multos and Smart Cards for Windows. However, whether Microsoft's platform will run Sun's Java API remains to be seen. Microsoft spokesman, Phil Missimore, with Bellevue, WA-based public relations firm Waggener Edstrom, says nothing in the Smart Cards for Windows platform would prevent a card manufacturer from putting the Java Card API and Java Virtual Machine (JVM) alongside the Microsoft virtual machine.

Whoever triumphs in the smart card operating system arena will have a strong competitive advantage in the market for smart card applications as well. In fact, the real contest in the smart card market will not only be over the platform, but the applications that run on it. "It's not the smart card for its own sake, but what you can do with it," says Brown, who predicts that the real growth in smart card technology will be in application development by software vendors, and that Microsoft–the number one software vendor–will enter the smart card applications market sometime in 1999.

In fact, with the right software onboard, smart card technology could wind up being used in a virtually limitless array of functions. "Smart cards could be great platforms for applications in finance, insurance, medical data and other types of data storage and management," says Dataquest's Cassell. "It may even be that, in the future, your computer will really be a smart card."

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.

URL/New Products

Foreign Language Translation on the Fly

Because more and more commercial Web sites target international audiences, Transparent Language has unveiled Enterprise Translation Server, which enables Web site visitors to click a button and view a dynamically generated translation of a Web page. The product translates documents cheaply and quickly, helping people "get the gist" of a foreign-language document for much less than it would cost to manually translate it, the company says. Behind Enterprise Translation Server is the TranscendRT server, which offers draft-quality translations with up to 80% accuracy.

Dictionary editing tools are said to allow Web sites to create business-specific dictionaries for greater accuracy. Translations can be performed from English to Spanish, French, German, Italian or Portuguese, and from Spanish, French or German to English. Users can connect to the Enterprise Translation Server from several clients, including Microsoft Corp. Windows desktop clients (which allows for drag-and-drop document translation), stand-alone Java clients and HTML browsers. Supported text formats include HTML, SGML, RTF, WordPerfect 5.1 binary, DOS and ASCII. Translations maintain the formatting of the original document.

Enterprise Translation Server runs on Windows NT and supports Microsoft Internet Explorer 3.01+ and Netscape Communications Corp. Navigator 3.0 Web browsers. Pricing starts at $5,000 per language direction (for example, English to French). An annual usage fee is also applied, which starts at $12,000 for 3 million words.

Transparent Language Inc.
22 Proctor Hill Road
Hollis, NH 03049
http://www.transparent.com
Circle 181

Turnkey Solution for IP Services

A new multiservice access platform from Xedia reportedly enables Internet service providers (ISPs) and large enterprises to integrate various IP services, including IP routing, Quality of Service (QoS) and security, into a single hardware/software box. Xedia's Access Point

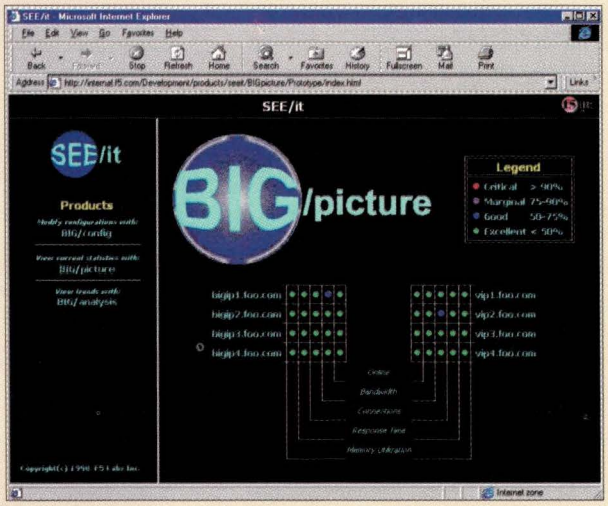
QVPN is designed to take the place of multiple boxes for firewalls, bandwidth management, virtual private network (VPN) gateways and routers.

Access Point QVPN includes Xedia's class-based queuing bandwidth management capabilities, which allow VPN customers to classify traffic according to explicit network policies, and supports major IP routing protocols, including Open Shortest Path First (OSPF), Routing Information Protocol (RIP) and Border Gateway Protocol 4 (BGP4). Its BGP4 implementation is said to support "multihoming," or multiple connections into the Internet backbone, with added reliability provided via support for the Virtual Router Redundancy Protocol (VRRP). Together, BGP4 and VRRP are said to allow inherent redundancy across

Add-On for F5's Server Array

F5 Labs has released SEE/it Application Suite, a value-added application tool set for the company's BIG/ip Server Array Controller. SEE/it comprises three browser-based modules for managing BIG/ip: BIG/config, BIG/picture and BIG/analysis. BIG/config is an installation and configuration tool that offers point-and-click configuration of all BIG/ip and 3DNS (F5's load-balancing IP application) features such as rate shaping and packet filtering. BIG/picture is a real-time monitoring tool, which displays data on network traffic via pie charts or bar graphs. BIG/analysis uses information generated by BIG/picture to predict future network needs, the company says. BIG/config is built into the latest release of BIG/ip, while BIG/picture and BIG/analysis are bundled together as an add-on package for $9,900.

F5 Labs Inc.
200 First Ave. W., Ste. 500
Seattle, WA 98119
http://www.f5.com
Circle 180



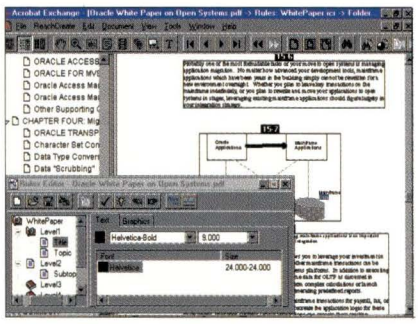
network access links for mission-critical VPN services. In addition, the product provides IPSec tunneling and encryption for both site-to-site and remote access VPNs. It includes support for Internet Key Exchange (IKE) and Public Key Infrastructure (PKI) integration with X.509 digital certificates and interoperates with major Certificate Authorities (CAs).

Access Point QVPN comes in five models: QVPN 10 for $7,795, QVPN T1 for $13,795, QVPN 100 for $19,995, QVPN 45 for $21,995 and Access Point ATM for $24,995. QVPN client software costs $79.

Xedia Corp.
119 Russell St.
Littleton, MA 01460
http://www.xedia.com
Circle 182

XML Application Server

ReachCast, a recently established company, has released its first products, ReachSite and ReachCreate, which together act as a platform for creating and distributing documents in eXtensible Markup Language (XML). The value of the tools lies in their ability to discover and expose information that resides not in a database, but in existing documents scattered throughout an enterprise, the company says.



ReachSite and ReachCreate are said to work by isolating information that resides in document formats such as Microsoft Corp. Word and Adobe Systems Inc. Acrobat, and converting that information into XML-tagged "information components," which can then be displayed as HTML or dynamic HTML in a browser.

Both products run on the Oracle Corp. Application Server and Oracle 8 and 8i databases, and are available for Solaris 2.6+ and Windows NT. Pricing starts at $75 per user for ReachSite and $100 per user for ReachCreate.

ReachCast Corp.
2010 Crow Canyon Place, Ste. 100
San Ramon, CA 94583
http://www.reachcast.com
Circle 183

Mission Control for Netscape Desktops

Following the release of Communicator 4.5, Netscape Communications has announced Mission Control Desktop 4.5, a tool set that is said to offer configuration and centralized management for Communicator 4.5 desktops throughout an organization.

With Mission Control, administrators can perform tasks such as locking client preferences and preventing end users from changing crucial settings. Users can create customized installation sequences over a corporate intranet and manage client configurations via an HTTP Web server or LDAP directory server, the company says. Mission Control also enables Netscape's SmartUpdate feature, which reportedly allows IT departments to automatically upgrade their users to the latest version of Communicator.

Mission Control Desktop 4.5 runs on Solaris, AIX, HP-UX, IRIX and Windows NT, and costs $1.25 per desktop client with a minimum purchase of 100 clients.

Netscape Communications Corp.
501 E. Middlefield Road
Mountain View, CA 94043
http://www.netscape.com
Circle 184

Integrated Small Business Server

Apexx Technology has integrated several new features into its Team Internet 100 product line. Team Internet 100 is described as a server that can connect five to 300 computer users to the Internet for Web browsing, email and other Internet applications. It is designed to provide simultaneous shared Internet access over a single connection for users on a local-area network (LAN), Apexx says.

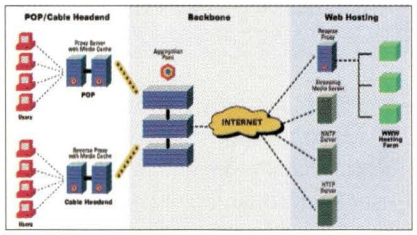
Newly integrated features include NetPartners Internet Solutions Inc.'s WebSENSE Web Filtering Software, designed to enable small businesses to control Internet access by blocking non-business-related sites, and a file sharing capability, called Simple File Sharing, that enables employees to retrieve, store and collaborate files over a network. Apexx Technology has also added its own spam filtering software, which is designed to eliminate unwanted email.

Pricing for Team Internet 100 starts at $1,695. It is compatible with most UNIX operating systems, as well as Windows NT, Mac OS and Novell NetWare.

Apexx Technology Inc.
506 S. 11th St.
Boise, ID 83707
http://www.apexxtech.com
Circle 185

Inktomi Server to Support RealNetworks' G2

Inktomi's Traffic Server 2.0 features a number of enhancements, including support for RealNetworks Inc. G2 System cache components for caching multimedia content and support for high-volume traffic Web sites.



With Traffic Server 2.0, Web hosting providers can distribute content within their hosting networks to provide faster delivery and minimize server overload, Inktomi says. This latest release also incorporates management features that address the requirements of large-scale content distribution, including cache "pinning" to ensure that key pages are always in the cache, support for multimedia host sites and logging to enable integration with billing systems.

Traffic Server 2.0 runs on Solaris 2.6, DEC Alpha, Digital UNIX and IRIX 6.5. A Windows NT port is scheduled for 1999. Pricing starts at $30,000 per CPU.

Inktomi Corp.
1900 S. Norfolk St., Ste. 310
San Mateo, CA 94403
http://www.inktomi.com
Circle 186

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.

New RS/6000 Bundles

IBM has announced several new RS/6000 S70 packages, including the S70 Advanced server, which is a new SMP system designed for mission-critical commercial environments such as enterprise resource planning (ERP), electronic commerce and business intelligence. IBM has also announced a bundled package called the RS/6000 HA-S70 Advanced Cluster Server, which features two preconfigured S70 Advanced servers and high-availability clustering software.

S70 Advanced server is available in four-, eight- or 12-way configurations, featuring four, eight or 12 262-MHz Power PC RS64-II processors. It comes with hot-swappable power and cooling and up to four I/O drawers per server. The base I/O drawer contains a minimum of 9 GB of Ultra SCSI disk storage, 32x CD-ROM (maximum), a 1.44-MB, 3.5-inch disk drive, two Ultra SCSI PCI adapters and 11 PCI adapter slots. Other features include 1 GB to 32 GB of main memory, up to 38-TB SCSI external disk storage, up to 22.7-TB Serial Storage Architecture (SSA) and 53 available PCI slots. It costs $150,000.

RS/6000 HA-S70 Advanced Cluster Server is said to feature IBM cluster technology that detects and recovers potential disk failures. It comes with 7133 Serial Disk Systems with 72.8 GB of SSA storage (scalable to 145.6 GB) and is packaged with High-Availability Cluster Mutliprocessing for AIX (HACMP Enhanced Scalability Version 4.3) cluster software. The bundle comes preinstalled with AIX 4.3.2 and costs $445,072.

IBM has also announced the S70 System Attachment Adapter, which allows the S70 to be attached to an SP and managed as a node via a single console. With the attachment, the SP acts as an

Storage for Heterogeneous Environments

LSI Logic has unveiled a new family of network-attached storage systems, the MetaStor family, which feature high availability, integrated backup capabilities, a Web-based user interface and multiprotocol support for heterogeneous platforms.

MetaStor storage systems, with support for NFS, SMB/CIFS, NetWare and AppleTalk, can be used in a variety of environments for target applications such as CAD/CAM, CASE, data warehousing, enterprise resource planning (ERP), imaging and OLTP, the company says. They are said to ensure uptime and availability via a dual-active redundant I/O path, as well as an advanced intelligent tape (AIT) library that is integrated directly into the system. The tape backup system features a 1-TB capacity and can backup 500 GB in eight hours, the company says, which allows for partial or full backups without interrupting users.

Management occurs through LSI's Web-based JetWorks Plus, which can be used to configure and manage hubs, network connections, storage and backup. JetWorks supports NIS+ and Domain Name System (DNS). In addition, JetWorks Plus offers the ability to configure security features such as read/write permissions and login authentication.

MetaStor hubs come in three basic configurations: SH850 (with 180 GB of storage capacity) for workgroup environments; SH7000 (with 1 TB of storage capacity) for departmental environments; and SH7400, with its dual I/O paths and automatic failover, is used in data centers and can handle multiple terabytes. Pricing ranges from $70,000 to $400,000.

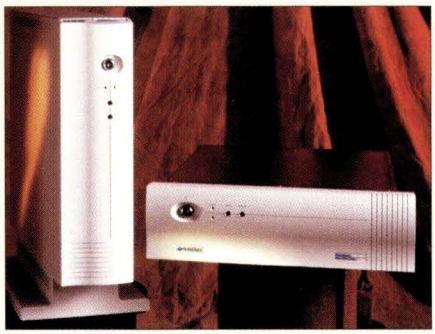
LSI Logic Corp.
1551 McCarthy Blvd.
Milpitas, CA 95035
http://www.lsilogic.com
Circle 100

application server and the S70 acts as the database server boosting database performance four-fold, IBM says. Up to eight S70s may be attached. It costs $10,000.

IBM Corp.
Contact local sales office
http://www.ibm.com
Circle 101

Eliminate Bottlenecks with Solid-State Storage

Frequently accessed data files, so-called "hot files," can cause significant performance bottlenecks–about 50% of I/O activity for only 5% to 10% of an application's data, according to Solid Data Systems. So Solid Data has introduced the Excellerator Ultra family of solid-state storage products, to which you can off-load hot files and improve application server performance by up to 600%, the company says.



The Excellerator Ultra disks each feature a high-speed Ultra SCSI interface and offer data access times of 14 msecs, approximately 1,000 times faster than typical magnetic disk drives and two to four times faster than competitive solid-state disks, the company says.

Excellerator Ultra solid-state disks are based on a Dynamic Random Access Memory (DRAM) architecture, offering storage capacities between 536 MB and 17.36 GB. System-level analysis software, called I/O Dynamics, is said to analyze the impact of disk activity on system performance and identify the most frequently accessed files in order to fine tune the system. Potential customers are also encouraged to use I/O Dynamics to determine whether they are experiencing I/O bottlenecks. Contact company for a free trial.

To protect Excellerator Ultra disks from the threat of a power outage, they are built with the company's Data Retention System, which provides integral battery backup, onboard disk drive with a CPU-independent data path, automatic backup control logic, redundant array of independent chips (RAIC) and redundant power supplies.

Excellerator Ultra disks are available in two models: Excellerator Ultra 800 with 536 MB to 5.36 GB of storage; and Excellerator Ultra 1000 with 1.07 GB to 17.36 GB of storage. Both models are compatible with UNIX operating systems. Pricing ranges from $25,010 to $226,050.

Solid Data Systems
2945 Oakmead Village Court
Santa Clara, CA 95051
http://www.soliddata.com
Circle 102

Sun Server for ISPs

Internet service providers (ISPs) and telecommunications companies alike can now achieve carrier-quality computing thanks to the Netra t 1125 server from Sun Microsystems, which is certified to Bellcore's Network Equipment Building Standard (NEBS) Level 3. With it, ISPs can deploy applications such as network management, subscriber services and electronic commerce applications in a commercial environment running on AC/DC power.

Netra t 1125 is rack-mountable and comes with a telco alarm that helps detect potential problems with telecommunications equipment. It can also come equipped with either a 33- or 66-MHz Gigabit Ethernet 2.0 PCI adapter.

Sun's Netra t 1125 server is priced at $17,995, with an additional cost of $2,095 to $2,295 for the Gigabit Ethernet adapters. All systems come preconfigured with the Solaris operating system.

Sun Microsystems Inc.
901 San Antonio Road
Palo Alto, CA 94303
http://www.sun.com
Circle 103

Fibre Channel-to-SCSI Router Unveiled

Crossroads Systems has announced a Fibre Channel-to-SCSI router for companies that want to move from a parallel SCSI infrastructure to a Fibre Channel-based storage-area network (SAN), but can't afford to do so all at one time.

Crossroads 4200 offers bidirectional connectivity between a Fibre Channel SAN and up to 30 SCSI devices, including RAID arrays, tape libraries and CD-ROM jukeboxes. Crossroads Systems says Crossroads 4200 can alleviate network bottlenecks associated with LAN-based backup immediately. Mission-critical data can travel at higher speeds over longer distances, and the consolidation of storage resources can significantly reduce a company's total cost of ownership, Crossroads says.

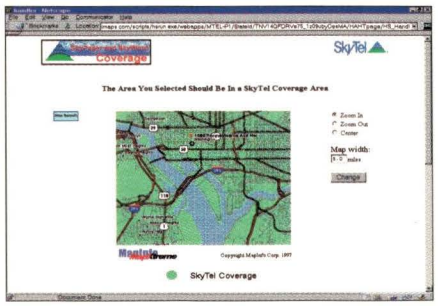
Crossroads 4200 is a Gigabit storage router that features a rack-mountable form factor, a single 100-MB/s Fibre Channel port and two autonegotiating SCSI buses (either Fast, Wide or Ultra; differential or single-ended), supporting up to 30 SCSI 2 or SCSI 3 devices and hosts, with throughput of 40 MB/s on each bus. A Gigabit Interface Card is said to enable connectivity over distances of up to 10km and an SNMP MIB database facilitates integration with existing management tools. Crossroads 4200 costs $7,995.

Crossroads Systems Inc.
9390 Research Blvd., Ste. II-300
Austin, TX 78759
http://www.crossroads.com
Circle 104

Spatial Analysis Over the Web

MapXtreme Java Edition, a 100% Pure Java mapping server from MapInfo, is now available for deploying spatial information over the Inter/intranet.

According to MapInfo, companies are increasingly using spatial information to do things such as troubleshoot problem areas, enhance customer service and support sales efforts. The Web, MapInfo says, is the deployment platform of choice. By integrating with the company's Spatial-



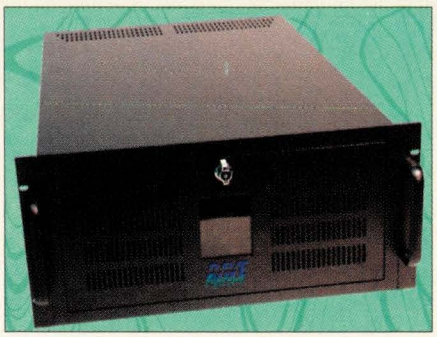
Ware Informix DataBlade module, MapXtreme Java Edition reportedly allows map data stored in a central RDBMS to be displayed via regular Web browsers.

MapXtreme Java Edition runs on any platform equipped with a Java Virtual Machine (JVM) and is priced at $24,495 for a four-CPU server license. A free, 30-day trial copy can be downloaded from the company's Web site.

MapInfo Corp.
One Global View
Troy, NY 12180
http://www.mapinfo.com
Circle 105

Ultra AXmp Rack-Mount Server Out

Rave Computer Association has integrated Sun Microsystems Inc.'s Ultra AXmp motherboard into a 5U-19-inch rack-mount chassis, called RackMount-



AXmp (RM-AXmp). The product is a scalable 64-bit UltraSPARC processing system that comes with Sun's Ultra Port Architecture (UPA). UPA supports a wide range of ports, including 32-, 64- and 128-bit and features four interface properties: master, slave, interrupter and interrupt handler.

RM-AXmp can support up to four 250-, 300- and 360-MHz UltraSPARC-IIi processors. The AXmp motherboard also supports up to six PCI slots, four at 33 MHz and two at 66 MHz, and comes standard with integrated dual-channel Ultra Wide SCSI, 10/100BaseT Ethernet, a 600-watt power supply and two cooling fans, the company says.

Pricing for RM-AXmp base model starts at $13,669 and features 256 MB of memory, a single 300-MHz module with 2 MB of cache, a 4-GB hard drive, a 5U rack-mount chassis with rails and an internal 1.44-GB floppy drive.

Rave Computer Association Inc.
36960 Metro Court
Sterling Heights, MI 48312
http://www.rave.com
Circle 106

Web Site Resource Manager

Bright Tiger's ClusterCATS resource management software for building Web sites is now available for Solaris running

Upgrades, Enhancements, Additions...

■ Hitachi's Software Business Group has announced TPBroker 3.1, an updated version of its transaction processing (TP) middleware. TPBroker now offers support for Sun Microsystems Inc.'s Java Transaction Service (JTS) and TPBroker Notification Service. JTS is said to allow developers to write transactional client/server applications in Java. TPBroker Notification Service, which is based on the Common Object Request Broker Architecture (CORBA), specifies how and when objects can communicate with one another via an event channel. It is designed to transmit structured CORBA event data from a CORBA application object and then issue the information to one or more CORBA object users. Applications can be written in C++ and Java without requiring the information suppliers to use the same platform as end users, the company says. TPBroker 3.1 runs on Solaris 2.5 and Windows NT 4.0 and can be used with extended architecture-compliant resource managers, such as Informix Corp. Informix (with ESQL package), Oracle Corp. Oracle 7.x/8.x, Microsoft Corp. SQL 6.5 and IBM Corp. MQ. A development version is available for $3,495. **Hitachi America Ltd.**, 3101 Tasman Drive, Santa Clara, CA 95054, *http://www.hitachisoftware.com.* **Circle 107**

■ Ascent Solutions has added capabilities to its PKZIP UNIX data compression software. New features include a 32-bit algorithm, self-extractor program, self-extractor password encryption and Year 2000 compliance. The company says Version 2.1 can zip and unzip files twice as fast as previous versions. Also, `.zip` files can be made into self-extracting (SFX) files thanks to the self-extracting program, Ascent says. PKZIP UNIX 2.1 supports Solaris, AIX, HP-UX, SCO UNIX and Linux. It costs $189 per user. **Ascent Solutions Inc.**, 9009 Springboro Pike, Miamisburg, OH 45342, *http://www.asizip.com.* **Circle 108**

■ Axent Technologies has introduced Version 3.0 of Intruder Alert with NetProwler, an intrusion detection system that integrates network- and host-based methodologies in a single product. It automatically detects and responds to attacks on a company's information system and network infrastructure, Axent says. NetProwler is a new network monitoring component for Intruder Alert 3.0 and provides network-based intrusion monitoring. The product runs on Solaris and Windows NT platforms. It costs $1,995 per manager/agent, plus $995 per server and $95 per workstation. **Axent Technologies Inc.**, 2400 Research Blvd., Ste. 200, Rockville, MD 20850, *http://www.axent.com.* **Circle 109**

■ Mesa Systems Guild has released a major upgrade to its Web-based project management application, Mesa/Vista. With Mesa/Vista 3.0, product development teams are able to access data from a variety of legacy systems using a Web browser. Access can be limited to select individuals within a group, a specific project or physical location, the company says. Other features include project management tools designed to offer up-to-date information on the status of a project. New to Version 3.0 is Lightweight Directory Access Protocol (LDAP) support, which allows systems administrators to manage user accounts. Other new features include a capability for linking project data between various applications and phase of a project's lifecycle and an enhanced user interface. Mesa/Vista 3.0 is available in two configurations: Project (for a single project) and Enterprise (for multiple projects). Pricing for Project starts at $7,000; contact vendor for additional pricing. Mesa/Vista 3.0 supports Netscape Communications Corp. Enterprise 3.0+ and Apache 1.2+ servers on Solaris and HP-UX. The client components support all Java-enabled browsers. **Mesa Systems Guild Inc.**, 60 Quaker Lane, Warwick, RI 02886, *http://www.mesasys.com.* **Circle 110**

■ Iona Technologies has introduced OrbixWeb Professional Edition, an enhanced version of OrbixWeb 3.1, the company's Java development tool. Java developers can now make use of new GUI tools, enhanced debugging tools and its support for Symantec Corp.'s Java rapid application development (RAD) tool, Visual Café, to build applications that tie Java technology to other platforms such as mainframes, UNIX or Windows, Iona says. A major addition to OrbixWeb is the integration of Iona's Orbix Wonderwall CORBA-IIOP firewall technology, which allows developers to create Java/CORBA-based Internet applications that can operate across corporate firewalls. OrbixWeb 3.1 Professional Edition is available on Solaris, HP-UX and Windows NT and is priced at $1,499. **Iona Technologies Inc.**, 60 Aberdeen Ave., Cambridge, MA 02138, *http://www.iona.com.* **Circle 111**

Netscape Communications Corp.'s Enterprise Server. The software previously ran only on Windows NT.

ClusterCATS Enterprise Edition monitors and manages Web site resources in order to deliver a high level of site availability and performance by managing application and server load, the company says. ClusterCATS also provides failover capabilities for Web, database and application servers, as well as session state management, content distribution and synchronization. In addition, ClusterCATS Enterprise Edition includes Java Accelerator and ApplicationSmart features, which together optimize server-side Java performance. Bright Tiger offers other accelerators for CGI, static HTML and Allaire Corp.'s ColdFusion.

ClusterCATS Enterprise Edition is available for Solaris 2.5.1+ and Netscape Enterprise Server 3.0+. Pricing starts at $5,000 for two servers.

Bright Tiger Technologies
125 Nagog Park
Acton, MA 01720
http://www.brighttiger.com
Circle 112

British Agents to Manage Network

U.K.-based RiverSoft has launched its first product, OpenRiver network management software. OpenRiver provides automatic topology discovery, monitoring and root-cause analysis of network problems. With OpenRiver, if the network changes, new network elements are mapped without reconfiguring the system, Riversoft says.

OpenRiver provides continuous topology monitoring using various methods, passive and active, to elicit the structure of the network, the company says. OpenRiver uses Active Managed Object Store (AMOS) object modeling, which models the state of network devices and interprets data. The object model can reportedly be changed without having to interrupt its operation.

OpenRiver uses agents that move out into the network and actively discover configuration topology. When changes are made to the network, the core system is automatically brought up-to-date. In addition, OpenRiver maintains a data store of the network configuration.

The network management software was designed to handle switched environments, including Asynchronous Transfer Mode (ATM), Frame Relay, Gigabit Ethernet and Virtual LANs. RiverSoft provides a desktop for Solaris and Windows NT, which can be installed anywhere on the network to support user-identified access and information profiling. The minimum specification requires a Sun Microsystems Inc. UltraSPARC-I, 64 MB of RAM and a 2-GB hard drive. Contact company for pricing.

RiverSoft Ltd.
Unit 7, The Coda Centre
Munster Road
London, U.K. SW6 6AW
http://www.riversoft.com
Circle 113

PCI-Based SPARC Clone

Tatung Science & Technology has unveiled the COMPstation U4MP Series Model 4360 server with four 360-MHz UltraSPARC-II processors. Housed in a 19-inch rack-mountable chassis, the COMPstation 4360 comes equipped with 4 MB of external cache per processor.

The system comes with Solaris 2.6 preinstalled and includes an enhanced Common Desktop Environment (CDE). Users can maintain full binary compatibility with existing SPARC-based software, the company says.

COMPstation Model 4360 supports two 66-MHz, 64-bit PCI devices and four 33-MHz, 64-bit PCI devices. A standard configuration includes four 360-MHz UltraSPARC-II processors, 1 GB of RAM and 9 GB of hard disk storage. It features up to six drive bays, suitable for four, 5.25-inch slots, one 3.5-inch floppy drive and one hard drive. Other standard features include dual Ultra Wide SCSI channels, two serial ports, one parallel port and 10/100BaseT Ethernet interface. Options include up to 2 GB of RAM, 80 GB+ of hard disk storage and Asynchronous Transfer Mode (ATM) support.

Tatung also offers the Solaris Server Intranet Extension package. Intranet Extension is a software suite designed to monitor system performance and provide remote connectivity, security management, network services and systems management. It includes multiple network service software products, including Sun Microsystems Inc.'s WebServer 1.0, Solstice InternetMail Server, Java Interface Definition Language (IDL) and Solstice NFS Client and Syntax Inc.'s TotalNET Advanced Server (TAS). Systems management tools include Solstice AdminSuite, Solstice DiskSuite, Solstice AutoClient and Solaris Data Backup Utility. Solaris 7 is an option.

Pricing for COMPstation Model 4360 starts at $38,290.

Tatung Science & Technology Inc.
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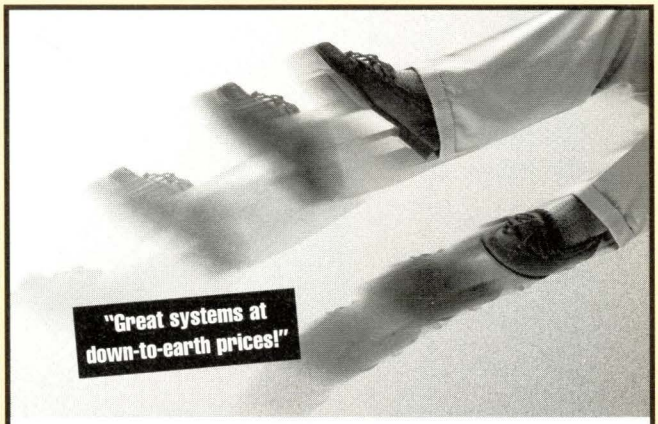

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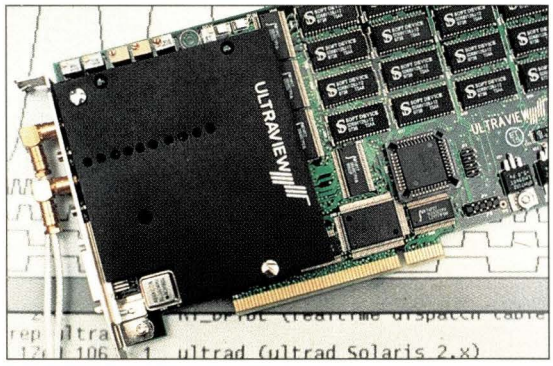

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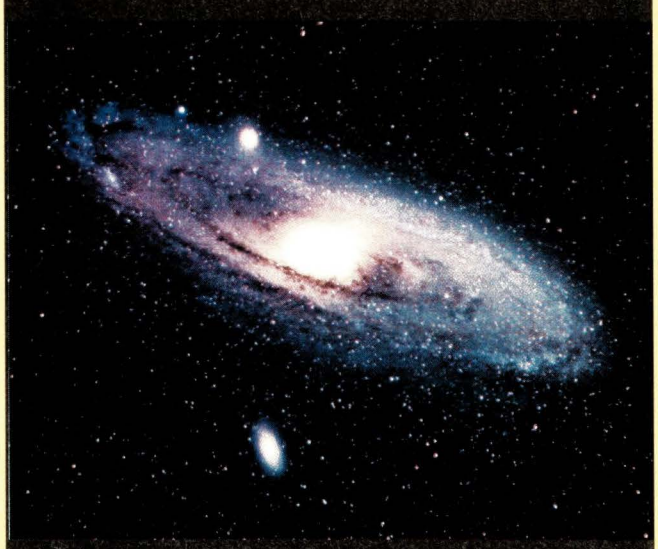

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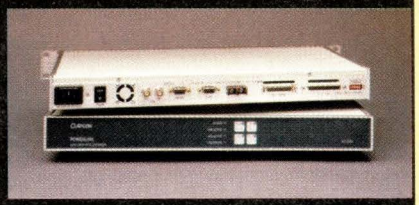

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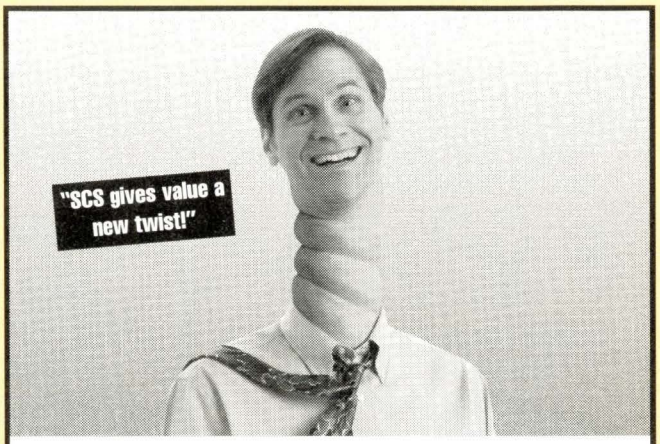

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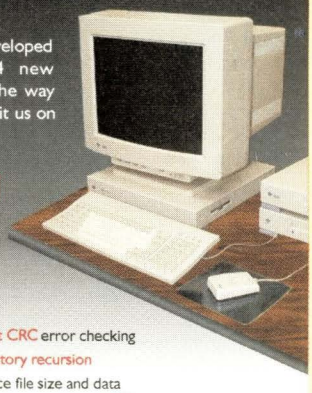

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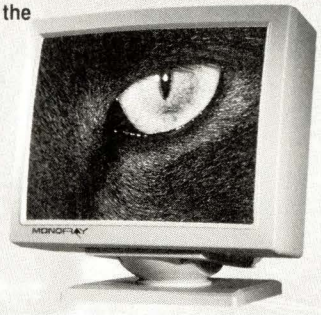

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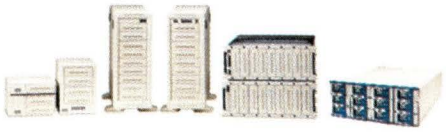

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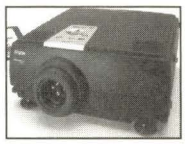

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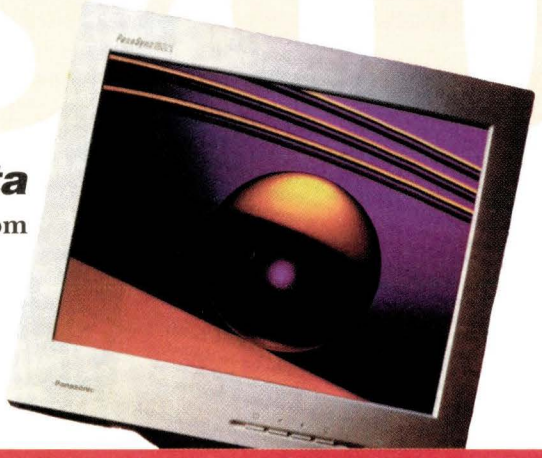

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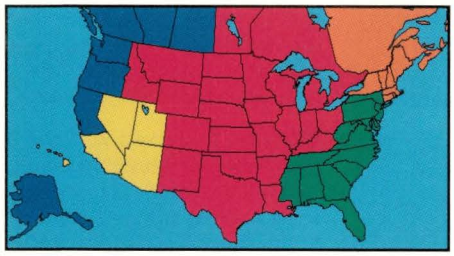

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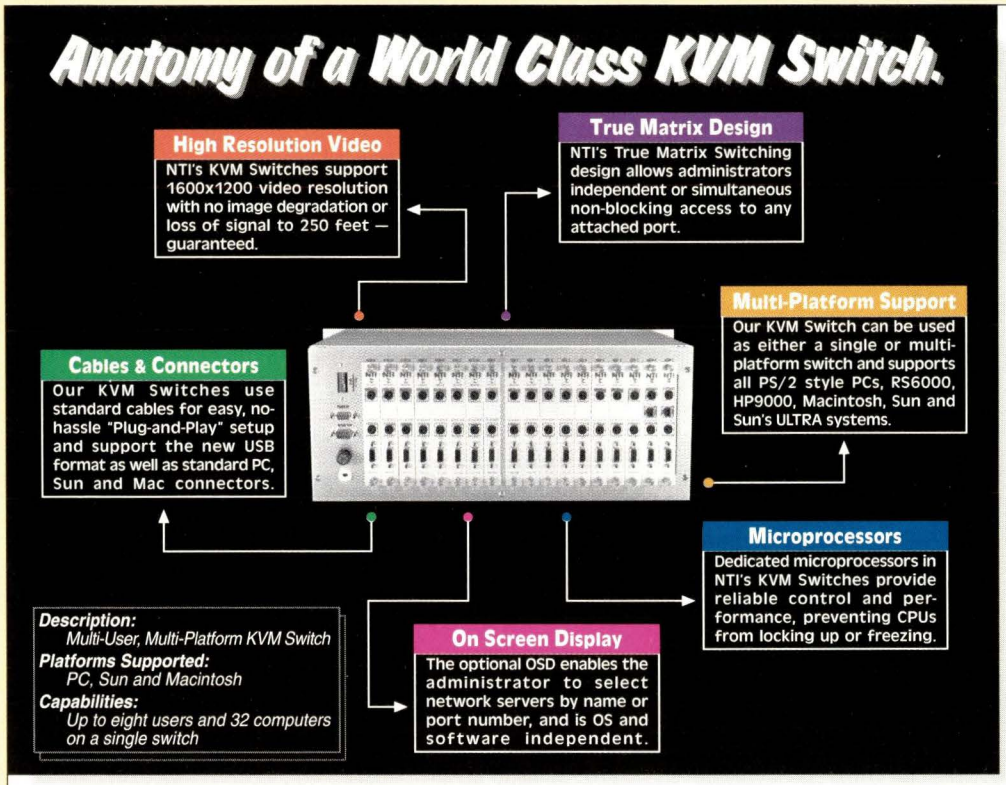

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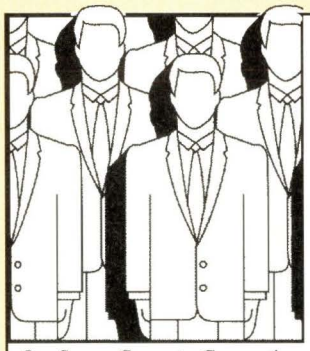

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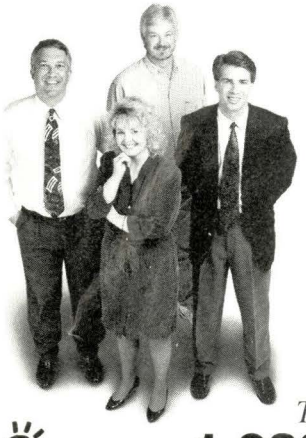

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