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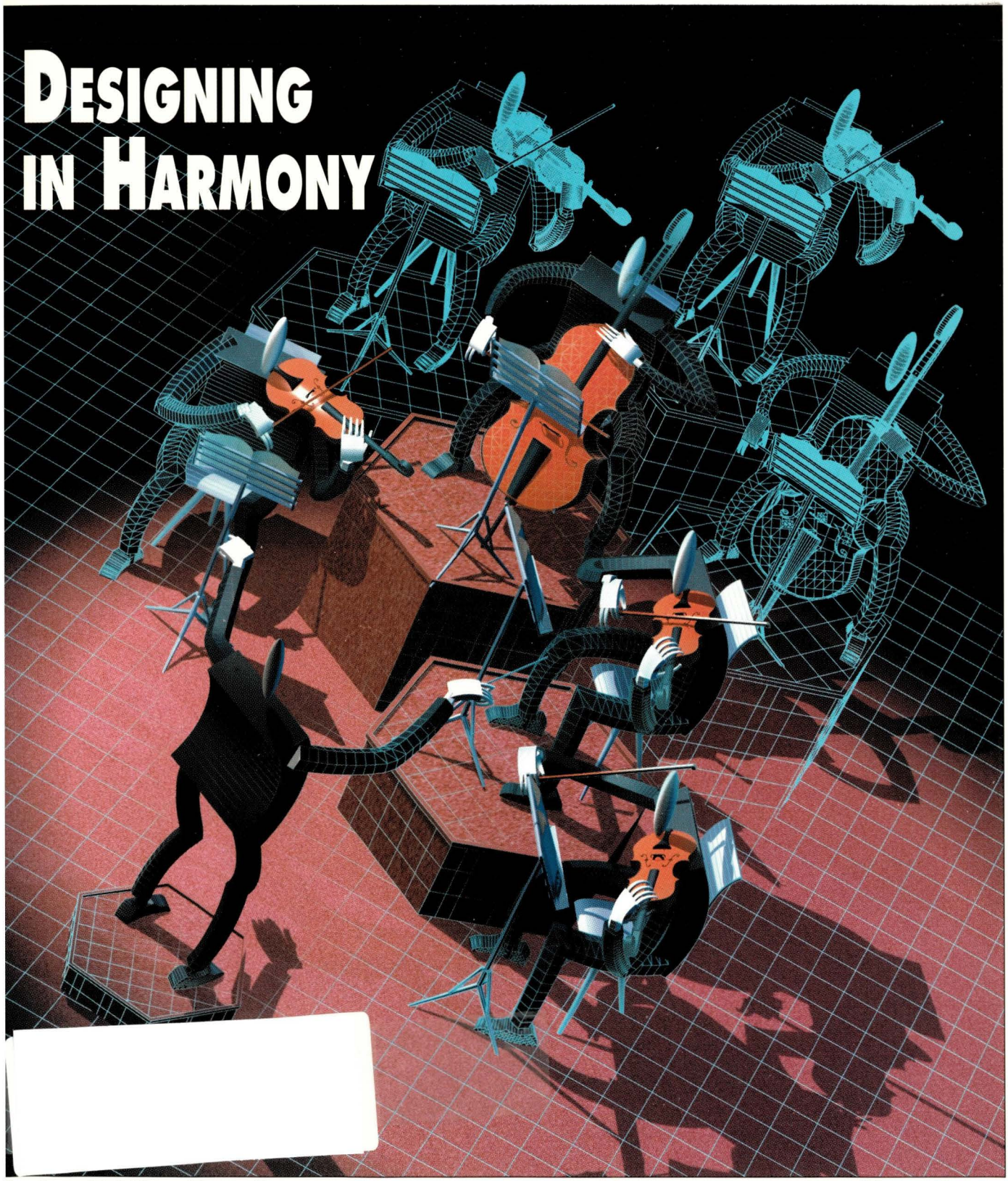

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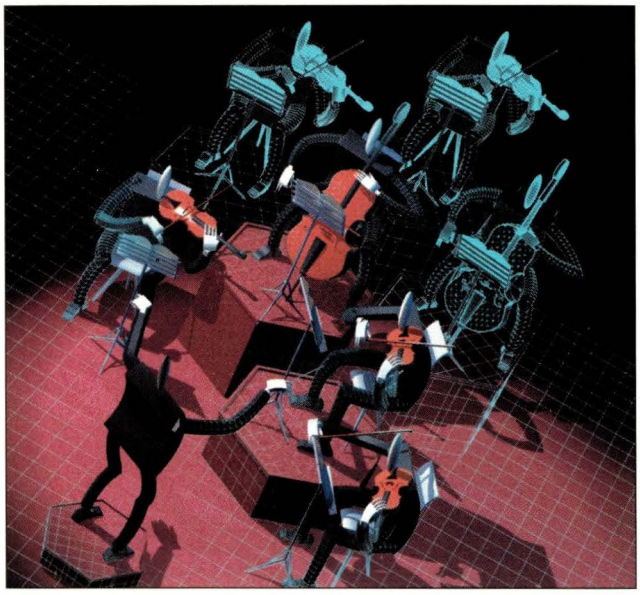

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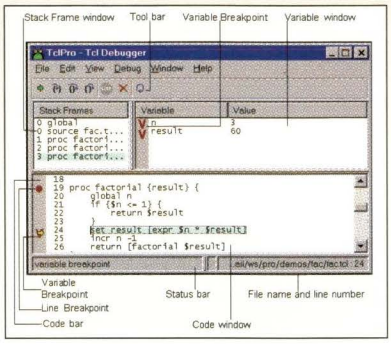

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64 Making the Outsourcing Decision

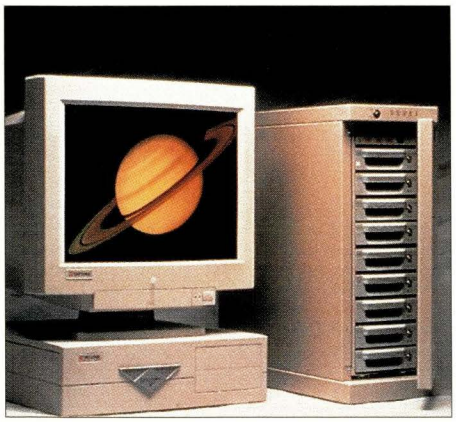
by Paul Korzeniowski

Web site hosting is no easy task, especially when staff, business partners and customers demand 100% uptime. And, for most companies, the decision whether to outsource or keep in-house isn't any easier.

Illustration by **ERIN TERRY**

69 URL/New Products

New products, services and resources for the World Wide Web market.



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EDITORIAL

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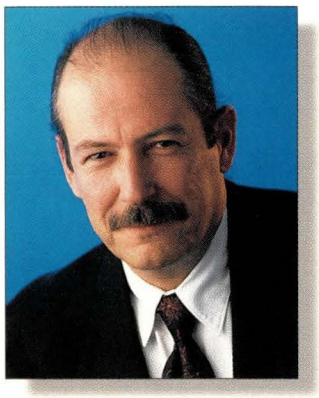

The Name Game

The philosopher in pinstripes, Yogi Berra, once said, "you can observe a lot just by watching." If you've read this column even infrequently, you know that I'm an admirer of the wit and wisdom of one of the best Yankee catchers of all time. This month's cover story, "Designing in Harmony," by Staff Editor Patrick Coleman, Page 54, reflects Yogi's point. Pat takes a long look at the CAD/CAM market. Once upon a time not long ago, when someone said "design workstation" you knew the machine was a UNIX box. "Today, engineers regularly switch among CAD software, office productivity applications and ERP systems. In light of this, NT vendors have made inroads with companies attempting to standardize on a single platform. In many cases, these companies have chosen NT because it makes office productivity applications available to the entire company," Pat discovered. Even AutoCad is no longer supporting Solaris. Things have really changed in the UNIX market in the past 10 years.

That's why *SunExpert* has continued to adapt to the changing environment as UNIX has become an infrastructure IT operating system as opposed to an engineering/scientific curio. Because it dominates the server side of the Web, we've added a Web-oriented supplement. Because UNIX servers have to coexist with NT, we've added a column devoted to UNIX/NT integration. Because Sun Microsystems Inc. and other vendors have adopted Java as a strategic language for information system development, we've launched a Java column. Our coverage has embraced a wide mix of server/workstation issues and will continue to do so. One change you'll notice, if you haven't already, is the cover. Take a look. See anything different? The name of the magazine is now *Server/Workstation Expert–S/W Expert*, for short.

Why would we change the name? "When you come to a fork in the road, take it," said Yogi, an inspiration to us all. We constantly monitor the demographics of our readership to stay in touch with how your job evolves. As part of the process, we discovered that 26.2% of you are responsible for AIX machines, 39% work with HP-UX, another 39% run Linux, 17% maintain Digital UNIX, more than 20% spend time with SGI IRIX and a whopping 96% work with NT-based servers. The name seems appropriate for the content.

It simply reflects what's been going on under the covers for the past two years. We will not be changing our dedication to covering UNIX, so expect *Server/Workstation Expert* to maintain its commitment to providing the hands-on IT information you need. Let us know when we stray from our mission.

Doug Pryor

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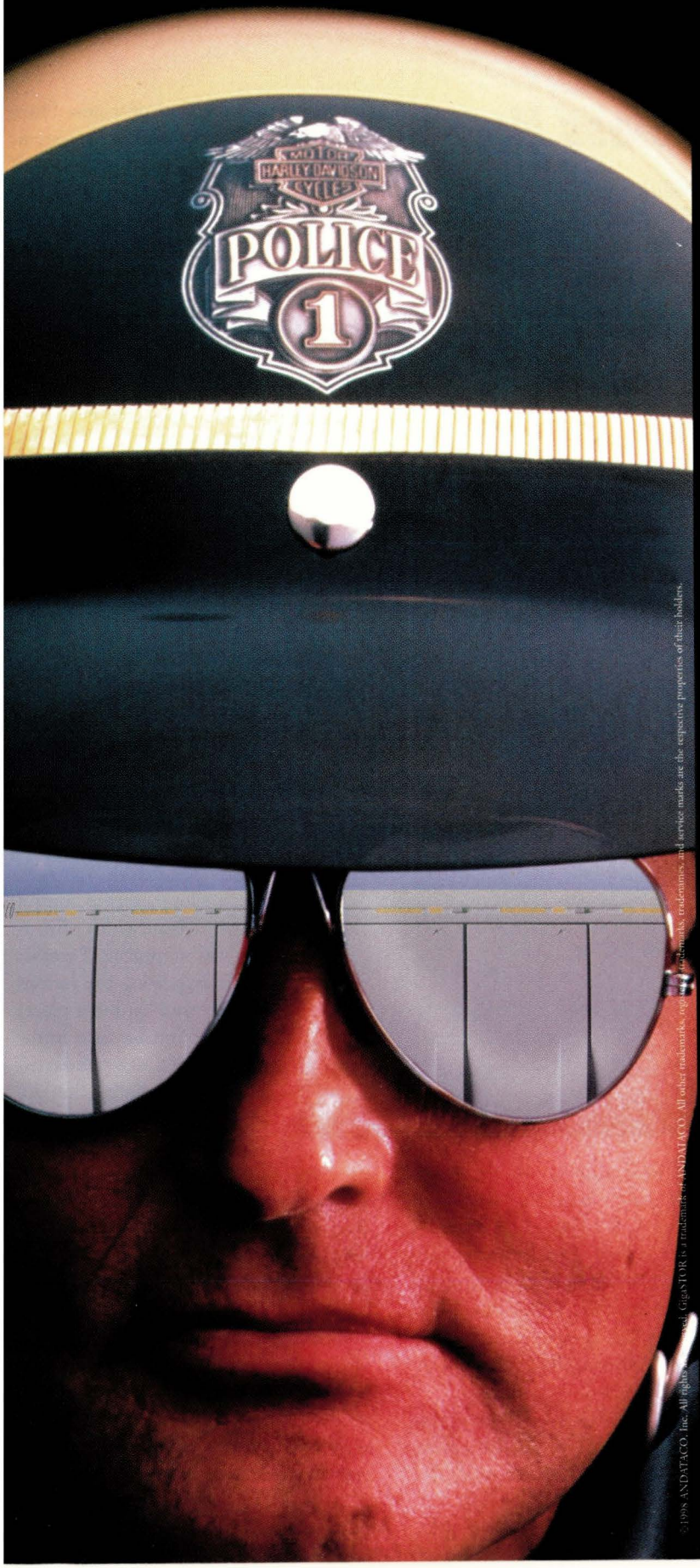

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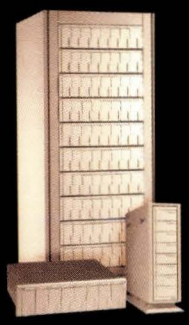

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Sun Shines into the Glass House

Sun Microsystems Inc. aims to play a major role in the data center. To accomplish this, the company has released several new products and services. Introduced in February under the "datacenter.com" initiative, Sun unveiled enhancements to its Enterprise server line, updated its clustering software and added new technology to its StorEdge product line. Furthermore, Sun believes it now has the technology to open the stable and reliable environment of the data center to the extended enviroment of the Internet.

"The data center has had to deal with a perplexing IT conundrum," says Masood Jabbar, president of computer systems at Sun. "[That is] how to take advantage of the power of the Internet without compromising the discipline, rigor and predictability that are key to running a data center."

Data centers have long been a stronghold for the mainframe. Machines like the IBM Corp. S/390 have traditionally powered corporate data centers, hosting legacy applications and mission-critical data. Sun says its enhanced Enterprise server line is capable of servicing these needs. While the company is clearly moving in on the mainframe's turf, neither Sun nor industry pundits see this as a replacement for big iron. Rather, Sun says it is providing a platform that has both the strength of the mainframe and the capability of running newer applications designed for the Internet and enterprise resource planning (ERP) systems.

"It is a mainframe alternative," says Dan Dolan, industry analyst for market research firm, Dataquest Inc., San Jose, CA. "Sun has been able to bring down the reliability, availability and scalability (RAS) that the mainframe has through the Ultra Enterprise line."

Some of the features that Sun has been working on to achieve these RAS capabilities include dynamic domain partitioning on the Enterprise 10000 Starfire system, as well as enhanced clustering capabilities and built-in system redundancy.

Of the data center-related announcements, perhaps the most noteworthy is the introduction of 400-MHz Ultra-SPARC-II processors across the entire Enterprise server line. Sun had been shipping a 336-MHz chip with its Enterprise servers. The company also unveiled a 100-MHz Gigaplane interconnect for Starfire. Called the Gigaplane-XB, it is designed to handle transaction processing, data warehousing and file serving tasks.

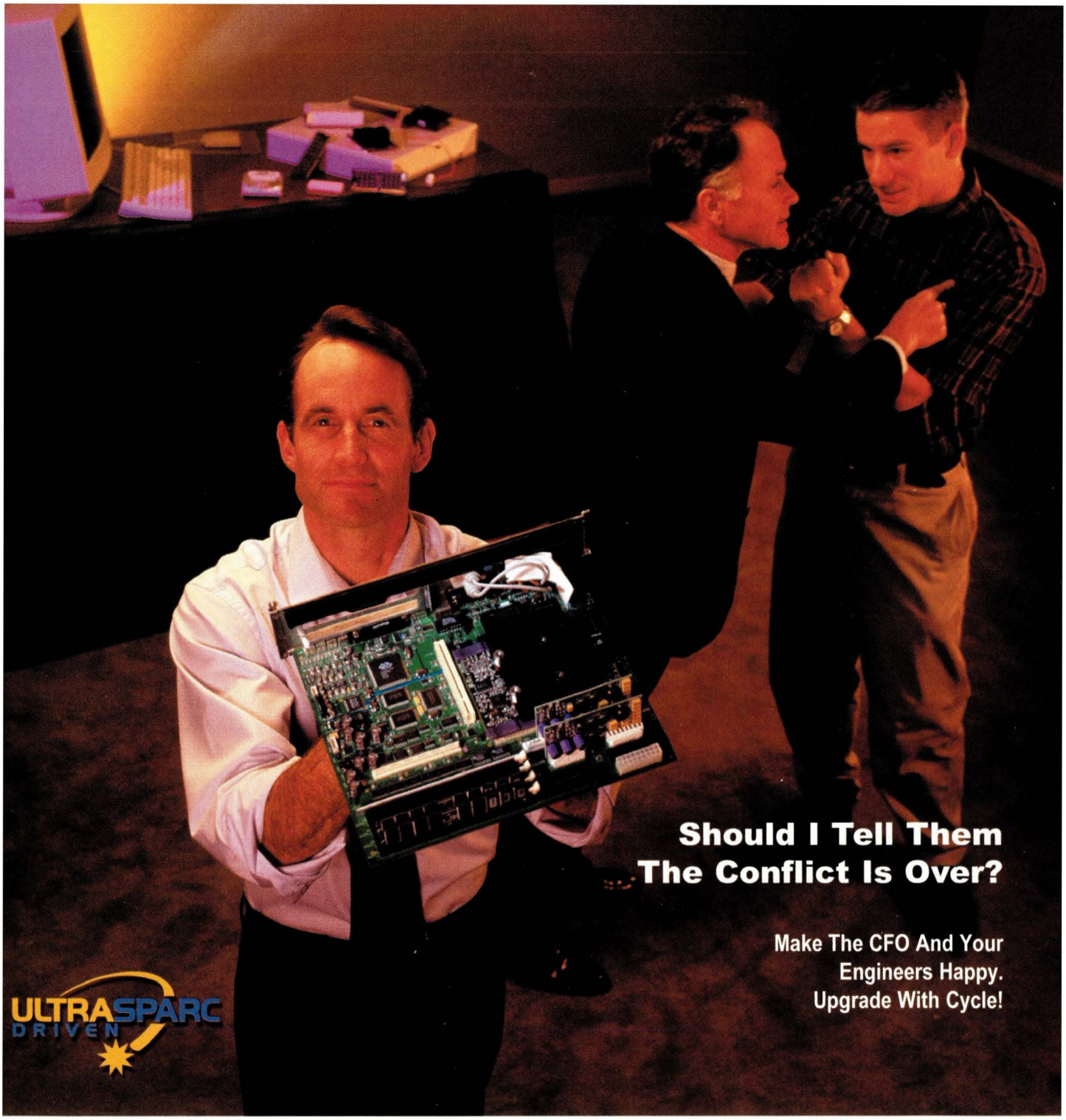
Improved RAS capabilities now available on the Enterprise 10000 Starfire system (above) are some of the features Sun has been developing as part of its push into the data center arena.

Another major piece of Sun's data center vision involves the StorEdge product line, which has been expanded with the introduction of a new Fibre Channel-based disk drive array system, called the A5200. The system houses 22 9.1-GB drives, capable of 10,000 RPM, and holds 200 GB of data. In addition, Sun is offering a robotic tape backup system that holds up to 11.8 TB and stores data at 266 GB/hour.

In the software arena, Sun has introduced Sun Cluster 2.2, a new version of its clustering software. The Sun Cluster software offers 64-bit support and four-node clustering capabilities. It comes with a Java-based management utility and runs with database software from IBM, Informix Corp., Oracle Corp. and Sybase Inc., as well as other applications, such as Lotus Development Corp. Notes and Netscape Communications Corp. servers.

Sun also announced Solaris Resource Manager, which allows users to simultaneously run multiple applications on a single server while allocating resources within a single domain, and Solaris Bandwidth Manager, which allows users to control network bandwidth allocation and to regulate IP traffic.

To help bring the various software and hardware pieces together, Sun has also introduced several new contractual services, including SunUp, which addresses application availability and predictability; SunVIP, a multivendor integration program designed to resolve compatibility problems between Sun and independent software vendor (ISV) products; Sun Microsystems Finance, which includes a leasing program backed by General Electric Capital Services and offers financing programs for Sun products and services; and Mainframe Affinity Center, which tests and validates systems that mix Sun products with mainframe environments.



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"They are bringing everything together," says Dataquest's Dolan. "Not only do they have the platforms, they have the operating systems and the common architecture running through the whole server line. They also have their relationship with GE Capital. That's huge. Now there is a central point worldwide to get leasing capabilities."

"To be a tier-one player, these were the steps Sun had to make," he says.–*ptc*

The Software Side of Sun

When Sun Microsystems Inc. first announced its planned merger with NetDynamics Inc. last July, there was skepticism on the part of industry analysts that a company known for its hardware business would be able to successfully enact a software strategy. Now, with the release of NetDynamics 5, Sun has taken the first steps to prove to cynics that it can deliver major software products.

"Sun has done a remarkable job in getting NetDynamics integrated and coming out with a new version," says Dave Kelly, vice president of application strategies at Hurwitz Group Inc., a Framingham, MA-based technology research firm. "This is a good step for Sun in offering software."

Priced starting at $25,000, Sun is positioning the NetDynamics 5 Web application server as the foundation of its software business. "NetDynamics is the core of the Sun enterprise software strategy," says Zack Rinat, vice president for NetDynamics at Sun. "A lot of people had doubts about Sun's ability to execute on mergers and to execute on software strategy, but here we are with the biggest release in the history of NetDynamics. This should be an indication of a turning point for Sun in terms of execution, commitment and urgency around software."

In addition to questions about Sun's software strategy, there has been speculation concerning the company's commitment to NetDynamics in light of its recent licensing deal with America Online Inc. (AOL) and the products AOL acquired from Netscape Communications Corp. The topic that is attracting the most attention is what will happen to Netscape Application Server, which competes directly with NetDynamics. The AOL/Netscape merger had not been finalized at press time, so Sun was unable to comment on its plans.

Nonetheless, Sun has not wavered in its promise to invest in and promote NetDynamics. Anne Thomas, senior consultant for Boston, MA-based research firm Patricia Seybold Group, believes strongly that Sun will continue to push NetDynamics as its Web application server despite the agreement to license AOL/Netscape products. "I'm not convinced that Sun's salespeople are going to be selling Netscape Application Server over NetDynamics," she says.

Clearly, the NetDynamics 5 release demonstrates Sun's commitment to the product line. Key improvements made to NetDynamics center around scalability and integration. NetDynamics uses a Common Object Request Broker Architecture (CORBA) to enable users to scale across multiple machines and processors.

Sun, Oracle Offer Raw Deal

Oracle Corp. has selected Sun Microsystems Inc. Solaris as the operating system kernel for its planned database appliance server, code-named "Raw Iron." In turn, Sun is permitted to combine components of the Oracle 8i database with Solaris. "We are doing a free exchange of core technologies, including source and binary, to each other," says Sun Chief Executive Officer Scott McNealy. "Both companies are very excited about receiving value back through functionality added to their respective products."

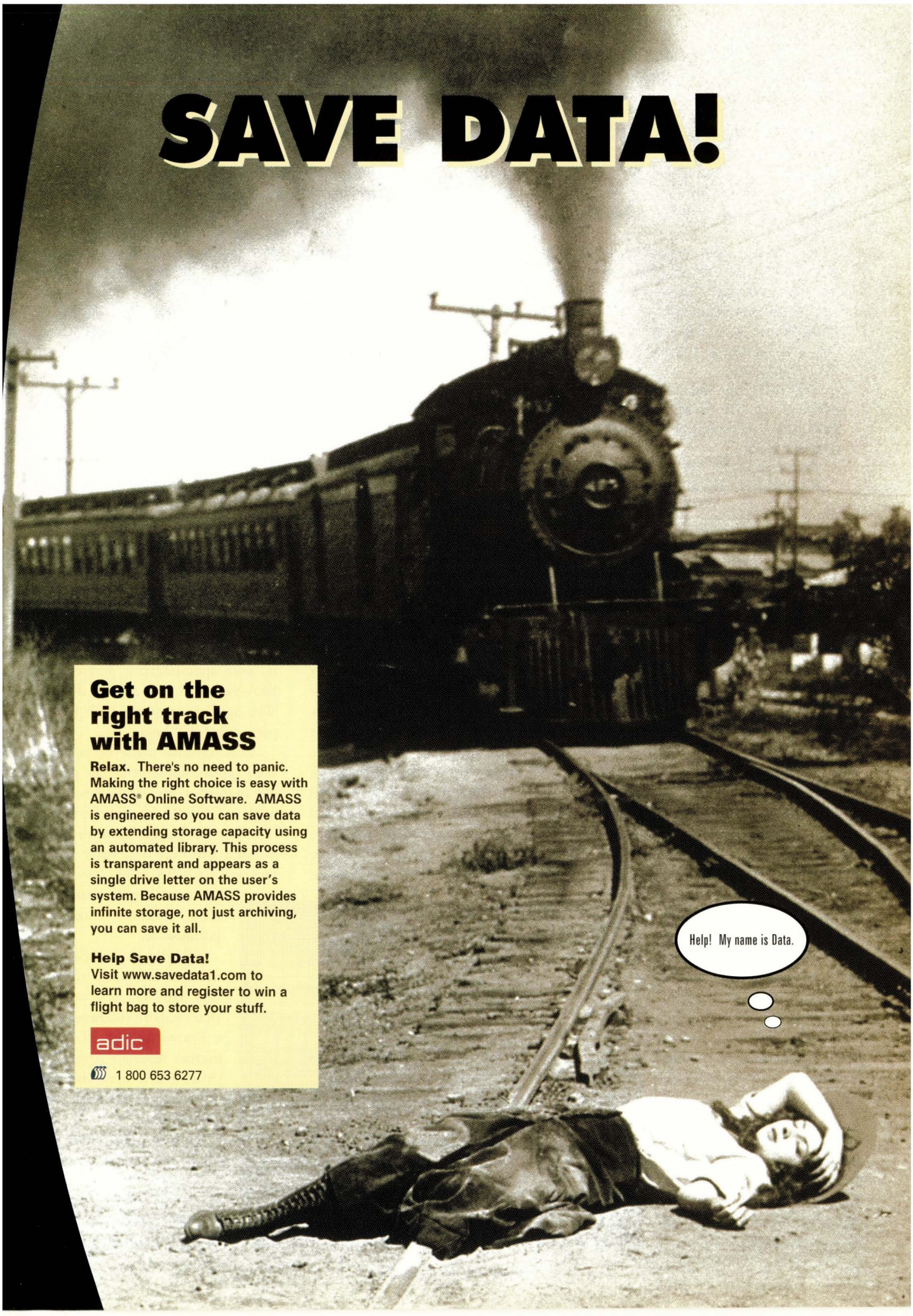
Raw Iron is a preconfigured database appliance. The design will keep the operating system invisible to users. Oracle aims to free its software from being dependent on any one operating system–specifically, Windows NT-based operating systems. "There is clearly an anti-Microsoft agenda," says Dwight Davis, analyst with Summit Strategies Inc., a Boston, MA-based market analysis firm. "Oracle positions its rhetoric against NT and makes the case that there are a lot of people out there that wish they didn't even have to think about operating systems."

The database appliance server will be based on the Oracle 8i Internet database and both products will be made available sometime mid-year. Oracle 8i will reportedly offer operating system-type features, such as file system and directory services. In the Raw Iron bundle, a stripped-down version of Solaris will primarily provide interfaces for the database, disk subsystems and I/O network.

Oracle Chief Executive Officer Larry Ellison praised Solaris for its 64-bit capability while also highlighting limitations in Windows. "Not only does Sun Solaris run brilliantly on SPARC, it also runs brilliantly on the Intel hardware. And as Intel delivers its new 64-bit technology, we need an operating system that takes full advantage of that hardware," Ellison says. "Unfortunately, Windows 2000, otherwise known as Windows NT 5.0 and not available until the year 2000, really turns that 64-bit Intel hardware into 32-bit Intel hardware. And we just don't have time to wait for Windows 3000."

The deal is nonexclusive, leaving the door open for Raw Iron implementations based on other operating system kernels. Speculation among industry watchers is that Hewlett-Packard Co. HP-UX could be offered in a future version of the database appliance server. HP and Dell Computer Corp. have agreed to sell the Oracle 8i appliance and it's expected that Compaq Computer Corp. and IBM Corp. will reach a similar agreement.

Raw Iron is scheduled to ship in both four- and eight-way symmetric multiprocessing (SMP) configurations. The initial release will not support clustering, but future versions will support Solaris-based clustering. A fully functional license of Solaris is available from Sun for $599.–*ptc*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Sun, IBM Cut Server/Workstation Prices

Customers shopping for UNIX workstations and servers may want to take advantage of the hardware discounts currently being offered by Sun Microsystems Inc. and IBM Corp.

In February, IBM announced price reductions on its RS/6000 F40 and F50 UNIX servers to appeal to small and mid-size businesses. The new prices are $9,900 for a one-way 233-MHz RS/6000 F40, $13,900 for a one-way 166-MHz RS/6000 F50 and $18,900 for a one-way 332-MHz RS/6000 F50. That represents a decrease in price of 29%, 30% and 21%, respectively.

Meanwhile, Sun announced in January that it has dropped prices on its Ultra 60 and Ultra 2 workstations, and on its Enterprise 2, Enterprise 250 and Enterprise 450 servers, by as much as 35%.

A sampling of the new prices are as follows:

- An Ultra 60 Model 1360 configured with one 360-MHz UltraSPARC-II chip, 128 MB of memory, 9-GB hard drive, 4-MB cache and Creator3D graphics now costs $9,995–down 26% from $13,595.
- An Ultra 60 Model 2360 workstation configured with two 360-MHz UltraSPARC-II processors, 256 MB of memory, 9-GB hard drive, 4-MB cache and Creator3D graphics is now priced at $13,595–down 35% from $20,870.
- A Sun Enterprise 250 server with one 250-MHz UltraSPARC-II chip, 128 MB of memory, 4-GB hard drive and 1-MB cache has dropped from $9,995 to $7,995.
- A Sun Enterprise 2 Model 2300 with two 300-MHz UltraSPARC-II chips, 512 MB of memory, 9-GB hard drive and 2-MB cache has dropped from $26,245 to $16,975–a decrease of 35%.
- A Sun Enterprise 450 server with one 300-MHz UltraSPARC-II chip, 128 MB of memory, 4-GB hard drive and 2-MB cache–previously $19,735–now costs $17,235.–*sjh*

Several features have been built around the architecture to provide fail-over load-balancing capabilities.

"We can continue to provide service with no single point of failure," says Charles Beckham, technical marketing manager for NetDynamics at Sun. "We can cluster across multiple machines, and if one of the machines goes down, everything will automatically route to another machine."

In addition, NetDynamics now employs Platform Adapter Component (PAC) technology. PACs are designed to wrap around software components, which can then be plugged into a Web application environment. Sun offers PACs for Component Object Model (COM), CORBA, SAP R/3 and OS/400, among others. In addition, if a user wishes to build custom PACs, Sun offers a series of development tools that create Java or C++ shells. The newly created PACs can then connect to the NetDynamics server via an external system.

"With PAC, we enable you to use components across multiple applications," says Rinat. "We give you a context where you can plug in CORBA objects, COM objects and EJB [Enterprise JavaBeans] objects and they can talk to each other."

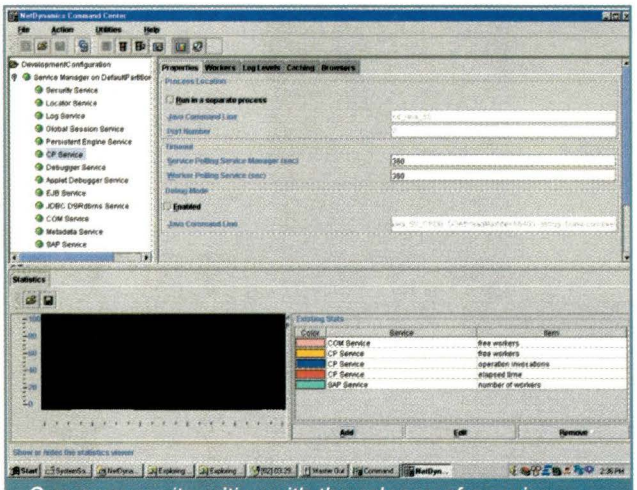
Hurwitz Group's Kelly says the PAC technology is fine for now, but it's important for Sun to continue to work on integration features. "PAC is a good first step," he says. "They need additional integration capabilities, whether these are integration adapters into packaged applications or legacy applications. Some of this technology might come out of Netscape."

NetDynamics 5 also implements Sun's own Enterprise JavaBeans 1.0 specification. The coupling of EJB and PAC allows fine-grained objects from universal databases, enterprise resource planning (ERP) systems and foreign component models to be integrated into the NetDynamics implementation as EJB components. This is a significant step forward for the product. Now that NetDynamics is part of Sun, it's important that the company supports its own specification. For example, BEA Systems Inc. is already shipping a Web application server with EJB support, called WebLogic.

BEA has also made news with its Web application servers. The company has merged a Java application server with a CORBA application server to create WebLogic Enterprise. The melded product will fully support Java and CORBA, while also running the core engine that powers BEA Tuxedo transaction middleware.

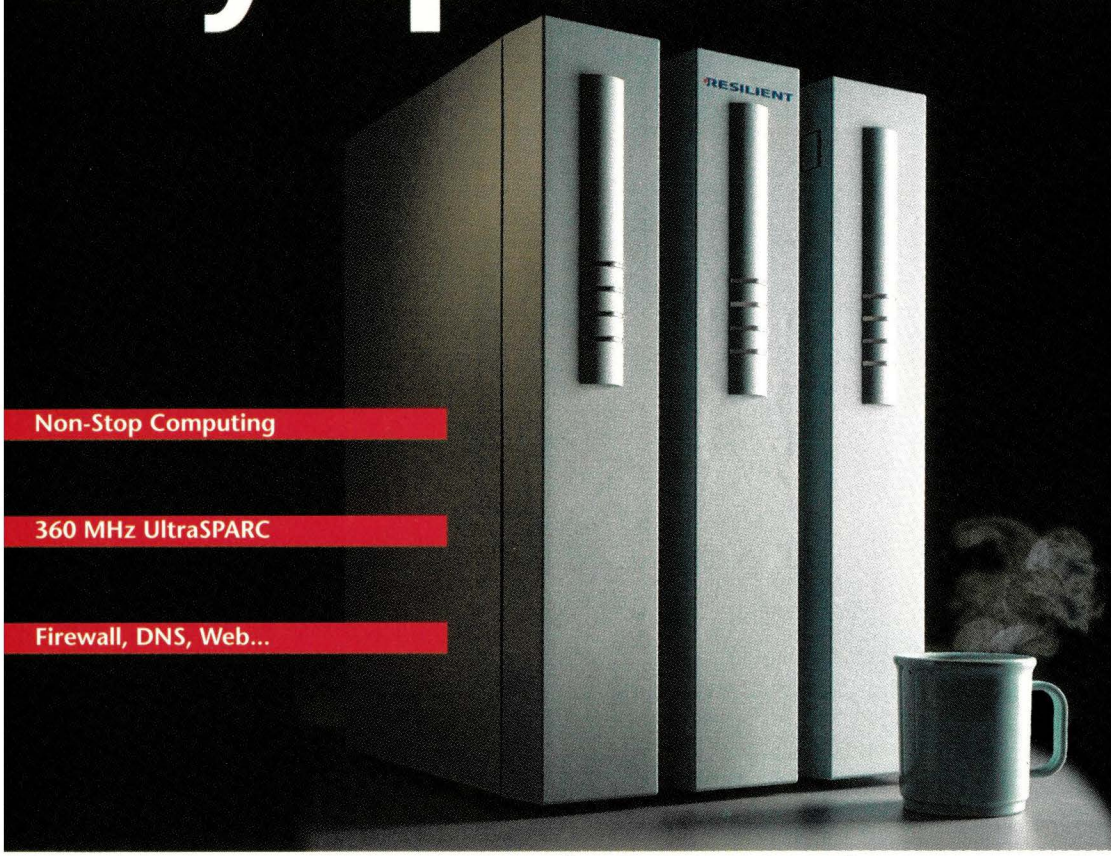
"Right now, [Sun] has more of the pieces together," says Sally Cusack, analyst at International Data Corp., a Framingham, MA-based market research firm. "But I think BEA, with the power of Tuxedo, will be tough competition."

Hurwitz's Kelly adds, "Most [Web application servers] are in a comparable phase of their life, where they're focusing on scalability and support for EJB component models. BEA has



Sun answers its critics with the release of a major software product, NetDynamics 5.

When it absolutely positively has to stay up all the time.



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had strong support for EJB. Sun has added that with the 5 version. Overall, they compare favorably."

Now, the industry is waiting to hear what will become of the Netscape Application Server.–*ptc*

Enterprise Server Goes Visual

Sun Microsytems Inc. has unveiled its Enterprise 3D system–a combination of two graphics subsystems and the company's Enterprise server line. Sun has intertwined Creator3D and Elite3D m6 graphics cards with the Sun Enterprise 3500 through 6500 series of servers. This combination marks the company's first foray into a new market.

"We're launching into the high-performance visual computing market space," says Will Shelton, product marketing manager for Sun's workstation products group. "There is a need in this market for visualization simulation."

The Sun Enterprise 3D system provides multipipeline and multiple frame buffer support, allowing up to eight graphics cards on the same system. The multiple frame buffers offer improved capabilities for the projection of high-resolution displays. This is ideal for large design reviews held in theater settings, Sun says.

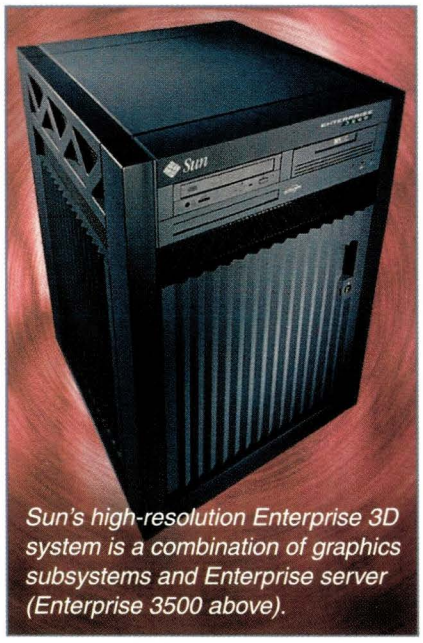
"This allows you to take the performance of each frame buffer and basically confine it to a [single] pipeline or a portion of the image," Shelton says. "That allows you to have higher resolution."

Although Sun's visualization system offers the scalability of its Enterprise servers, some industry watchers believe the offering is not yet at the same level as other visualization systems, such as Hewlett-Packard Co. HP Visualize and Silicon Graphics Inc. InfiniteReality.

"It's their first strike at the market," says David Witzel, research analyst with D.H. Brown Associates Inc., a technology consulting firm based in Port Chester, NY. "They've got a good solution, it just needs to be refined now to take advantage of the customer base that would want the same exact product that HP and SGI are currently offering."

In particular, one of the refinements Witzel suggests would be in the graphics subsystem of the Elite3D m6. "It's not the [HP] Visualize FX6," Witzel says. "The Sun Elite3D m6 is a little bit behind HP in terms of raw power."

In addition to a high-resolution display, the new Sun Enterprise 3D system is designed to handle applications with heavy computational analysis, such as automobile crash test programs or airflow simulations on the body of a car.



Sun's high-resolution Enterprise 3D system is a combination of graphics subsystems and Enterprise server (Enterprise 3500 above).

The new Enterprise 3D system can scale up to 16 processors with eight Elite3D graphics cards. This is significant because HP Visualization systems currently house only six graphics cards. Pricing for a Sun Enterprise 3500 server with Creator3D graphics starts at $49,995, and prices for Sun Elite3D configurations begin at $53,794.–*ptc*

An Interface of One's Own

Java's claim to fame has always been its platform and device independence, which Sun Microsystems Inc. says allows it to run on just about anything that has a chip, from the biggest enterprise servers, to the smallest consumer smart cards.

But when it comes to GUIs, Java's platform independence hasn't always had a lot of punch. Traditionally, developers wanting to tack a GUI onto their Java applications have had to rely on the Java Abstract Windowing Toolkit, or AWT, which maps each GUI element (button, scroll bar, etc.) to the platform's native graphics toolset, whether it be Win32 or Motif under UNIX.

And while that might be an acceptable solution for a desktop application, if your application is slated for a consumer device such as a Web phone, the AWT approach won't do you a lot of good because many of the embedded operating systems these devices rely on don't come with user interface toolkits.

Sun has proposed a cure for this problem with the February release of PersonalJava 3.0, the Java platform intended for networkable consumer devices such as personal digital assistants (PDAs). Among other features, PersonalJava 3.0 includes the Truffle graphical toolkit, which comprises a windowing system and a set of Pure Java widgets. In other words, the AWT no longer maps to the native graphics toolset because the peer set is written directly in Java. Truffle, therefore, allows device manufacturers to bypass native graphical toolsets and instead deploy their own, customized user interfaces. Along with a customized look and feel, developers also get greater ease of implementation and a smaller footprint, Sun says.

In the world of embedded device manufacturers, a customizable GUI is a big deal, says Lynette Liu, senior product manager for Sun's consumer and embedded products division. "In the consumer space, graphics toolsets [from other vendors] are not appropriate," says Liu, because for branding and marketing reasons, most vendors want to establish their own look and feel.

Also new in PersonalJava 3.0 are improved debugging facilities provided by the Java Virtual Machine Debugging Interface (JVMDI) and the JVM Profiling Interface (JVMPI).

PersonalJava 3.0 is one of the first products–along with EmbeddedJava 1.0, announced in January–to fall under the umbrella of Sun's source community licensing model, initiated as a way to appease Java licensees in the embedded space who were requesting more say over the direction Java took in their market.

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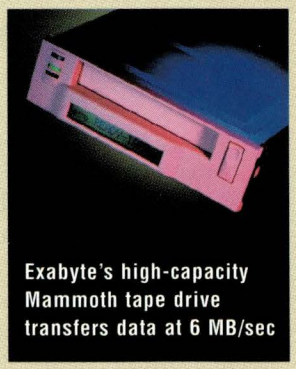

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Under this licensing model, Java licensees may access source code for development purposes at no charge. Sun will continue to charge royalties on commercial Java products.

The source community licensing model is certainly "a step in the right direction," says Ray Alderman, president of the Embedded Software Association, Scottsdale, AZ, but in the long run, it's kind of like "kissing your sister–there's no pleasure in it." By refusing to give up potential royalties, Sun is betting that "Java is technically good enough that [embedded device manufacturers] will pay the buck," Alderman says.

But then again, Sun's source community licensing model might not be enough to bait embedded device manufacturers who play in a high-volume, low-margin market. "In this market, having to pay royalties is like getting a large bucket of cold water dumped on your head," Alderman says.

To that effect, other embedded operating system vendors such as Cygnus Solutions, Sunnyvale, CA, and Microware Systems Corp., Des Moines, IA, simply give away their kernels and make money selling tools and service contracts. Whether or not the benefits Java brings to the table are enough to outweigh the downside of paying royalties is something "the market will eventually decide," Alderman says.–*ab*

Tune In to Java TV

We all know that TV shows such as "Star Trek" and "Buffy the Vampire Slayer" are especially popular among computer engineers, but if Sun Microsystems Inc. has its way, they'll soon be tuning in to Java TV instead.

No, Java TV is not an animated show documenting the adventures of Duke, the programming language's penguin mascot. Rather, Java TV is an API designed to help electronics manufacturers deliver digital television (DTV) applications such as video-on-demand, electronic programming guides and interactive multicamera sporting events through devices such as set-top boxes, satellite receivers and digital televisions.

Announced in April 1998 at the Java ONE conference in San Francisco, CA, the Java TV API was recently embraced by a number of key players in the DTV industry, including manufacturers such as Koninklijke Philips Electronics N.V., Amsterdam; Sony Corp., Tokyo; Matsushita Electric Corporation of America, Secaucus, NJ; and Motorola Inc., Schaumburg, IL. DTV service providers like Hongkong Telecom IMS and LG Electronics, Princeton, NJ, and digital television software providers, such as OpenTV Inc., Mountain View, CA, also announced their support.

Besides enabling DTV applications, the Java TV API will give developers the means to access television hardware, for example, tuner control for changing channels and on-screen graphics.

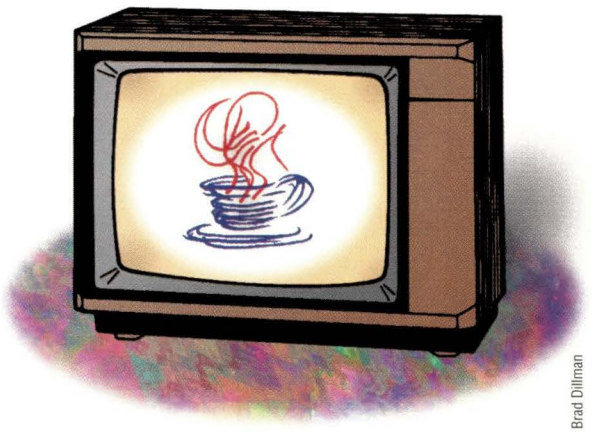
While a number of leading DTV players have backed the Java TV initiative, the announcement only registers as a "good first step" for Java TV's future, says Tim Bajarin, president of Creative Strategies Inc., an analyst firm based in Campbell, CA. Java is a good fit for DTV, says Bajarin, but "its potential will only be filled if Sun can get the right kind of partnerships." Already, Sun is facing competition from Microsoft Corp. Windows CE, of which cable giant Tele-Communications Inc., Englewood, CO, has licenced 5 million copies for use in set-top boxes.

Also, several critical DTV vendors belong to the Advanced Television Enhancement Forum (ATVEF), which relies heavily on Web technologies such as HTTP and JavaScript. Founding members of ATVEF include hardware vendors Intel Corp., Microsoft and Network Computer Inc.; television companies such as CNN, NBC and The Walt Disney Company; and transport and consumer electronics companies like DirectTV Inc. and the aforementioned Sony.

However, Sun sees ATVEF's focus on Web-centric services for the television as misguided. "Digital television is not about doing more work on the television–that's what computers are for–it's about promoting a new television paradigm," says Eric Chu, manager of strategic markets for Sun's consumer and embedded products division.

But, says Ron Rappaport, Internet industry analyst with Zona Research Inc., Redwood City, CA, "manufacturers are not about to put all their chips in one spec. The future is still much too obscure."

Indeed, many questions about the future of digital television–and, therefore, of Java TV–still loom large in industry observers' eyes. For example, analysts see a potential problem with DTV hardware, which, like most computers, will require processor upgrades approximately every 18 months. But Creative Strategies' Bajarin doubts consumers will be willing to change digital television sets that often. "These days, when consumers buy a television, they tend to keep it around for at least seven years," says Bajarin. "If you're paying between $1,000 and $2,000 for a big-screen television, that thing had better stay around for a while." The consumer market, Bajarin explains, will not be as tolerant of the need for hardware upgrades as are "computer guys."



Brad Dillman

Nevertheless, Java TV is bringing Java back to its roots, even if the applications it will enable seem a bit futuristic. "We're finally going to get to see Java being used on devices, which is, after all, what it was created for," says Rappaport. "What this announcement does is give formal structure to a lot of vision coming out of Sun."

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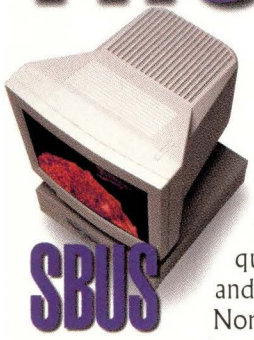

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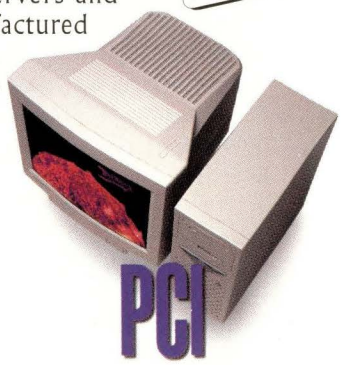

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begin to expect real DTV applications? Analysts remain unsure. "More than one year and less than five," offers Rappaport, adding, "I threw away my crystal ball years ago."–*ab*

Sun Elbows its Way into Telco Market

Sun Microsystems Inc. has always played heavily in the telecommunications space, but recent hardware and service announcements have raised Sun's standing in the market from that of young upstart to pending superpower.

In January, Sun staked its claim to the $110 billion telecommunications equipment market with announcements of telco grade servers and storage, partnerships with leading telco software providers, additional members for its Java Advanced Intelligent Networks (JAIN) initiative and service offerings for its network equipment provider (NEP) customers.

First and foremost, Sun announced a new telco-grade fault-tolerant server, the Netra ft 1800, designed for Intelligent Network (IN) and Advanced Intelligent Networks (AIN) telecom applications, such as signal control processing, emergency 911 and calling card authentication services.

The new server features dual four-processor 300-MHz UltraSPARC chipsets and 4 GB of memory.Expandability comes by way of an additional 16 PCI and 12 SCSI slots, as well as four CD and DAT slots. And as is required by all central office environments, the Netra ft 1800 is fault-tolerant, certified to Bellcore's Network Equipment Building Standard (NEBS) Level 3, which states that the Netra ft is impervious to any number of natural disasters.

And when you buy a Netra ft 1800 outfit from Sun, you can also buy the matching shoes and handbag. Sun-certified storage for the Netra ft 1800 includes the Netra st A1000/D1000 NEBS-certified storage arrays based on Sun's StorEdge product line. The arrays offer up to 108 GB of storage per array, with both AC and DC power options available. These RAID arrays also feature redundant hot-swappable power, fans and drives. In addition, Sun offers a PCI expansion cabinet for those users who find they don't have enough with the Netra ft's existing 16.

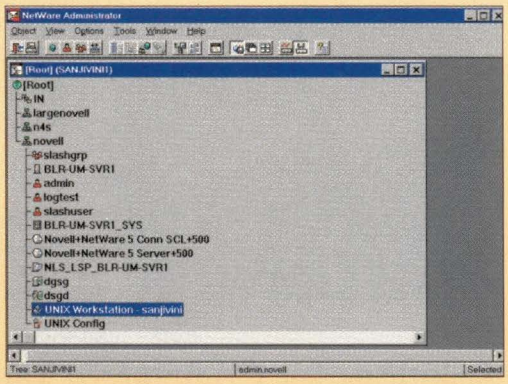
More fault-tolerant cards for the Netra ft will be made available in the coming months as Sun works with third-party PCI module vendors through its ftSAFE program to help them "ruggedize" their product offerings.

Also present at the Netra ft 1800 unveiling were new backers of Sun's JAIN initiative, including Bellcore, IBM Corp. and Trillium Digital Systems Inc., Los Angeles, CA. JAIN, a telecom industry framework based on the JavaBeans component architecture, aims to speed up the process of develop-

Novell Delivers Directory Services to Solaris

The release of NDS for Solaris 2.0 by Novell Inc. has loosened the ties between Novell Directory Services (NDS) and its network operating system, NetWare. NDS was designed specifically for NetWare, but owing to its popularity, the company has been creating additional platform support for the directory. Currently, NDS is available on NetWare 4 and 5, Windows NT, OS/390 and now Solaris 2.6. Novell promises support for Solaris 7 in a future release.

"The directory services decision was tied into the underlying operating system. So even if you liked NDS and the functions of it for management of other capabilities, it forced you to accept NetWare," says Richard Villars, director of network software research at International Data Corp., a Framingham, MA-based market research firm.



Owing to the popularity of NDS, Novell has extended its operating system support to now include Solaris.

But that has changed, to a degree. Although NDS supports Solaris, Novell does require that at least one NetWare 5 license is running somewhere on the network. "We store the master copy of the user account database on the NetWare 5 server and replicate that out to the Solaris machine," says Paul Corriveau, product marketing manager for NDS.

NDS for Solaris allows users to log into NetWare, Windows NT and Solaris SPARC servers using a single password and user name. In addition, a network administrator can manage users, groups and access to multiple network applications from any location, across multiple platforms. "Solaris administrators no longer have to physically go and create a user account on their machines and then create the user account on NetWare," says Corriveau. "We have provided a single point of administration. That is a big benefit."

Pricing for NDS for Solaris is the same as NDS for NT. It is offered with two separate licensing components: a server license and a per-user connection license. Each Solaris server that stores an NDS replica is required to have a server license, which costs $695, and user licenses cost $26 each. Current owners of NetWare 4 and 5 may obtain matching licenses for Solaris servers at no extra charge.

Novell has also announced a licensing agreement that will allow Sun Microsystems Inc. and Novell to work together to create Java- and Jini-enabled devices on networks that support NDS.–*ptc*

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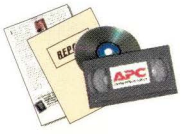

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ing new telephony applications by allowing developers to deliver new services across multiple platforms simultaneously. Announced last June at SuperComm '98, Sun already counted ADC Telecommunications Inc., Minneapolis, MN; DGM&S Telecom Inc., Mount Laurel, NJ; and Swedish firm Ericsson Infotech AB, among JAIN's supporters.

With these announcements, Sun suddenly sees itself pitted against well-established telco equipment providers such as Tandem (now Compaq Computer Corp., Houston, TX) and Stratus (recently acquired by Ascend Communications Inc., Alameda, CA). Despite the fact that Sun is a relative newcomer to this space, observers are confident that Sun will do well.

For one, says Rob Rich, senior vice president of telecommunications research for the Yankee Group, an analysis firm based in Boston, MA, Sun is banking on the ubiquity of the Solaris and SPARC platform within the industry. "A lot of telco applications are developed on Solaris," Rich says, which must then be ported to either Tandem or Stratus proprietary platforms.

Another factor in Sun's expected success with the Netra ft 1800 is the level of price/performance it delivers over competing products. Priced starting at $180,000, the Netra ft 1800 is actually quite competitive, says Ken Kalb, president and chief executive officer of Continuous Computing Corp., a manufacturer of SPARC-based, NEBS-compliant telecom equipment based in San Diego, CA. "Five years ago, you would have paid $5 million plus for a comparable system," says Kalb. "And that's not counting custom development costs."

But most of all, Sun is positioning itself as a generic hardware platform provider for other companies, Rich says, choosing to remain outside the telecom software fray. Instead, Sun has opted to forge relationships with networking "powerhouses" such as Cisco Systems Inc. and Lucent Technologies, Rich says. This strategy is in contrast to that of Tandem and Stratus, which places more emphasis on providing proprietary application and middleware to the telecom market, Rich says.

Which is to say, Tandem and Stratus will "find other areas to play in" besides telco-grade fault-tolerant hardware, Rich says. More bluntly put, "Sun is just going to whack 'em," according to Kalb.

Less obvious companies that stand to lose from Sun's entry into the market are OEMs, systems integrators and resellers, says Kalb, as Sun moves toward creating more and more specialized products itself. "The OEM-tier is really getting squished," says Kalb. However, Continuous Computing will do well, he believes, because it is not competing for the same market segment as Sun. "We have overlapping services, true, but we target the $25K to $50K space, whereas Sun is looking at the $100K plus market."–*ab*

Compaq, SCO Strengthen Lineup

Two major players and longtime partners in the UNIX arena–Compaq Computer Corp. and the Santa Cruz Operation Inc. (SCO)–beefed up their operating system product lines in February with announcements in both the high and low end of the market.

Compaq's Digital UNIX, which Compaq acquired when it purchased Digital Equipment Corp. last year, is getting a major face-lift with two upgrades–one announced in February and another, more major upgrade due mid-1999. Meanwhile, SCO is targeting the small business market with the release of UnixWare 7.

Compaq's February upgrade to Digital UNIX, renamed Tru64 UNIX, adds support for Switched Fibre Channel, a new printing system based on Xerox Corp. PrintXchange technology, and support for Compaq's TruCluster V1.6 clustering software. The new operating system also includes support for Compaq's newly released AlphaServer DS20 dual-processor server and Workstation XP1000 desktop products.

While Tru64 UNIX 4.0 offers a number of enhancements, industry analyst Tony Iams of D.H. Brown Associates Inc., Port Chester, NY, says the real improvements will come later this year with the release of Tru64 Version 5. Version 5 will include support for Very Large Memory (VLM) for enterprise and high-performance technical applications, dynamic system management, support for tens of thousands of concurrent users and the inclusion of Advanced Server for UNIX for interoperability with Windows NT, Compaq says.

Both upgrades will help boost Compaq's standing among UNIX vendors, Iams says. "They had already been in a strong position. This is going to sustain that momentum." In fact, D.H. Brown's November 1998 report on UNIX operating systems ranked Digital UNIX second in overall functionality, behind the IBM Corp. AIX operating system.

The Compaq announcement is likely to give SCO a run for its money as well. Compaq is SCO's largest OEM for UnixWare, selling more than $1 billion worth of UnixWare-based products. However, with the purchase of Digital, and Compaq's renewed commitment to the Digital product line, the longevity of that partnership could be in jeopardy. Although Compaq is positioning UnixWare as a 32-bit operating system for its Intel-based servers and Tru64 as a 64-bit operating system for high-end Intel and Alpha RISC environments, the two operating systems are nonetheless likely to encroach on each other's market share.

"This undermines the role of UnixWare, which, historically, Compaq has been very closely involved with," says Iams. "They do a billion dollars in business on UnixWare every year, and they've stated that [UnixWare] is going to be their 32-bit operating system, which means it's going to be around for a while. But, strategically, the future belongs to Tru64 UNIX."

This will be SCO's first foray into the small business market with UnixWare.

With its announcement in February, SCO made clear that it is attempting to strengthen its hold on the low-end UNIX market with the introduction of UnixWare 7.1 Business and Departmental editions–essentially, different licensing structures for the same operating system. The standard configuration of the Departmental Edition, designed for medium and large businesses, supports two processors and 25 network user licenses. The Business Edition is aimed at small businesses that need one server to handle multiple mission-critical tasks and supports a single processor configuration with five network users.

SCO has traditionally been strong in the small business market with its OpenServer UNIX server product line. But this will be SCO's first foray into that market with the UnixWare line, says Tamara Newberger, director of product marketing for SCO. "We've priced this [new operating system] at an Intel price-point, which gets us into that small business market space. But we also have some interesting new features that are specifically targeted for that market."

Both editions include a new Webtop feature for browser-based systems administration from any client–as well as Network Station Manager software for running IBM Network Station Network Computers (NCs) from a UnixWare server–and Internet services such as email, remote access and Web and FTP servers. In addition, UnixWare 7 adds support for Linux applications. Linux, a freeware UNIX operating system, has long been popular with individual developers and small businesses and is now enjoying a surge in popularity among larger organizations, as well as garnering support from major software vendors.

Competition from Linux could be UnixWare 7's biggest problem, says Iams. "Everyone's been focused on Linux versus Windows NT. But where you're really going to see Linux making inroads is in the low-end UNIX market. I'd say that a cheap Linux is more of a threat to SCO than NT at this point."

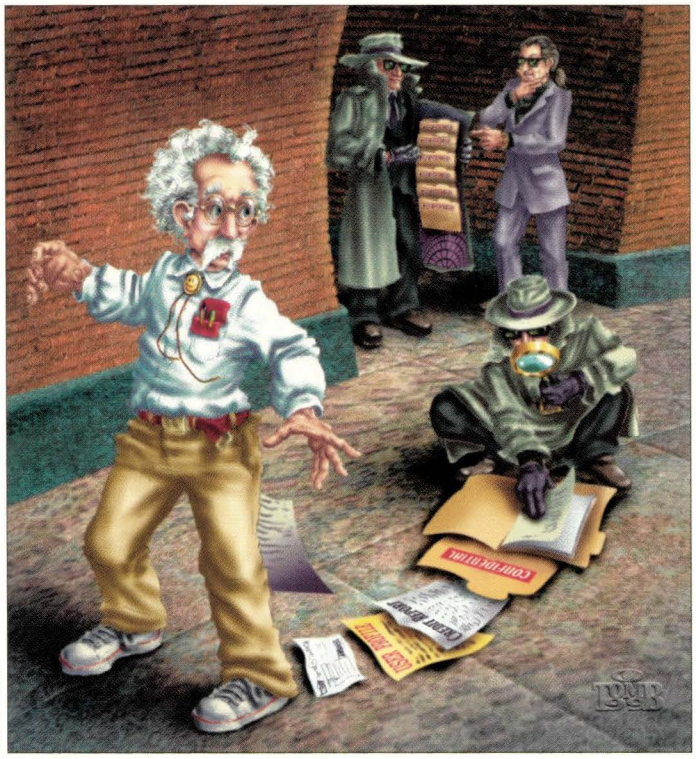
SCO's Newberger disagrees: "Linux is good for UNIX. It's done a good job of poking holes in non-UNIX competitors. But there are several flavors of Linux and that is confusing for the marketplace. It's hard for customers to know which to choose." SCO supports Red Hat Software Inc.'s Linux release in UnixWare 7.1, says Newberger, and expects many Linux developers to chose UnixWare as a deployment platform for both Linux and UnixWare applications.

SCO is also partnering with IBM and Sequent Computer Systems Inc. to develop a new UNIX operating system for the Intel Corp. IA-64 chip (see "New UNIX for Intel Promised," *SunExpert*, January 1999, Page 16). Dubbed Project Monterey, the new operating system is scheduled for mid-2000. All three vendors have pledged to support UnixWare as the alternative for customers who want to stay with the 32-bit Intel architecture.

Future releases of UnixWare will include features to make it more compatible with Project Monterey, says Newberger, including a 64-bit API and API compatibility with AIX. But SCO does not plan to do away with UnixWare after the Monterey operating system is released, according to John Bondi, vice president of server product marketing at SCO. "UnixWare 7 [and Monterey] will coexist for many years to come."–*sjh*

Ask Mr. Protocol

by Michael O'Brien



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A: No. The study of privacy is a tricky one, especially if considered in a historical perspective. This column has already discussed the history of the office. Mr. Protocol hasn't because he doesn't actually have to work in an office, being as how his physical locus is hard to pin down at the best of times. Hence, Mr. P. doesn't actually give a flattened Big Stuf Ding-Dong wrapper about offices, and thinks "Dilbert" is a brand name for filberts. This hasn't stopped his amanuensis from maundering about offices, being as how amanuenses and offices sort of go together in a depressingly regular sort of way.

The office is a rather new institution, having been named for part of a house and for a regularly performed duty. We are not very good at them yet. In some sense, offices are designed to be unpleasant because we're encouraged to do work in them, not have a good time. Happy is the person for whom "work" and "good time" don't form a dichotomy. People have been working together to achieve a cooperative goal for, oh hmmm, what is it now? Two or three million years. We've been working in offices for a couple of hundred. Everybody who thinks offices will still be around in another couple of thousand years, please raise your hands. Thank you. Now seek therapy.

Just as our perspective on The Office changes if we take the long view, so our perspective on the nature of personal privacy changes if we take the long view. I mean, if you go back far enough, there wasn't any. The only thing that netted us anything like what we would today call privacy is something that we built a special building for, and called it a "privy." Everybody knew everything about everybody, and because everyone would have been in everyone else's pockets, assuming anyone had pockets, no one thought much about it. Tribalism at its most pure. Or so we think. Look below the surface of a "primitive" tribe and you'll see a set of personal and social taboos and strictures that amount to a personal privacy directive that would make an anchorite look like the king of the Manhattan cocktail party circuit.

Then came cities–another thing we're not very good at yet–and with them, the idea of the stranger. Lots of strangers, in fact.

Consider the following true tale: There once was a 16-year-old boy named Carlos, a native of Chihuahua in Mexico. Like everybody else in the region, Carlos was a mestizo, a mixture of North American Indian and Spanish blood. Carlos had a job at a gold mine. Every week, Carlos and another man packed out the week's supply of gold, a three-day trip to the nearest city. On one such trip, the weather turned bad and the two men got lost. They wander-

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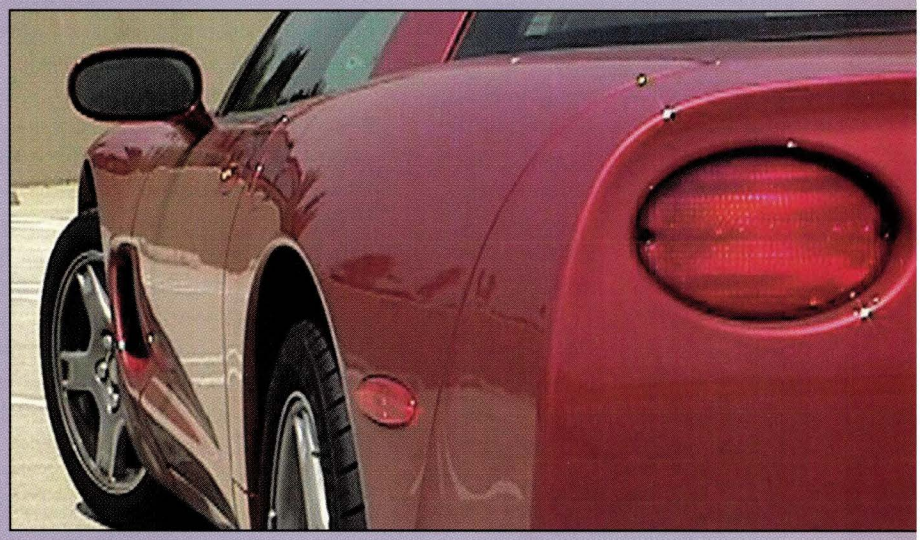

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ed along until they came upon two young women working in a field. The women's reaction was extraordinary: Upon sighting the men, they clutched each other and wailed in abject terror, like people who had just been surprised by Death itself. They made such a fuss that a man came out of the nearest house carrying a shotgun.

Things would have gone ill indeed for Carlos and his colleague (nor would anyone likely have told the tale), except that, by extraordinary chance, the men knew one another. The man with the shotgun was the foreman at the gold mine and recognized Carlos and the other man immediately.

When Carlos inquired into the extraordinary behavior of the two young women, the man hung his head. "They are my daughters," he said. "And I am ashamed to admit it, but you are the first human beings they have ever seen except for myself and their mother."

People who believe that you must go to the depths of the Philippine jungle to find natives who have never seen outsiders are mistaken. The canyon depths of northern Mexico hold many Raramuri Indians who have never seen anyone outside their families. And the reaction of the young women is strikingly indicative of our natural fear of strangers. As soon as we are surrounded by strangers, our lives are deformed. We can no longer live our lives openly and naturally, and still be comfortable. The degree of discomfort varies by person, and is responsible for the wide variety of degrees of privacy sought in today's society. Whether this fear and discomfort is "wired-in," as is, apparently, our ability to recognize a face, is beside the point. Rather, the point is that one old word for foreigner, "cacogen," actually means "the dirty people."

In some sense, a well-settled, comfortably backward English country village–especially pre-20th century–is, to put it bluntly, tribal as all get-out. "Himself" holds court down at the local, and everyone knows who to get hold of to get something done around the place. Everyone knows everyone's blessings, faults, peccadilloes and peculiarities. Partly in spite of this, and partly because of it, there are very strong lines of personal privacy, just as in primitive societies. Because the society is so settled and stable, though, no one thinks twice about them, no one feels forced to justify them and anyone who breaks these privacy taboos is looked down on as a busybody, a nosy parker, or as Henrietta Tainsh, that old witch who can't leave anybody alone, God rot her bones.

Now comes life in the big city. We're surrounded by strangers. Privacy is no longer something to be taken for granted, with unspoken limits agreed to by (almost) everybody. Privacy becomes a matter of exact public definition, of legislation, something that, if valued, must be defended on both an individual and a collective level. It goes directly to the degree of variability society can and will permit among its members. The result is unsettling and becoming more so.

Some years ago, a young man in a mid-size Eastern U.S. town decided that he'd had enough of the 20th century. Life was, by and large, more civilized in the 19th century, so he went back there. He dressed in Victorian clothing, he decorated his house in Victorian style, he got rid of his telephone and his electricity. His house was both heated and lighted by gas.

This caused a brouhaha. Some local officials claimed he couldn't legally live in a house that didn't have all of its utilities turned on. He pointed out that it wasn't fair to force him to be a customer of a company he didn't want to do business with, and besides, his house was no more or less safe than houses were in the days before Edison and Westinghouse.

Our society is now in the excruciating position of deciding, on a case-by-case basis, when we do and do not have an "expectation of privacy." Life in the United States has now reached the point where the number of people who are aware just what privacy rights they have is vanishingly small. Our Social Security Number, by law, may not be used by other Federal agencies as a universal identifier, except as specifically allowed by legislation. Many people take this prohibition to be universal. It isn't. Any state or local agency can require you to cough up your SSN. Federal law doesn't say a thing about that. Credit companies and just about everyone else can tell you, "Give us your SSN, or you're not doing business with us."

In fact, the use of a Social Security Number as a universal identifying number is pretty much complete. Attempting to protect it now puts anyone who makes a real effort at privacy into enough of an exception that, in most cases, they can be told to "buzz off, we don't need your business." In some cases, refusing to give an SSN results in an offhand comment, "That's all right, I'll just look it up." The clerk then correlates a couple of database entries, and if the names and addresses match, an SSN is obtained. This feat is usually performed in an offhand and superior manner, which eventually leads to bodily injury and a forced career change.

The Public Internet

On the Internet, the situation is at least somewhat easier: You don't have any privacy rights at all. This is one of the downsides of a largely unregulated Internet. What privacy there is, is self-regulating. Organizations like the Electronic Privacy Information Center (`http://www.epic.org`) carry out campaigns on specific issues, as well as general education campaigns. At the moment, for example, EPIC is supporting a boycott of Intel Corp. because the next generation of Intel Pentium chips, the Pentium III, is slated to contain a serial number which can be requested over the Internet to track Web usage. More than 30 companies have already stated that they plan to create applications that will use this serial number. So much for self-policing in the privacy arena.

This is not to say privacy is a lost cause. It isn't. For one thing, many successful sites have published privacy policies (and many more have not). Match.com, for example, an online matchmaking service, states in its privacy policy that, "We will not share your personal information with anyone outside of our corporation."

Some might think that's pretty basic; a matter of expectation. Think again.

The fact is lots of companies would love to share information about you and would love for you to be entirely without options on the matter. Some companies are trying to hammer out

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agreements, which would allow them to share "cookies"–those little snippets of seemingly meaningless text, which get set automatically in your Web browser (or not, if you've turned them off) in order to track your usage.

Be it noted here that cookie usage *within* a site is generally benign. It allows the site to track your usage of that one particular site. For example, a cookie can carry an encrypted password, which allows you to access proprietary information at the site without having to log in every time. Between sites, it's the bread and butter of the "banner ads"–those ad strips found at the top of Web pages. The advertising site needs to know where you came from so it can credit the site carrying the advertising.

Once sites begin sharing cookies, though, all bets are off. A large enough consortium of companies could trace your navigation of the Web from site to site to gather information about how you use the Web–which sites you visit and in what order, what items you buy, the works. Knowing that a Web site has a stated policy of not sharing the information it gathers about you with others is comforting.

Now consider another site, eBay.com. This online auction site has recently had the heat turned up. eBay doesn't sell anything besides Web listings, but it provides a conduit for private parties to list, sell and buy just about anything. It does have a policy that it will pull a listing for anything illegal or questionable, such as explosives or firearms. eBay is wildly successful. Like most wildly successful enterprises, it has no hope of policing itself. Hence, it became a great place to sell knockoffs, fake Rolexes, the whole sorry range of things normally found lining the inside of some character's trench coat on Maxwell Street.

People in various walks of life who generally take note of such things began to complain about the high level of fraudulent goods being sold on eBay. In reaction, eBay instituted the unfortunately named "Legal Buddy" program, where content owners–people with legal claim to trademark or copyright–can inform eBay of auctions that appear to involve illegal goods. eBay offers members of this program the ability to specify a Boolean ruleset to match auctions carrying goods with the magic name or trademark, and have matches mailed to them daily. On request, eBay will disclose to "Legal Buddies" the seller's personal information.

This all seems fair enough. eBay requires its users to register, and registration requires a street address, as well as an email address. If people lie, they lie.

But the company goes on to say: "eBay cooperates with all law enforcement inquires and with all third parties to enforce their intellectual property or other rights. Therefore, members of the eBay Legal Buddy program (*which includes local, state and federal law enforcement*) can request your user ID, name, street address, city, state, zip code, country, phone number, email and company information. [Emphasis added.]"

And, earlier in the agreement: "...we can (and you authorize us to) disclose any information about you to law enforcement or other government officials

s we, in our sole discretion, believe neces-ary or appropriate. [Emphasis added.]"

Now this is interesting. In order to void legal problems, eBay forces you o agree to disclosure of anything and verything it knows about you to anyone laiming to represent law enforcement. Copyright holders are limited by eBay olicy to gathering information about eople who are a) selling items, which) appear to violate copyright or trade-nark. Only people engaging in such rade are open to such requests.

But, according to stated policy, nyone who calls up and claims to be vorking for, or on behalf of, the Truth r Consequences New Mexico Police Department can ask anything about any-ody, and eBay gets to make up its own nind about whether or not to tell them. You have nothing to say in the matter.

What's even more interesting is how his is put into practice. Some of these lisclosure rules change over time. eBay as just come up with a new set, which t promulgated on its Web site, with the nnouncement that the new rules would e put in force in 30 days. Now, after that oint, presumably you can quit using the ervice. However, there is nothing in any f this, and certainly nothing on the law ooks, that says eBay has to delete the nformation about you it currently has.

The Internet is young and policies nd viewpoints change from month o month. The fact of the matter is no natter what the stated privacy policy of site is, the information you give to the ite, and the information it gathers about our use of the site, should be treated as ublic information because anybody can hange their policy at any time. English ommon law saw fit to enforce some of he earliest restrictions on the operation f government to grant the citizen a ixed and certain measure of privacy. To his day, no government representative, ncluding law enforcement, can enter our home without either an invitation r a warrant. No such guarantee applies o anything you do on the Internet.

To put things in another perspective, rivacy policies are meaningless in the ace of computer piracy.

Most well-written privacy policies oint out that the site can only take easonable and proper steps to secure the site against external invasion. Damn few people would be able to steal information about you from a police station, but it's a dicey matter whether they'd ever catch anyone who broke into eBay and ripped off the list of street addresses of nice juicy consumers who bid on high-ticket items, yum yum.

In this the Internet's infancy, what we are presented with is a mandatory balancing act: how much information we choose to reveal about ourselves versus how much benefit we can derive from the Internet. Many people appear to have no concerns about privacy at all. In Mr. P.'s view, which admittedly is only tangential to our notion of reality, this is because many people feel they no longer own various parts of their lives whose privacy used to be taken for granted; their finances, for example, or their purchasing preferences.

They do not hesitate to disclose all because they feel they have already lost not only the expectation of privacy, but ownership. Their employer and their bank control all their money, let alone information on where that money goes. With such a lifestyle, privacy becomes a dim and hazy notion, rather than something to be guarded. Welcome to the monkey house.

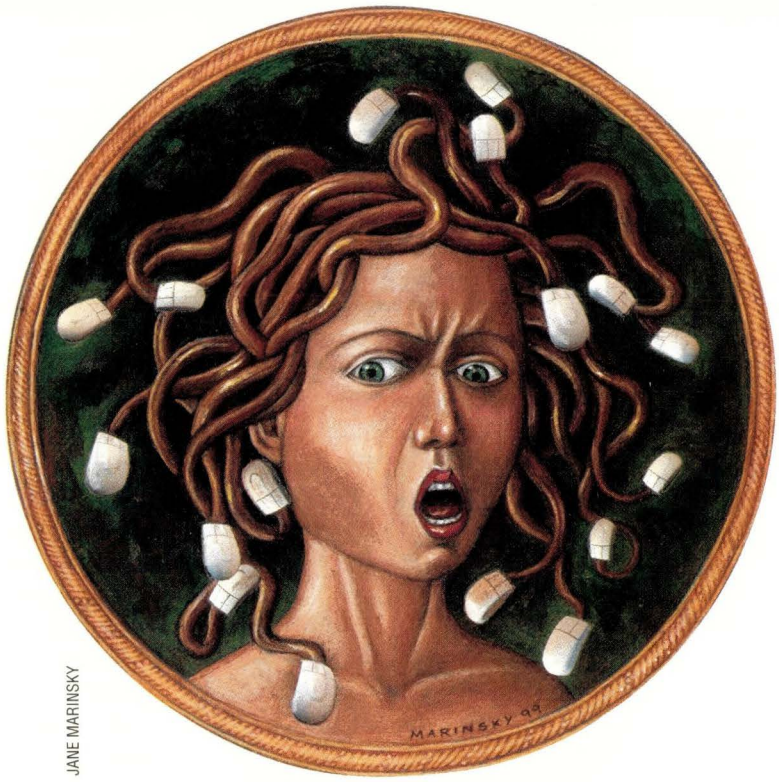
Law enforcement cannot enter your home without a warrant, but they can find out a lot about what's in your home. All they have to do is call up eBay and ask. ⊸

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

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

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

by Peter Collinson, Hillside Systems



JANE MARINSKY

Automation

Two years ago, I wrote an article that attempted to analyze what was lacking in the approach to computing promulgated by Mr. Gates' company. The article was called "The Trouble with Windows" (*SunExpert*, January 1997, Page 26), and it attracted hate mail from several people. I had mail from people saying that what Microsoft Corp. generates is truly wonderful, and I shouldn't be criticizing it. I had mail from people saying that the article was heavily biased in favor of Microsoft, and why on earth was I writing it in–that holy of holies–a magazine devoted to UNIX. The mail was split pretty evenly, so I took it as a sign that the unbiased path I had attempted to follow was successful to some extent.

I started to write the article because I perceived that UNIX folks are very good at simply dismissing Windows products with a throwaway line. How often have you heard: "Windows is just ****"? (It's my pleasure to allow you to substitute your own favorite expletive.) This type of summary dismissal seems all too common and means there is no widely spread, well-understood set of rational reasons for rejecting, or even questioning, what happens on a Windows machine. I guess that when pressed, techies do have a bunch of reasons, which mostly boil down to reliability and code integrity. But it always seems interesting that these issues don't seem to worry the people who make the purchasing decisions. Perhaps the two groups don't talk.

As time has passed, it has become more fashionable to attack Mr. Gates' company. However, the current attack wave is based on the trading methods that have been, and are being, employed. Surprise, surprise, suddenly Mr. Nice Guy is really Mr. Nasty, and what's more, the so-called "Halloween" documents reveal that it's all intentional nastiness. (Just in case the Halloween documents have passed you by, they are internal Microsoft memos annotated and placed on the Web by Eric S. Raymond, author of "The Cathedral and the Bazaar," you can find the URL at the end of this article). Actually, I became somewhat more aware of the tactics adopted by Microsoft (and others) by reading Jerry Kaplan's account of the rise and fall of the Go Corporation: *Startup: A Silicon Valley Adventure*, (published by Penguin Books, 1996, ISBN 0140257314), which I read in one rush on a plane.

I am sure nobody can deny that some of the reason for the success of Windows is the point-and-click nature of the beast. Take an example: Microsoft Word has ousted Corel Corp. WordPerfect, although WordPerfect was the market-leading word processing package at one time, and certainly had a head start. My guess is that people have moved to Word because it is more mouse-oriented, and the learning curve to get simple things done is shorter. I confess that I haven't looked at WordPerfect for some time,

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but will undoubtedly do so again because it's now available for Linux. Word began to take over because WordPerfect inherited the magic keystroke approach to editing that was (and is) common in UNIX text editors. The observation then, is that most users don't want to train their body to use a magic keystroke to achieve some action, they would rather point and click with a mouse. The problem is the keystroke is a "hidden action," and you need to remember it, whereas pointing with a mouse requires little or no training.

However, as I attempted to illustrate in my column two years ago, the mouse-based approach doesn't scale. People are forced to do complex tasks using combinations of mouse movements, and there's no simple way to automate these. My view is the Windows product line has generated a large class of people who are essentially controlled by the system, their gainful employment is simply to make the mouse move. Being a slave to the computer runs counter to my personal philosophy: The computer's role is to do the boring tasks. The message to managers and users should be that much time is wasted doing things that are better done by the computer, and by "better," I mean faster and more accurately.

Challenging Microsoft

Well, Linux is now being hailed as the world's "last best hope" to provide computer users with some viable alternative that places control of their computers back into their own hands. I hope so. I like the ability to understand and fix the bugs on my systems. However, I think the media take on Linux at the moment is "good as a server, bad on the desktop." The reason for this oft-heard discrimination against UNIX systems has always mystified me. For an illustration, look at what Linux can do straight out of the box. You can pay $50 to Red Hat Software Inc. for a copy of its Linux release and receive a system that requires no further software expenditure. It comes on three CDs with a plethora of editors (including WordPerfect), an excellent graphics program (GIMP), full Internet connectivity with a wide range of user applications, database support (both open source and commercial), a complete programming environment encompassing many languages...the list goes on. Alternately, you can pull it over the Web for nothing, but then you don't get the commercial offerings.

Still the media says: "Not for the desktop." I am sure Linux is branded with this tag because some of its applications date back to early X11 releases and need to be made considerably better looking. Also, the applications that people apparently want need more work. There's a columnist who writes for a U.K.-based magazine that has "converted" to Linux from Windows, but in his most recent column, he was complaining about the lack of a nice-looking file manager. Well, I must confess that I haven't looked for a file manager on Linux and I never use the one I have running under CDE on Solaris.

The Linux world needs to put lots of work into making the visual desktop easy to install, easy to use and, above all, better looking. There are signs that "being better looking" is being tackled. The Red Hat distribution unpacks with several X11 window managers that present visually pleasing and usable environments. There are more window managers available on the Internet. As I said, work is still needed in the applications area. Many open-source applications use the Athena widget set, which has a dreadful look and feel.

The aim of making things easy to install is also being tackled, and again there is some way to go. The UNIX world needs to learn this trick from Microsoft. One thing Windows 95 did was to sort out connecting to the Internet with a modem. It used to be dreadfully difficult to do this. More often than not, it turnkeys on Windows 95. You are probably sunk when it fails; but when it works, it works very easily.

The UNIX world needs to get enough awareness to convince hardware manufacturers that they should supply information to Linux developers in the same way they do for Microsoft. For example, my machine that runs Linux also runs Windows NT. The manufacturer of my graphics card supplies an NT driver for its product and this driver knows about my monitor. I don't have to worry about setting up obscure configuration files. To be sure, X under Linux works on my system, using a reasonably simple configuration program. But it is supporting a generic monitor, so it does not run the screen as well as NT does.

Linux is now being hailed as the world's 'last best hope' to provide computer users with some viable alternative that places control of their computers back into their own hands.

So far, as a newbie Linux user, I have encountered no great surprises, or perhaps I should say, only pleasant ones. Linux appears to support the mix of System V and BSD commands that I am used to on my Sun running Solaris. If you use Solaris, you will feel quite at home on Linux.

Getting the Job Done

I have wandered down the Linux path somewhat more than I originally intended, and perhaps you are sitting there wondering about the starting point for some of the stuff mentioned above. What does that idiot mean about automation? I just sit at my terminal using my vendor-distributed system to get my job done. How do I get to the nirvana where my job will be easier?

Step one is realizing that it is possible to create your own scripts and tools to automate your work. You don't need to be a programmer, all you need is a willingness to learn. At the outset, you'll need the ability to use a text editor. There are various simple text editors around. If you use CDE on your Sun, then point the mouse at the screen background, click your right mouse button and you will be presented with a menu that includes a simple text editor. You can find

another text editor by opening a shell window and typing `textedit`.

Step two is understanding the restrictions. If you never use a shell-based environment to talk to the system and want to create your own visual applications, then the job is harder. It's not impossible, but harder. Most UNIX programs are designed to work in the shell environment. If you use CDE, you can group these commands into actions and make those actions work by clicking from the desktop. The best starting place to tailor your environment is to use the UNIX primitive commands to create other more personal scripts that are initiated from the shell.

Step three is recognizing that a proportion of what you do is repetitive and that spending time on automating these tasks will ease your workload. The most normal course of action is to type a bunch of commands, realize that you did very nearly the same actions the day before, but say "OK, I'll think about automating it tomorrow." Tomorrow never comes. The next day, the same thoughts flit through your mind. Another common trap is "it's complicated, and it's only a one-off task." Well, one-off jobs are always done more than once.

Recognizing that you are doing a repetitive task is not easy, especially when you are concentrating on something specific. Look for common command sequences and don't worry too much about the files to which they are being applied.

For example, I tend to keep my personal archive of software online. The archive contains code I have written and all the publicly available programs I use. Of course, there is never enough disk space to store information that I want to access for a short period. Also, I want to minimize the load on my system backups. A complete dump of my entire system currently fits onto one (large) DAT tape, which is convenient for a number of reasons.

I want to find some way of storing file trees in a compressed form on the disk, so I know where they are and can access them as needed. On UNIX, there are two tools that take a file system subtree and create a single file. The commands, `cpio` and `tar`, were designed to drive tape units for archival purposes. However, on UNIX, a tape device is a file, and the programs can also write the same information to a file on disk. I tend to use `tar` because that's what I am used to.

To store my files, I can take all the files in some portion of the file system tree and create a `tar` archive, and then compress that archive to save space. To create the archive, I'll type

```
$ tar cf dir.tar dir
```

where `dir` is the name of the subtree I am archiving, and `dir.tar` is the file that the data will be packed into. I can now compress that file. These days, I use GNU's `gzip`:

```
$ gzip dir.tar
```

The command takes a file, compresses it and renames it by adding the suffix `.gz`. Actually, these two commands can be

combined into the following one-liner:

```
$ tar cf - dir | gzip > dir.tar.gz
```

where we've told the `tar` command to send its output directly into the `gzip` command by specifying a hyphen as the target file name. Now, I want to delete the original directory:

```
$ rm -rf dir
```

To reverse the operation, I just run the command line:

```
$ gzip -c dir.tar.gz | tar xfp -
```

making the `gzip` command send its output into the `tar` program. This unpacks the archive and recreates the original tree.

I used to type these commands, and as you can see, they are short and quick to use. However, one day I realized that I was often compressing files and decided to create a command file to do the task for me.

Designing a Script

I could just copy the store-and-compress one-liner into a file and would have a new command. However, that command would only work on the directory name that I entered in the file. I want to be able to select the source directory when I run the command, so the command file would need to take an argument. I want be able to say something like this:

```
$ tpack dir
```

Also, is it a good idea to delete the data in the script? What happens if things go wrong? What happens when I've given this new command a large directory to pack, and then leave the terminal? If the `tar` and `gzip` fail for some reason, am I happy that the files will be deleted? Of course, the answer is no. Too many bad things can happen, and data is precious.

One alternative is to rename the directory that has been packed up, so that when I arrive later, having forgotten I packed it, I can identify directory trees that can be deleted.

Here's the start of the script:

```
#!/bin/sh
```

The first line tells the system that it is a shell script, and that it should use the command `/bin/sh` to interpret and execute the script. In some circumstances, you don't need this initial line, but it's a good idea to get into the habit of adding it to a file. Continuing on:

```
tar cf - $1 | gzip > $1.tar.gz
mv $1 $1.dele
```

Now if you look back at the original commands, you'll see that the packing and compression text here is similar to the lines I typed before. The only difference is I've replaced `dir` with `$1`. Shell scripts work by "text replacement"; when the command is run, the `$1` is replaced by the contents of the first argument to the script. If the script had two arguments, then you could access the contents of the second argument by typing `$2`.

The `$1`, `$2`, etc. are a special case of *shell variables*, names in the shell that are replaced by the text they contain. You can always type something like this:

```
$ s=/home/user/dir/down
```

Note: there should be no spaces around the equals sign. We use it by saying

```
$ cp onefile $s/onefile
```

and copy the file to the expanded target directory. This trick can be useful if you are copying several files and don't want to do much typing. Incidentally, if you are a `csh` user, you have to set the variable, as follows (note the spaces):

```
$ set s = /home/user/dir/down
```

Making It Better

Our script will now work, but are there any snags? What happens if we call this script by accident with no arguments? When there are no arguments, the `$1` is replaced by an empty string and the command will still run. Something should be done to make the script more robust. We could put in a test and cause the script to die in these circumstances. However, I will side-step the problem by observing that at some point I am bound to want to run this command on several directories, so ideally, I want to be able to give it several arguments on the command line:

```
$ tpack joe fred jim
```

To handle several arguments, I need to place my commands into a loop and step through the arguments one at a time.

Here's the revised script:

```
#!/bin/sh
for dname in $*
do
     tar cf - $dname | gzip > $dname.tar.gz
     mv $dname $dname.dele
done
```

Again, the pattern of the commands is identical to the text we had before, except that `$1` has been replaced by `$dname`. The shell performs exactly the same replacement operation, but in this script, the directory name will be taken from the `dname` variable. In the script, `dname` is the loop variable, and the `for` statement tells the shell to repetitively execute the commands between `do` and `done`, setting `$dname` to the next value taken from the list that follows the word `in`.

Sure, there's no list of values after `in`, it's another magic internal shell variable: `$*`. When the script is run, `$*` is replac-

ed by all the arguments to the command, creating a list of values that is used by the `for` statement. If we call our script with

```
$ tpack joe jim jack
```

then `$*` is replaced by `joe jim jack` when the `for` loop is initiated. The loop starts with the `dname` variable being set to `joe`, then to `jim` and, finally, to `jack`. The list after `in` is now empty and the loop terminates.

When the script is called with no arguments, the list after `in` starts off being empty and the commands inside the loop are not executed. As a result, our new script is safer when called with no arguments.

Creating a Command

We've created the command in the editor, what next? Well, I've assumed that the new command will be called `tpack`, so we will need to write our text into a file called `tpack`. We need to turn this file into a command that the shell can execute, and do this by setting the execute bit:

```
$ chmod +x tpack
```

We can now execute the new command by typing `tpack` into the shell. Incidentally, if you still get a "Command not found" error, try typing `./tpack` (read on to understand why).

If you are planning to run this command from your home directory compressing and saving directories, then you may be happy with what we have constructed. However, this is often not the case. Directories will be littered all over the system and we need some way of telling the shell where to look for the `tpack` command. I, along with many other people, have a private `bin` directory that lives under my home directory. I will want to place the `tpack` command into my `bin` and tell my shell to look in that directory when I type a command.

The shell uses an environment variable, `PATH`, to contain a colon-separated list of directories that are to be searched whenever you type a command. You can see the current value of `PATH` by typing

```
$ echo $PATH
:/usr/bin:/usr/ucb
```

In this example, the shell will search the current directory (shown by the initial empty string before the first colon), then `/usr/bin/` and, finally, `/usr/ucb`. You may find that the `PATH` variable already contains a private `bin` directory, and you have a thoughtful systems administrator to thank. If not, then we can add to this list by typing

```
$ PATH=:/home/pc/bin:/usr/bin:/usr/ucb
```

This uses the normal shell variable definition statement. You should replace `/home/pc/bin` by the path to your own private `bin` directory. There's one further piece of magic. Setting a variable like this only sets it in the current shell. If you want to pass the new string into all the commands you use, which you generally do, then you need to say

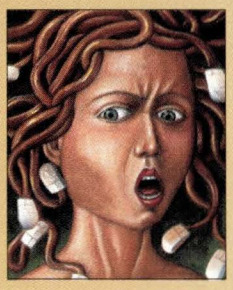
```
$ export PATH
```

Having done all that, you can now happily type `tpack` from any directory in the file system and your shell will locate it in your private `bin` directory.

Incidentally, things are a little different in `csh` and its derivatives. The `csh` shell's search path is controlled by the `PATH` variable and you set this using a list enclosed in round brackets, where the directory names are separated by spaces:

```
set path=(. /home/pc/bin /usr/bin /usr/ucb)
```

Here the dot character is used to indicate that the shell should search in the current directory, then my private `bin`, then `/user/bin` and, finally, `/usr/ucb`. The `PATH` variable possesses some special properties. Changing it will automatically change the environment setting for `PATH`, exporting the change to other programs.



The shell uses an environment variable, PATH, to contain a colon-separated list of directories that are to be searched whenever you type a command.

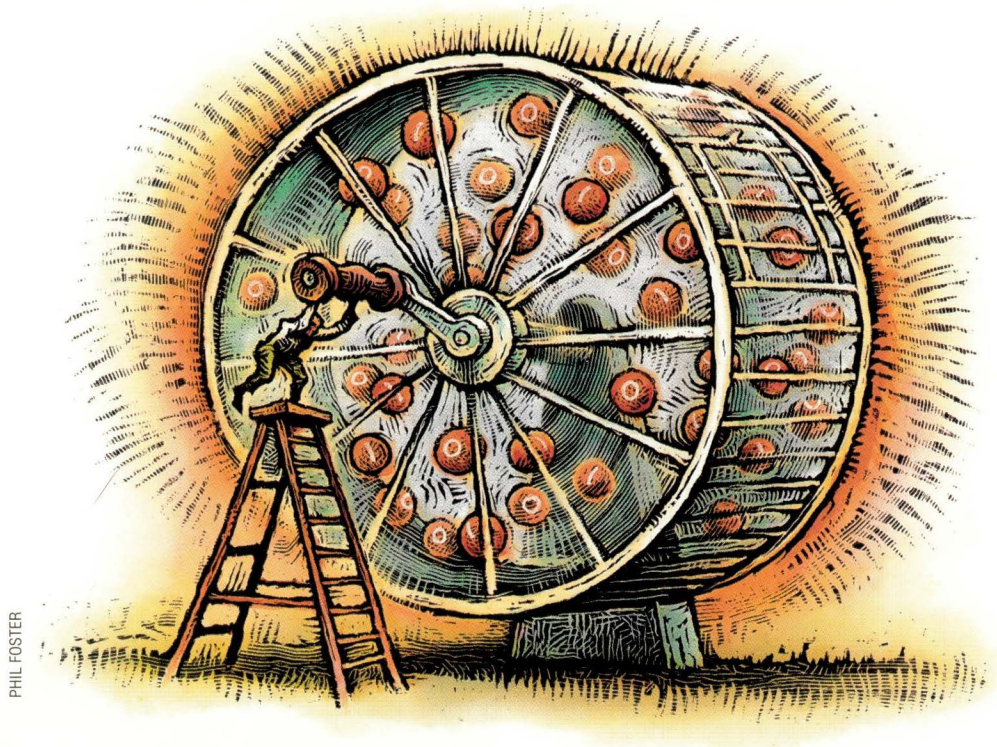
You don't want to have to type this information into your shell every time, so you need to place the setup line (or lines) into your shell startup file. The precise name of this file depends on the shell you're using. If you are unsure, consult a local guru.

More Information

You can find the Halloween documents at `http://www.opensource.org`, and if you haven't seen them they are well worth a visit. Eric S. Raymond's "The Cathedral and the Bazaar" can be found at `http://www.tuxedo.org/~esr/writings`. If you are interested in news from the open-source movement, then a visit to `http://www.slashdot.org` may be illuminating. My aforementioned article, "The Trouble with Windows," can be found at `http://sun.expert.com/C2/1997`–it's a PDF file so you'll need a copy of Adobe Systems Inc. Acrobat. ➸

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

by S. Lee Henry



PHIL FOSTER

Flipping Coins

This month, we're going to look at a script for generating random strings. At first glance, this may not appear to be all that useful. In time, however, offsprings of the simple Perl script presented here might work their way into some of your more serious projects. We'll also explore some of Perl's syntactically efficient commands along the way.

The script (see Listing 1, Page 34) takes a text file and generates random passwords of a moderately secure nature. That is to say, although the strings created are based on word pieces, we insert some unpredictability with respect to the words and the size of the pieces chosen. You can also elect to use any other source of data in place of the `/usr/dict/words` file to further obfuscate the end result.

Two of the more interesting commands used in this script are the `join` and `split` commands. If you take a look at the output of the `join` and `split` commands, you might argue that their names ought to be reversed:

```
zucchini }
Zurich   }     join output
zygote   }

zucchiniZurichzygote } split output
```

The `join` command appears to be separating our pieces of text, while the `split` command appears to be joining them together.

What is actually happening here, however, is that the `join` command is putting our pieces of text together, while retaining the new lines from the original text file. The `split` command, on the other hand, is turning the text into individual elements in an array, but printing them as if they were a single string.

Backing up just a bit, the `join` command turns separate elements into a single string and (optionally) inserts a separation character between each element as it does so. For example, if you entered the following commands:

```
@words=("java","sun","linux");
join (":",@words);
print @words;
```

you'd get this response:

```
java:sun:linux
```

If you then used the `split` command to break your new string into pieces, using the ":" character as the delimiter, you'd end up with the original three-item list. Whenever you join and split on the same character, you wind up with your original array. If, on the other hand, you split on the letter "n," you'd get the strings: `java:su`, `:li` and `ux`.

In Listing 1, we are joining with a null (that is, inserting nothing) and splitting on the new line. Because the `split` character is dropped, we get the effect of dropping new lines.

Another interesting line in the

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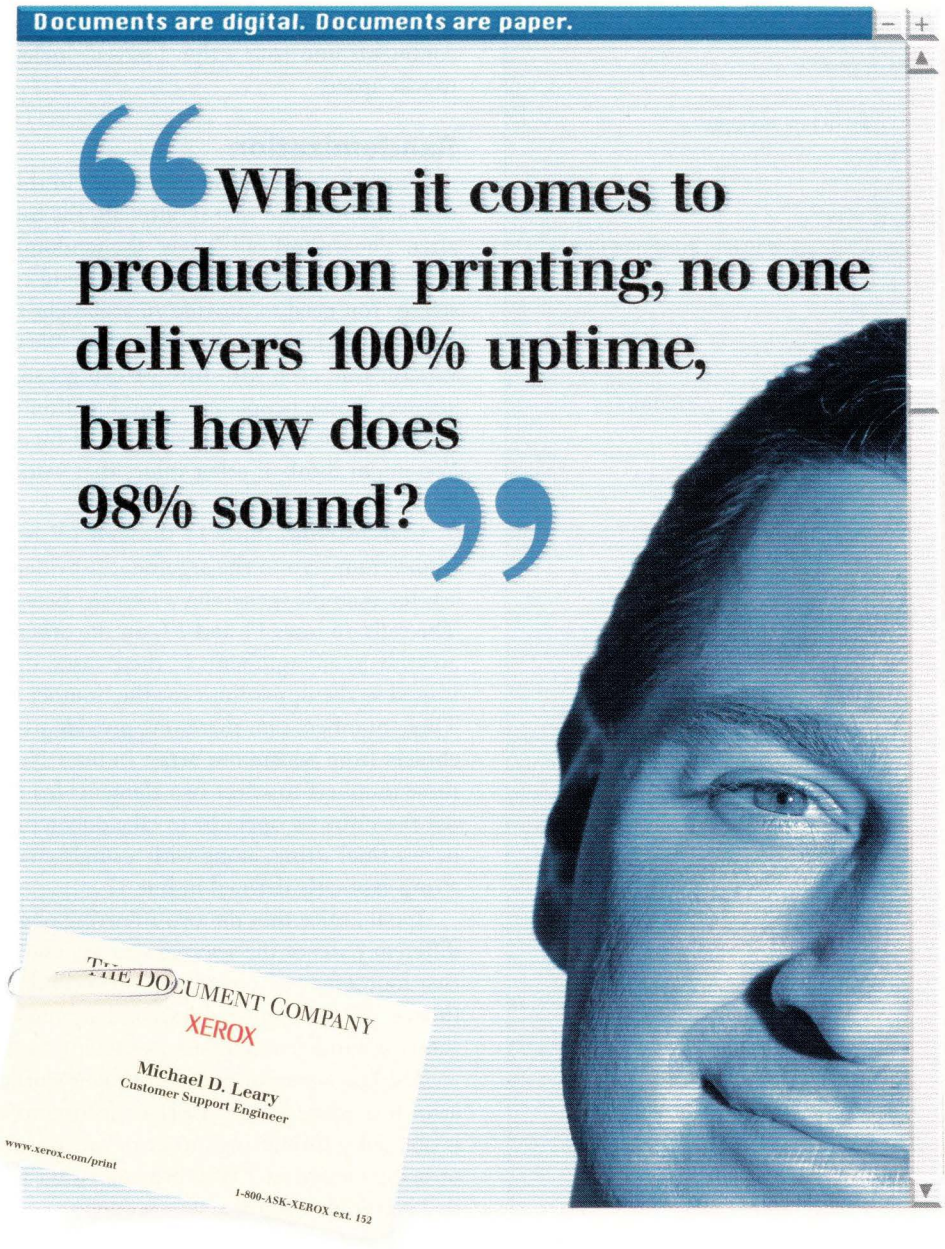

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Listing 1. ranstring.cgi Perl Script

```
1  #!/usr/local/bin/perl

2  $word_file = "/usr/dict/words";
3  $delimiter = "\n";

4  open(FILE,"$word_file")
5     || &oops('open->word_file',$word_file);
6  @FILE = <FILE>;
7  close(FILE);

8  $chunks = join('',@FILE);
9  @chunks = split(/$delimiter/,$chunks);

10 srand(time);

11 $choice1 = rand(@chunks);
12 $choice2 = rand(@chunks);
13 $number = rand(10);
14 $digit  = substr($number,3,1);

15 print "\n";
16 print substr($chunks[$choice1],0,4);
17 print substr("!#27-=9843",$digit,1);
18 print substr($chunks[$choice2],-4,4);
19 print "\n";

20 exit;

21 sub oops {
22    ($error,$file) = @_;
23     print <<"END_ERROR";
24 Content-type: text/html

25 <html>
26  <head>
27   <title>Cannot access word file</title>
28  </head>
29  <body bgcolor=#FFFFFF text=#000000>
30   <center>
31    <h1>OOPS: Cannot access word file</h1>
32   </center>
33 </body>
34 </html>

35 END_ERROR

36 exit;
37 }
```

`ranstring.cgi` script is line 6, which, in one simple command, reads in the entire input file and stores it in an array. Each line in the input file becomes an element in the array. The preceding line opens the file, or calls an error procedure if it cannot, and the following line closes the input file.

We have placed the definition of the actual file and the delimiter near the top of the file so they are easily modified without affecting the remainder of the script. This is good script-writing practice. You might also want to toss some comments into your script. I haven't included any, primarily to save space.

Randomization

The other interesting commands in this script provide the randomization that is, after all, the heart of what we are after. The `srand` call "seeds" the randomizer. If a seed is not provided, every run of this script would result in the same string. You need to provide an argument that will result in a different value every time it is called. We've used the `time` variable but, even with this, we can get some repetitive answers. Some people use a combination of `time` and the process ID of the current running of the script, `time ^ $$`. You might think of other values that work better. If so, I'd love to hear from you.

Calls to `rand` (lines 11 through 13) return numeric values from zero to the argument provided. Our call on line 13, for example, generates a number between zero and 10. The calls on lines 11 and 12, on the other hand, are using an array as an argument. In these cases, the size of the array is used as the upper limit for the number to be generated. These numbers can, therefore, provide pseudo-random choices from within our array. In lines 16 and 18, we use these numbers to select two elements from our array, then use the `substr` operator to take only a piece of each to use in our final string, along with a single character from the string explicitly defined in line 17.

You'll notice that the two substring operators are selecting different parts of the selected strings: The first selects the first four letters of a word and the second selects the last four (hence, the "-" sign in the second argument). Varying these values is another way to get a different result.

The last aspect of this script that's worth discussing is the error procedure. The HTML code around the error message is obviously formatting our error message in anticipation of being viewed in a Web browser. You can easily remove this if you like. Alternately, you might want to add similar HTML code around the display of the generated "random" string. Feel free to use and abuse this code in any way that suits you.

A fairly recent convert to Perl, I am frequently astounded by how much work I can get out of a single line of code. Though I am never one to call this language "intuitive" (I seem to use that word less and less frequently), an investment in its basic operation and syntax is worth whatever time you can spend on it. As I sit at my "nav" (navigation) station writing this column, O'Reilly & Associates Inc.'s second editions of *Learning Perl* (by Randal L. Schwartz and Tom Christiansen, 1997, ISBN 1-56592-284-0) and *Programming Perl* (by Larry Wall, Tom Christiansen and Randal L. Schwartz, 1996, ISBN 1-56592-149-6) are by my side. ⊸

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by Æleen Frisch

LYNNE CANNOY

Useful Tools, Part 2

This month, we continue our discussion of useful Windows NT command-mode utilities, focusing on tools for systems administration and the various Windows NT versions of standard TCP/IP user commands.

Sysadmin Commands

A number of important frequently required systems administration operations can also be performed quickly from the command line. The `chkdsk` command, for example, is used to check the integrity of a file system under Windows NT. The command takes the drive letter for the desired file system as its argument. The `/f` option tells the command to fix any errors it finds; the default mode merely displays information about current file system status. For example, the following command checks and fixes the file system located on drive `h:`

```
chkdsk /f h:
```

If you attempt to run `chkdsk` on a file system that is currently in use, you'll receive an error message that the command cannot be run at that time, and you will be given the opportunity to schedule an automatic file system check at the next system restart.

The easiest way to send a message to a user or group of users is to use the `net send` command, which takes the name of the desired user and the message as its argument. For example, the following command sends a message to user `rchavez` (we've wrapped the command to fit):

```
net send rchavez "the correct
command is compact not compress"
```

In place of the user name, you can use an asterisk or the `/users` option, which sends the specified message to all users in your group or to all users connected to the local server, respectively.

The name specified to the `net send` command is actually any defined network name and is not limited to user names. By default, a user's user name is defined as a network name whenever he logs in, and computer host names are defined as network names whenever the corresponding system is up.

In addition, you can define network names using the `net name` command, specifying one of the `/add` or `/delete` options, depending on whether you want to add or remove a network name. For example, the following command defines the network name `webmaster`, setting its target to be the user who executes the command:

```
net name webmaster /add
```

There is also a series of `net` commands that provide much faster ways of manipulating system services than going through the **Services** control panel. They are `net start`, `net stop`, `net pause` and `net continue`, which start, stop, pause and resume the service specified as the command's argument (use `net start` without an argument to see a list

of currently running services and their corresponding names). For example, the following commands stop and start the print spooling service:

```
net stop spooler
net start spooler
```

Similarly, the `net share` and `net use` commands provide faster and more efficient means for defining and attaching to system shares (compared with using items under the object's or My Computer's **Properties** menus). Without arguments, `net share` displays a list of currently shared resources for the local system, as shown in Listing 1.

So-called hidden shares are listed first, followed by publicly available shares. Note that both disk and printer resources are included in the list.

The net print command can be used to display the queue for a remote printer and to manipulate jobs within it.

The `net share` command uses the following syntax when defining a new share:

```
net share name=drive:path
```

where *name* is the share name for the new share and the argument immediately following the equals sign (=) specifies its disk location. For example, the following command defines the share name `chemdata` as the path `j:\chem\data`:

```
net share chemdata=j:\chem\data
```

Adding the `/delete` option to the command removes (stops sharing) an existing share. Note that, in this case, *=location* is not needed.

The `net use` command will similarly display a list of currently mapped remote resources or define a new drive letter for a remote resource. In the latter case, the desired drive letter and remote resource's UNC path are given as the command's arguments. For example, the following command defines drive letter `w:` as the `in_box` subdirectory of the `writers` share on the system `vala`:

```
net use w:\\vala\writers\in_box
```

The `net print` command can be used to display the queue for a remote printer and to manipulate jobs within it. For example, the following commands display the contents of the queue for printer `picasso` on system `vala`, and then place job number 3 on hold:

```
c:\> net print \\vala\picasso
Printers at \\vala
Name          Job #    Size          Status
---------------------------------------------
picasso Queue          2 jobs    *Printer Active*
rchavez       2        282836        Printing
xwilliams     3        11748         Waiting
The command completed successfully.
c:\> net print 3 /hold
```

The `/release` and `/delete` options may be used instead of `/hold` to release a previously held job or delete a job, respectively.

The `net file` command can be used to list local resources that are currently in use by a user from some remote system, for example:

```
c:\>net file
ID   Path                      User name    # Locks
-----------------------------------------------
678  g:\NETXRAY\README.WRI     bchang           0
679  i:\CDROM.ICO              xwilliams        0
681  i:\747-2.hlp              rchavez          1
The command completed successfully
```

At the current time, three local files are in use via the network. The `net file` command's `/close` option may be used to force closure of an open item. The following command closes the help file currently open on disk `i:`, for example:

```
net file 681 /close
```

As a final example of useful systems administrative commands, we'll briefly consider two additional `net` commands that can manipulate data related to user accounts. The `net user` command displays information about a user account and

Listing 1. Shared System Resources

```
c:\> net share
Share name  Resource                        Remark
------------------------------------------------
IPC$                                        Remote IPC
print$      c:\WINNT\system32\spool\drivers  Printer Drivers
BUP         c:\BUP
C           c:\
CD          i:\
NETLOGON    c:\WINNT\system32\Repl\Import\S  Logon server share
NTIn        f:\NT Incoming
picasso     LPT1:                Spooled    picasso
The command completed successfully
```

can also modify user account settings. In the latter mode, it includes a plethora of options that provide access to a large subset of available user account attributes. For example, the following command modifies the domain user account `pavlova`, changing its full name, expiration date, user profile path and login script path attributes:

```
net user pavlova /domain ^
/fullname:"Olga Pavlova" ^
/expires:1/1/99 ^
/profilepath:\\vala\p2\OP ^
/scriptpath:Chem.Bat
```

The `net user` command also offers the ability to add and delete user accounts via its `/add` and `/delete` options.

Finally, the `net accounts` command provides a couple of useful functions. It can be used to modify the settings of the various systemwide password characteristics or change rules. It can also be used to force an immediate synchronization of the user account database from the primary domain controller to the backup domain controllers, for example:

```
net accounts /sync
```

NT Versions of TCP/IP Commands

When the TCP/IP networking protocol is installed on a Windows NT system, quite a few command-line utilities become available. For example, the `finger`, `ftp` and `telnet` client utilities are added to the system, and they work in the same way as they do on other systems. Similarly, the `hostname` command is also provided, although you cannot use it to set the system host name (as you can on UNIX systems) only to display it. Likewise, a basic `ping` command is provided, which can determine the connectivity status to a remote system; although, again, none of the fancy features found in some implementations are present in the Windows NT version.

The `arp` command can be used to display and manipulate the physical address-to-IP address translation table. For example, the following command

Listing 2. The netstat Command

```
c:\> netstat
Active Connections
Proto  Local Address    Foreign Address     State
TCP    vala:1025        demeter:nbsession   ESTABLISHED
TCP    vala:1091        dalton:ftp          ESTABLISHED
TCP    vala:1100        hamlet:finger       CLOSE_WAIT
TCP    vala:nbsession   demeter:1026        ESTABLISHED
...
```

Listing 3. IP Statistics

```
c:\> netstat /s /p IP
IP Statistics
Packets Received                    = 1552
Received Header Errors              = 0
Received Address Errors             = 0
Datagrams Forwarded                 = 0
Unknown Protocols Received          = 0
Received Packets Discarded          = 0
Received Packets Delivered          = 1552
Output Requests                     = 1172
Routing Discards                    = 0
Discarded Output Packets            = 0
Output Packet No Route              = 0
Reassembly Required                 = 0
Reassembly Successful               = 0
Reassembly Failures                 = 0
Datagrams Successfully Fragmented   = 0
Datagrams Failing Fragmentation     = 0
Fragments Created                   = 0
```

Listing 4. TCP Statistics

```
c>\> netstat /s /p tcp TCP Statistics
Active Opens                        = 4282
Passive Opens                       = 5104
Failed Connection Attempts          = 17
Reset Connections                   = 152
Current Connections                 = 23
Segments Received                   = 827324
Segments Sent                       = 866312
Segments Retransmitted              = 2312
```

adds an entry to the translation table saying that the IP address `10.0.220.27` corresponds to the specified Ethernet address:

```
arp 10.0.220.27 11-11-22-22-33-33
```

The form `arp -a` may be used to display the current translation table contents. In addition, the `ipconfig` command displays useful information about TCP/IP settings for the local system. Include the `/all` option for the most detailed display.

The UNIX `netstat` command is also available under Windows NT. As usual, it takes a list of options and an optional reporting interval length as it arguments. If the latter is included, then the statistics are refreshed after each specified period of time elapses. Without arguments, the command displays a list of active network connections for the local system, as shown in Listing 2.

The command's `/s` option displays statistics about current connections and recent traffic, as well as error rates on a per-protocol basis–note that you can limit the display to specific protocols using the `/p` option. For example, the command shown in Listing 3 displays the statistics for the IP protocol, thereby providing data about overall TCP/IP network traffic. Traffic was very light on this

Listing 5. The nbtstat -s Option

```
c:\> nbtstat -s
                    NetBIOS Connection Table
Local Name            State        In/Out    Remote Host          Input   Output
-------------------------------------------------------------------------------
VALA                  Connected      In      DEMETER       <00>   10KB    14KB
VALA           <03>   Listening
ADMINISTRATOR  <03>   Listening
...
```

Listing 6. The tracert Command

```
c:\> tracert dalton
Tracing route to dalton [193.0.9.22]
over a maximum of 30 hops:
1  <10 ms   <10 ms   <10 ms  jovial  [193.0.13.5]
2  181 ms   180 ms   180 ms  whimsy  [193.0.12.42]
3  180 ms   180 ms   181 ms  daltonr [193.0.9.22]
Trace is complete
```

system over the given reporting period.

Similarly, Listing 4 displays information about network traffic using the TCP protocol. The protocol is performing well over this interval of fairly light network activity, and the small percentage of errors is nothing to worry about.

The `dnsstat` command can provide information about Domain Name System (DNS) server-related network activity and the `nslookup` command may be used to troubleshoot the host name-to-IP address translation process.

The `nbtstat` command displays information related to NetBIOS activity, including the contents of the current NetBIOS name translation table. For example, the `-s` option displays a table of active NetBIOS connections (see Listing 5). Note that options to this command must be preceded by a hyphen and may not use a forward slash.

The `route` command is another interesting utility and may be used to set up and modify static routes on a local system. It has the following syntax (we've wrapped it to fit):

`route` [*options*] [*cmd* [*dest*] `[MASK` *netmask*] [*gateway*] `[METRIC` *hops*]]

where *cmd* is one of the `route` command's defined subcommands, *dest* is the destination IP address, *netmask* is the network mask (it defaults to `255.255.255.255`, so it is often necessary to specify the correct netmask), *gateway* is the IP address of the gateway system and *hops* is the number of hops from a local system to the destination. Defined subcommands for `route` include `print` (display contents of routing table), `add` (add entry to routing table), `delete` (remove entry from routing table) and `change` (modify entry in routing table).

For example, the following `route` command and entry for the network `192.0.13.0`, specifying a netmask of `255.255.255.0` and the IP address `192.0.9.22`, has the following gateway:

```
route add 192.0.13.0 MASK ^
255.255.255.0 192.0.9.22
```

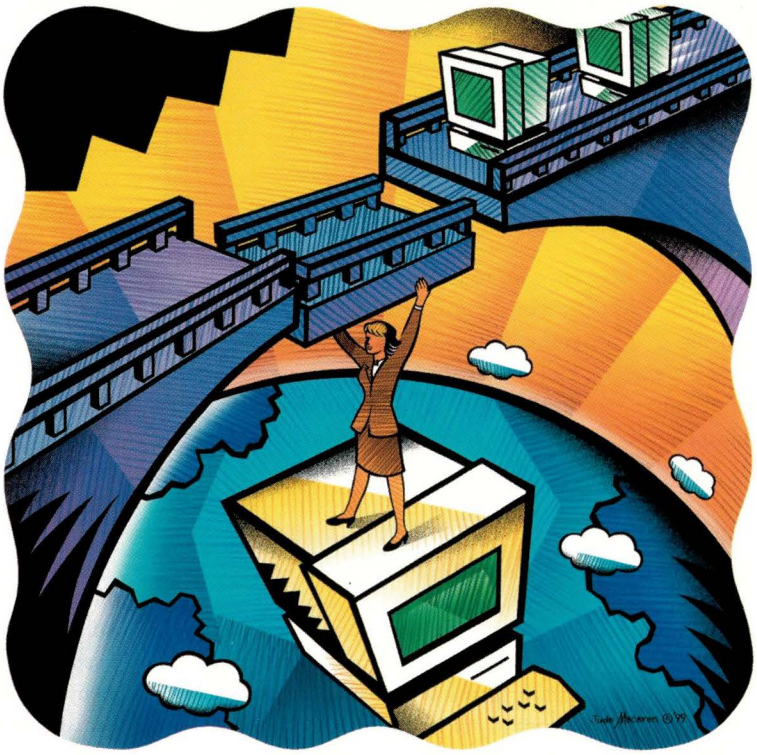
Include the `/p` option when adding a static route to make it persistent, meaning that it will survive a system reboot (by default, added routes are temporary). When you're deleting a routing table entry, you do not need to specify any argument other than the destination IP address. Finally, you can use the form `route print` to display current contents of the routing table.

To close, we'll briefly consider the `tracert` command, which may be used to display the exact route taken to reach a remote destination. For example, the command in Listing 6 displays the route used to get to a remote system named `dalton`.

I hope the past two columns have convinced you of the efficiency and ease-of-use of the available Windows NT command-mode utilities.

Æleen Frisch *is systems administrator for a very heterogeneous network of UNIX and NT systems. She is also the author of the books* Essential System Administration *and* Essential Windows NT System Administration *(both from O'Reilly & Associates Inc.). In her spare time, she enjoys painting and lounging around with her cats, Daphne, Susan, Talia and Lyta. Email:* `aefrisch@lorentzian.com`.

by John S. Quarterman



JUDE MACEREN

Interview with Esther Dyson

For some time now, I've been writing columns about issues of Internet governance, the most recent of these being "Internet Politics Endgame," *SunExpert*, December 1998, Page 38. The columns usually mention the Internet Assigned Numbers Authority (IANA), or its successor the Internet Corporation for Assigned Names and Numbers, ICANN (`http://www.icann.org`).

An unexpected recent development was the appointment of Esther Dyson as ICANN Interim Chairman, apparently by Jon Postel just before his death. Esther is publisher of the well-known industry newsletter, *Release 1.0*, and of a new book, *Release 2.0*, and is the former chairman and current director of the Electronic Frontier Foundation (EFF). For more information about Esther, see her company's Web page at `http://www.edventure.com`.

I've encountered Esther from time to time, for example, in Bucharest in 1995. But I never expected to see her in this new position because she has not been an active participant in either the International Ad Hoc Committee (IAHC) or the International Forum on the White Paper (IFWP) processes, and she is known as a PC expert, not an Internet expert.

So I took a simple approach to find out how this happened and what she planned to do about it: I asked her. Here are her responses, taken from a telephone interview conducted on January 18, 1999.

Background

JSQ: How were you appointed?

ED: We were told it was because we weren't involved in the hostilities.

JSQ: What do you see your qualifications as being?

ED: Having spent a lot of time in Eastern Europe. Also, willing to spend time on it; not many people are willing to spend as much time. I do know something; more than the average person. I also have intellectual curiosity and a reporter's background. I listen to a lot of people with different agendas and try to figure out the honest unbiased truth. I realize some people always won't be happy, but in the long run, we have to do stuff. I am an entrepreneur. I have

Important Dates

- **November 14, 1998**
  Open meeting with the ICANN Board held at the Cambridge Mariott, Cambridge, MA.
- **January 23, 1999**
  Workshop on ICANN membership issues held at the Harvard Berkman Center, Cambridge, MA.
- **February 5, 1999**
  Deadline for ICANN Supporting Organization (SO) applications.
- **March 3, 1999**
  Singapore ICANN Board open session.

funded companies. My natural constituency is small start-ups, somewhat like would-be registries, or other net services, and business in general.

JSQ: Were you previously involved with IANA?

ED: I never met Jon Postel–people are often surprised to hear that. I was at one of Ira Magaziner's earliest meetings where he was trying to understand the net. I was also at another meeting hosted by Magaziner where Tony Rutkowski was involved.

As public disclosure, I knew Ira back in the '80s or early '90s, when he was a consultant and he hired me as a subconsultant. Also, for example, I knew Jim Barksdale when he was CEO at Fedex, and I had a meeting this morning with Richard Forman of Register.com, whom I had met earlier in another context.

JSQ: Were you aware of how polarized and hostile this political process had become?

ED: I knew there was a fair amount of nastiness. I'm used to flaming. I'm busting my ass trying to learn more.

Openness and Transparency

JSQ: Are you familiar with Jim Dixon's complaints about substantive discussions taking place on the IFWP list, which has been made into a closed list?

ED: It's not just Jim Dixon's complaints; it's everybody's. I'm used to defending my own mistakes, but not other people's. I don't think closed lists are such a sin. If you claim you represent a consensus, you need an open list; but to get work done, you need a closed list. It's become so polarized. If you want to claim a consensus, you need to bring it out into the light of day and open it up to public scrutiny.

You can start out being open, then get overwhelmed. How do you moderate a list without being dictatorial? You moderate enough. The great thing about net governance is people are free to leave. By and large, the problem works itself out.

JSQ: There was a lot of confusion over the IFWP Steering Committee. For example, it repeatedly promised to publish minutes, yet didn't do so, or did so very slowly. Another issue was what was the legal status of any part of IFWP.

ED: We have a real legal status.

JSQ: You will be publishing minutes?

ED: Yeah, we have already. Another issue is the board is simply not visible to people. I'm trying to get them out more. I want them to be known; they have opinions. Our opinions are not binding and so we shouldn't be scared to have them. Right now, we're faceless until we vote. But going out there can be a little scary because people can jump all over you.

JSQ: Are you aware of Jay Fenello's comments about wanting to see public discussion of applications for ASO [Address Supporting Organization]?

ED: Not aware of them, but seems to make sense. We have no applications yet. When we get them, they will be posted. Or if they are for some reason completely unresponsive, we will send them right back. The goal is to get them visible.

JSQ: Sounds like people are spending a lot of time complaining and not much producing drafts or forming organizations.

ED: Yes. But certainly regarding the DNSO [Domain Name Supporting Organization], several groups are working away. The IETF [Internet Engineering Task Force] as well, on a PSO [Protocol Supporting Organization] proposal.

JSQ: Do you expect to get applications by the February 5 deadline?

ED: We will probably get the DNSO, but the others, maybe not until the May board meeting.

Acceptance and Role of ICANN

JSQ: The initial ICANN open board meeting in Cambridge, MA, was widely reported as having a very hostile audience. How did you perceive it?

ED: First of all, it wasn't an open board meeting. It was an open meeting with the board; we weren't voting. It was reported as hostile, and it was hostile, but I found it useful. I didn't think anybody was really out of line. In Russia, people hit each other in parliament, and they murder politicians. I can live with this kind of hostility. People are generally much nicer in person than they are in the lists. They don't like how we were chosen, but were not hostile to us personally. To a reporter from the print press who was not familiar with the online discussion, it was very hostile, but not so much to someone familiar with the online discussion. Put it this way, I had a good time. You see, fundamentally, it is really interesting.

'The great thing about net governance is people are free to leave. By and large, the problem works itself out.'
– Esther Dyson

JSQ: You've mentioned Internet governance. Yet in your January 9 response to a letter from the Board of the Internet Society of Mexico, you say: *"Please not[e], however, that our charter is management of the Internet's technical resources, and not 'governance of the Internet' and the people on it."*

ED: Did I say "Internet governance" in regard to ICANN?

JSQ: Hmm, not specifically referring to ICANN, no, and you actually said "net governance."

ED: The term "Internet governance" is specifically not accurate in reference to ICANN. There are several aspects of governance that are relevant here: 1) governance of ICANN, that is, the board; 2) governance that ICANN exerts–this is limited to technical infrastructure, not people's behavior, privacy, spam, etc., except in unusual cases; 3) Internet governance–what EFF has to deal with–and related issues, such as how mailing lists govern their members.

The real trick is what is universal and what is something

you can safely leave to the market, whether lists or other.

We are trying to limit our purview. Even if we were megalomaniacs, there is too much for us to do. Certainly, ICANN will evolve over time. My personal mission is to create a structure that can evolve and that has the legitimacy to evolve. We haven't proved ourselves. We weren't elected. There is no large public support yet for what we do, so we have to be very limited in what we do. We mostly limit ourselves to governance of ICANN itself, so our successors can be elected and have more legitimacy.

'Certainly, ICANN will evolve over time. My personal mission is to create a structure that can evolve and that has the legitimacy to evolve.'

– Esther Dyson

JSQ: Your first public pronouncements about ICANN seemed to indicate you were opposed to a membership feature for ICANN, but now it sounds like you are for it. Are you for a membership structure for ICANN?

ED: Personally, I am. The board voted for it. This is one thing we're learning–how to speak for ourselves–once I understood the distinction between being a charity that is accountable to no one and being a public organization that is not giving something away something, rather is managing a public trust.

JSQ: When you say "a charity," are you referring to EFF?

ED: No, EFF is a different kind of organization; it's not a charity. I was referring to our original model for ICANN. Our original model was flat-out wrong. I was wrong. I changed my mind. I'm learning.

Geography

JSQ: One problem with the IAHC and gTLDMoU [generic top-level domain memorandum of understanding] was that it didn't take into account ccTLDs [country code top-level domains]. Will ICANN deal directly with those, or not?

ED: Right now, we're trying to maintain the status quo; maintain sovereignty of governments.

JSQ: But that was something that wasn't the status quo.

ED: Well, we're trying to deal with other issues first.

JSQ: Are you aware of the complaints from Latin America and the Caribbean that their region is not adequately represented? Do you think that you are sufficiently familiar with this issue to deal with it?

ED: Not at all; neither is the board, and it probably should be. Not necessarily as part of this interview, could you send me some names of people in ALyC [Latin America and the Caribbean] who would be appropriate to discuss this with?

JSQ: Sure, I'll do that.

[Via email on January 25] **ED:** I subsequently met with a group of five Latin Americans to start learning more, last Saturday. It is only a start, but you have to start somewhere. It was a productive, friendly meeting.

JSQ: I see you have two good people from the region on your membership committee now.

ED: Thanks.

JSQ: An interesting side effect of the IFWP process was that, partly because of the IFWP meeting in Buenos Aires, a new political organization, ALCI [Association of Latin America and the Caribbean for the Internet], sprang up to deal with Internet political issues. I'm not clear on what ALCI has actually done, other than change its name to ECON LAC. Meanwhile, and perhaps partly in reaction, the venerable organization ENRED [Foro de Redes de América Latina y el Caribe] has suddenly in the past few months become quite active in expressing its opinions to IANA and in promoting candidates to the ISOC [Internet Society] and ICANN boards. Do you think this is something that ICANN should be doing; assisting in organizing such organizations for geographical regions?

ED: It is not our mission to organize them. In some sense, it is their mission to organize us.

JSQ: In which sense?

ED: They should be joining the membership and helping out with determining ICANN's mission.

JSQ: There is no one from that region on the ICANN Board.

ED: That is one of the first things we intend to correct when members get elected.

JSQ: Given that about 60% of almost everything on the Internet, including users, is in the United States, how do you avoid ending up with all the board members being from the United States?

ED: You create geographic slots.

JSQ: What about Africa? There has been a recent spate of activity there toward creating an African NIC [Network Information Center]. Should ICANN assist with that?

ED: We will take the same approach as for Latin America. Can you send me some names for Africa?

JSQ: I'm not nearly as familiar with who's doing what there, but I see you have the current AfriNIC Chair on your membership committee.

ED: Yes, Nii Quaynor.

The ICANN Board

JSQ: There has been some contention over the difference between interim versus initial board members. IFWP recommended one, but IANA created the other for ICANN, with different terms and probably other differences.

ED: The initial board is the nine people who were appointed, plus Mike Roberts who is a director as long as he remains president. He's temporary while we search for a permanent president.

JSQ: I imagine it must be hard to find someone willing to fill the post.

ED: That's true.

JSQ: And are you interim or initial?

ED: I'm interim as chairman, but I'm a real initial director. Actually, I was "elected" by the board because I was the only one who volunteered. I was not interim chairman going in. Interim is even shorter than initial. I am interim; Michael is interim. Interim is more like tentative. The initial board is to serve one-year terms, renewable to two, and then quit. We could get a whole new slate.

The Real Issues

JSQ: Well, those were the topics I wanted to cover in this interview.

ED: There's 10 times more to say, but you have to pick specific topics. We haven't even gotten into the real issues.

JSQ: What do you consider to be the real issues?

ED: All the DNSO stuff.

JSQ: For example?

ED: Trademarks, new gTLDs, ccTLDs. How people deal with completely different regulations governing different SOs. Monopolies such as NSI [Network Solutions Inc.], what is properly a monopoly and what isn't.

JSQ: Could you say a few words as to why trademark interests have a special seat at the table, how much work the ICANN Board put into the current DNSO proposal and whether they will give the same assistance to any other group who wishes to put in an application to be the names council?

[Via email on January 25] **ED:** What do you mean by TM [trademark] interests have "a special seat at the table"? For what it's worth, they feel *underrepresented*. I guess *everyone* feels unfairly treated, which may be more or less a good sign. No one *feels* he has won. The ICANN Board has put in no work on the DNSO proposal, though Mike and I have gone to a number of broader-based meetings…and yes, we have talked to the various groups. We try to talk to everyone who wants to talk to us.

JSQ: I imagine you haven't had much time to get into the real issues yet.

ED: The board has certainly not made any decisions. We've all been thinking about it. The decisions are not worded that way, they are worded about more specific concrete issues. We also worry about issues such as, what about other name spaces than the DNS [Domain Name System]?

JSQ: OK, thanks. Maybe we can get into those issues another time. ⊸

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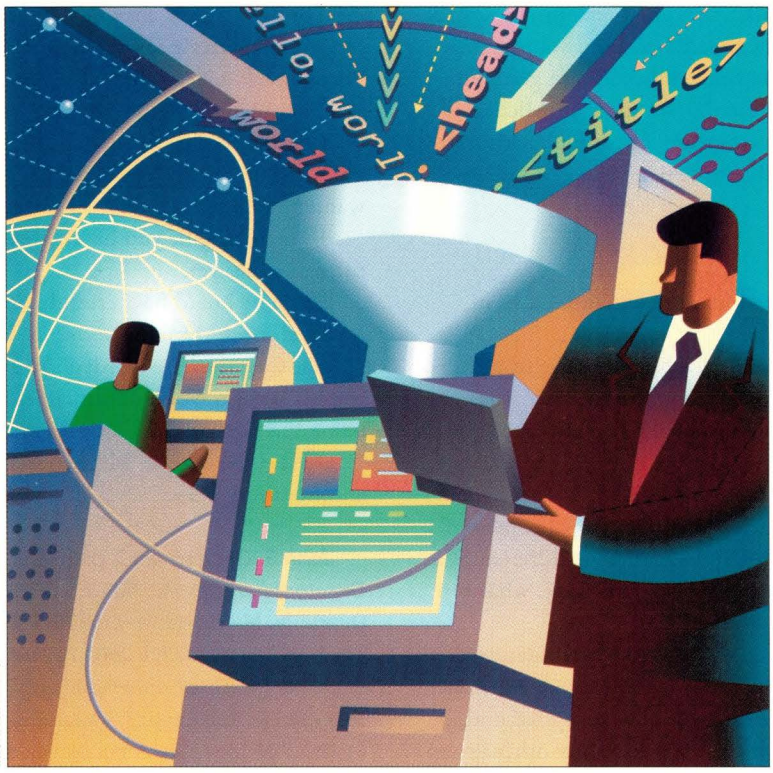
by Jeffreys Copeland and Haemer



MICHAEL AVETO

"All sorts of interesting things happened when programmers tried to [manually] copy subroutines...it therefore seemed sensible to have the computer copy the subroutines."
– Grace Murray Hopper on why she built the first compiler

"hello, world"
– Nearly every compiler writer since then

A Simple Web Script

If you haven't done any Web programming yet, but would like to try, this month's column is designed to help you get started. We'll create a Web page, a CGI script and a simple, LWP-based Web client. None of these will be sophisticated or difficult. On the way to making them, we'll show you how to make a simple front end for an arbitrary Web page. We'll start the usual way.

Hello, World

November 21, Haemer's birthday, is World Hello Day. "Hello, world" is a catchphrase that every programmer knows–a literary allusion to the very first page of *The C Programming Language*, by Brian W. Kernighan and Dennis M. Ritchie (published by Prentice-Hall Inc., now in its second edition, ISBN 0-13-110370-9), perhaps the single most influential book in programming:

1.1 Getting Started

The only way to learn a new programming language is by writing programs in it. The first program to write is the same for all languages:

Print the words

```
hello, world
```

This is the basic hurdle; to leap over it you have to be able to create the program text somewhere, compile it successfully, load it, run it, and find out where your output went. With these, mechanical details mastered, everything else is comparatively easy.

In C, the program to print "hello, world" is

```
main()
{
 printf("hello, world\n");
}
```

The line, "The first program to write is the same for all languages" wasn't true until K&R wrote it. Now, "hello, world" is a noun, an adjective and occasionally even a verb. We, for example, are about to show you how to "hello, world" in several new ways. There are many Web pages devoted to "hello, world" in hundreds of languages, for example, `http://www.latech.edu/~acm/HelloWorld.shtml`.

(We note that the other accepted way to demonstrate a programming language is to write the "99 bottles of beer" program. Examples of this in different languages are available at `http://www.ionet.net/~timtroyr/funhouse/beer.html`.)

We'll want a "hello, world" for each piece of our application: Web page, CGI script and Web client.

The Web Page

Here's the HTML for a "hello, world" Web page:

```
<HTML>
<HEAD><TITLE>Hello
        HTML</TITLE></HEAD>
<BODY>
<H1>hello, world</H1>
```

```
</BODY>
</HTML>
```

The hard part will be figuring out how to point your Web browser at it. You can start by putting it on your own machine:

```
$ cat << EOD > /tmp/hello
<HTML>
<HEAD><TITLE>Hello HTML</TITLE></HEAD>
<BODY>
<H1>hello, world</H1>
</BODY>
</HTML>
EOD
$ netscape file:/tmp/hello
```

Eventually, though, you'll need to figure out how to put it on the same machine as a Web server. This involves analogues to all the mechanical problems described in K&R. You'll need to at least do the following:

• Find a machine you have access to that's running a Web server. If you administer your own machine, you can install one. The most popular Web server is Apache (`http://www.apache.org`). More Web sites run the Apache server than all other Web servers combined, and its market share is growing. One thing that keeps this from an antitrust suit is that no one owns or sells it. It's open source and it's free. (One thing that keeps increasing Apache's market share, even on Windows NT-based machines, is that, unlike the corresponding Microsoft Corp. product, it's limited by hardware performance, not by the performance of the NT scheduler.)

• Figure out where to install it. Web servers don't let you get files from just any old place on the server's machine. That would be a tremendous security hole.

Although a URL like `http://woodcock/hello/hello.html` really is on `woodcock`, and the file is `hello.html`, the directory it's in really isn't `/hello/`. Instead, it's probably `/usr/local/etc/httpd/htdocs/hello/`. For better or for worse, you'll need to talk to the person who administers the server to find out where to put your page and what URL it will correspond to. This is analogous to writing a shell script and then installing it on your machine. Where you're allowed to install it will vary, and even if you install it in `/usr/local/bin`, you'll probably invoke it as `myscriptname` and not as `/usr/local/bin/myscriptname`. Moreover, invoking it without a full path doesn't mean there's a copy in your current working directory.

The analogy isn't exact because there's no analogy to the user-specified search path (a systems administrator can specify global search paths), but it gets the idea across.

• Figure out what the permissions and ownerships need to be. As with shell scripts, permissions and ownerships have to be set correctly. Here, too, these will vary with the installation. Sometimes, you may even need to conform to a naming convention, such as `foo.html`.

We warn you that getting through this list the first time can be annoyingly time-consuming. So was getting your first C program to compile and run, but it was so long ago that the mechanical difficulties have been forgotten. It may help to remind yourself that the HTML for the Web page is trivial; once you overcome the administrative hurdles, it's relatively smooth sailing. Asking a friend for help is probably the most painless way to proceed.

The CGI Script

Here's a "hello, world" CGI script:

```
#!/usr/local/bin/perl -w

print "Content-type: text/html\n\n";
print "hello, world\n";
```

A CGI script is a piece of code the server runs at the request of the client, which constructs a Web page on the fly.

When you use the AltaVista search engine to search for `+duoglide+music`, the URL it takes you to is `http://www.altavista.com/cgi-bin/query?pg=q&kl=XX&q=%2Bduoglide+%2Bmusic`. There is no page of HTML on the server called `query?pg=q&kl=XX&q=%2Bduoglide+%2Bmusic`; it is just a request to the server to run a program called `query`, with `pg=q&kl=XX&q=%2Bduoglide+%2Bmusic` as input (actually with a decoded version as command-line parameters, but we're trying to avoid that level of detail). The `query` program then queries its database, generates HTML on the fly and hands it back to the server, which returns it to you as though it were a static page of HTML sitting somewhere on its disk. Put another way, a CGI script isn't HTML, but it injects HTML into the output stream: "I'm not a Web page, but I play one on an HTTP port." This can be a little confusing at first.

The tiny protocol used for communicating between the server and the script is the CGI referred to in the name, the Common Gateway Interface.

Here, again, the really hard part will be finding out what machine you can put this on, where on the server it needs to be installed, what the permissions and ownerships need to be and whether the file needs to follow any particular naming conventions. One added piece of complexity is you need to make sure the script is syntactically legal. The message you see when a script won't run will be something like this:

```
The server encountered an internal error
or misconfiguration and was unable to
complete your request.
```

Not much of a clue. Here, frequent use of `perl -c` to precheck the syntax will be a big help.

The good news is the script is run by the server and lives on the server machine, just like a Web page. Because you've figured out how to install Web pages, getting the same information for your CGI scripts is easy. However, a caveat: A paranoid systems administrator may disallow CGI scripts because of security worries. We always encourage staying on good terms with your systems administrator.

This column won't be a tutorial on CGI, HTML, Web

client programming or administering a Web server. For each of these topics, there are many books and online tutorials; some of them good. We will, however, spend a moment proselytizing for Lincoln Stein's CGI.pm.

The CGI program we showed you earlier handcrafts a CGI script. It's a pretty simple script, but CGI scripts quickly get more complicated. For anything much more complex, CGI.pm is the tool of choice. Here's a CGI.pm "hello, world":

```
#!/usr/local/bin/perl -Tw
use strict;
use CGI qw(:standard);

print header();
print start_html("Hello CGI");
print h1("hello, world");
print end_html();
```

When you install and run this, you'll notice that, unlike our earlier CGI script, the output looks like our original HTML page.

(We'll also pause to evangelize `use strict` and the flags `-T` and `-w`. These are safety features. If you're going to publish Web pages for the whole world to see, you really should take some serious precautions to ensure no one can shoot you in the foot.)

Examining Web Pages

So is the HTML that the CGI.pm generated really identical to the HTML we wrote by hand? Let's look.

If you're running Netscape, you can look at the raw HTML that your browser is interpreting by clicking on "View," and then "Page Source." Doing this for the hand-coded HTML page shows that the browser is seeing exactly what we wrote. Here's what the CGI-generated page reveals:

```
<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML//EN">
<HTML><HEAD><TITLE>Hello CGI</TITLE>
</HEAD><BODY><H1>hello, world</H1></BODY></HTML>
```

Browsers don't care about layout for HTML source, so the only differences are the first line, which is a comment (comments in HTML start with `<!`), and the different title, which we gave it on purpose.

Don't stop at just looking at the source in your browser. You can capture it as a file. Click on "File," then "Save As," and save the source ("Format for Saved Document: Source") as `file/tmp/cgi.output`. Then do this

```
$ netscape file:/tmp/cgi.output
```

This is an extremely good trick. See something on the Web you like? Capture the source, edit it with your favorite text editor until you get something that looks like what you want, using your browser to look at it while you make your edits, and save it. (If you don't like clicking the "Reload" button each time you want to see the results of your changes, see "We Use vi to Edit Web Pages," *SunExpert*, May 1997, Page 90.)

A Simple Web Front End

We can expand this idea of "new Web pages from old" into a twist on the popular UNIX pastime of front-ending commands. Let's suppose you frequently use a Web front end to a database, and the query page is more general-purpose and noisier than you would like. You now know enough to make a custom-tailored front end with very little work.

In our example, we'll use `http://www3.ncbi.nlm.nih.gov/Omim/searchomim.html`, the front end for searching articles published by Online Mendelian Inheritance in Man (OMIM), the National Center for Biotechnology Information's repository of information about human genetics.

The original OMIM Web page lets users limit their searches in a wide variety of ways. We would like an interface that searches the same database and still permits us to enter any keywords we choose, but limits our searches to the last seven days and returns all articles by default. While we're at it, we'd like to pare down the text on the screen and change the background color.

A little experimentation turns the original, 56-line form into the 19-line derivative shown in Listing 1.

Line 3 changes the title to make it easier to find in our Forward list or bookmarks.

Line 5 changes the background color to the soothing "mint green" that David Siegel recommends (see `http://www.dsiegel.com/tips/wonk2/background.html`).

Line 11 changes the text to make the form say what it's really for, and line 14 reduces the number of words.

Lines 8 through 13 point to an image and a CGI script. In the original form, these were given as relative paths because they were on the same machine as the form. Here, they've been expanded to full URLs, to point to the original machine.

Listing 1

```
1  <HTML>
2  <HEAD>
3  <TITLE>Updates from OMIM</TITLE>
4  </HEAD>
5  <body bgcolor="#EEFFFA">
6  <A HREF="/">
7  <img border=0 align=top
8    src="http://www3.ncbi.nlm.nih.gov/PMGifs/NCBI_logo.gif"
9    alt="NCBI GenBank"></A>
10 <HR>
11 <h3>Recent Articles from Online Mendelian Inheritance in Man</h3>
12 <FORM METHOD="POST"
13  ACTION="http://www3.ncbi.nlm.nih.gov/htbin-post/Omim/getmim">
14 Keyword(s):
15 <INPUT TYPE="text" VALUE="gene" NAME="search" SIZE=40>
16 <INPUT TYPE="hidden" NAME=search_time VALUE=7>
17 </FORM>
18 </BODY>
19 </HTML>
```

http://webserver.cpg.com

For technical managers of World Wide Web sites.

WebServer OnLine focuses on hardware/software to implement, maintain and/or upgrade web sites.

Free Online Magazine, No Password Required.

Listing 2

```
1  #!/usr/local/bin/perl -Tw
2  # $ID: query_omim,v 1.3 1999/02/01 00:10:26 jsh Exp $
3  use strict;

4  use HTTP::Request::Common qw(POST);
5  use LWP::UserAgent;

6  my $usage = "usage: $0 [keyword]\n";
7  my $keyword = @ARGV ? shift : "gene";

8  my $ua = LWP::UserAgent->new();
9  $ua->agent("Fezilla/v6.9 Irridium");
10 $ua->env_proxy();

11 my $ncbi = "http://www3.ncbi.nlm.nih.gov";
12 my $req = POST "$ncbi/htbin-post/Omim/getmim",
13  [ "search" => $keyword, "search_time" => 7 ];
14 my $resp = $ua->request($req);
15 die $resp->status_line(), "\n" if $resp->is_error();
16 (my $content = $resp->content()) =~ s(HREF="")($&$ncbi)g;
17 print $content
```

Line 15 is the data-entry field. We left it as is, but gave it a default value that is likely to be found in all entries: the keyword "gene." The rest of the options and choices have been eliminated.

Line 16 is an input field that the CGI script demands a value for, but we always want it to have the same value. Making it a hidden field and hard-coding its value achieves this end.

Conceptually, it's no different from aliasing `ls` to `ls -CF`, but it's nice to know that such tricks aren't confined to the command line.

Back to the Future: The Command Line

Speaking of the command line, if we're just interested in grabbing a bunch of data off the Web, why go through a form at all? Is there a way to write programs that would let us query Web databases from the command line without ever invoking a browser, say, like this?

```
$ query_omim fragile-X
```

Yes. This is a job for LWP, Gisle Aas' "Library for WWW access in Perl." Basically, LWP is a suite of modules that lets you create programs that act as tiny browsers and other sorts of user agents. The programs you write are typically special-purpose, but lack the enormous overhead of launching an 8-MB browser and the performance penalties that come from waiting while it retrieves and displays forms.

Listing 2 shows an example.

Lines 1 through 3 are boilerplate and lines 4 and 5 bring in the necessary modules. Lines 6 and 7 do argument processing; we've confined ourselves to a single search key because it's just an example.

Line 8 actually creates a browser "object." Pretty amazing. Line 9 names it, in case someone's collecting browser statistics at the other end. We could masquerade as Netscape, Lynx or some other browser, but why not be honest?

Line 10 gets the HTTP proxy information from the environment variable `$http_proxy`.

Line 11 contains the name of the site, to save a little typing. Lines 12 and 13 format a request, with the target address and the field names lifted right out of the source of the form we showed you earlier.

Line 15 sends the request and gathers the response as an object. Line 16 checks the exit status. If there was an error, it reports it. If not, we gather up the contents, discarding any HTTP header information, resolve the relative paths to absolute paths and print the result, which we can look at with our browser for further processing.

This should give you the basic idea.

This command-line utility doesn't need any special permissions, nor does it need to live in any special directories. It's just another Perl script.

Whew. That's a lot. If you had never done any Web programming before, you've now made a Web page and a CGI script, written a Web page replacement front end and a Web client. Not bad for one column. But not that difficult, either. Come to think of it, last month's math problem may have been harder. In fact, it may have been more difficult than we thought, see `http://cardit.et.tudelft.nl/~arlet/puzzles/putnam.html`. (The William Lowell Putnam Mathematical Competition is arguably the acme of national undergraduate math competitions.)

Then again, it may have been easier than we thought it was. Dr. James Flanagan of the University of Iowa Medical School, explained it to us by email:

Open lockers will be those numbered N, where N is an integer with an odd number of factors. Factors come in pairs, e.g.,

1 x N = N

A x B = N

so that 1, N, A and B are all factors of N. The only cases where there are an odd number of factors are those where N is a square of another integer, e.g., C x C = N.

So, the open lockers are all those whose number N is a square of another integer.

Until next time, happy trails. ⊸

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

by Jim Frost

NAOMI SHEA

Beans, Beans, Everywhere

Since the early 1990s there have been a number of approaches toward making applications that can be assembled from many smaller pieces, usually called *components*. Sun Microsystems Inc. has tried twice–first with ToolTalk and later with Distributed Objects Everywhere (DOE)–to establish some kind of standard component framework and has failed miserably each time. Other vendors have tried too, and two component systems, Object Management Group's Common Object Request Broker Architecture (CORBA) and Microsoft Corp.'s OLE/COM/ActiveX/whatever-they're-calling-it-this-week, are fairly successful.

But one big limitation in all of these component systems is they have been very difficult for programmers to use. Each requires laborious definition of all of the interfaces to your program, special compilation and care to follow unusual runtime semantics. In the case of Component Object Model (COM), the requirements are out of hand; there are more than a dozen interfaces that a COM object must define, at a minimum, to even be valid! Taking an existing piece of code and creating a working CORBA or COM object out of it can result in sudden hair loss in even the best developers.

A large part of the reason why CORBA and COM are so hard to use is because the languages that are typically used with them, C and C++, don't create objects that describe themselves very well. The programmer has to add the missing information so the rest of the system knows how to talk to the object.

With Java Developer Kit (JDK) 1.1, Sun introduced *JavaBeans*, self-contained, self-described objects that can be combined with other objects to create an application. JavaBeans are Java's answer to component software and, in my opinion, are probably the single most important concept in Java today. This month, we'll discuss how to build simple beans, and over the following months, we will expand that into a bean framework and, finally, an Internet server that is built entirely from beans.

What's Different about JavaBeans?

A good question to ask yourself is why, if it has been so difficult to get component software working with the existing object frameworks, should Java be any different? The answer lies in the way Java classes are packaged for an application.

In most traditional programming languages, the source files are compiled into object files and the object files are packed together into a single file, the application executable. This executable is monolithic–it cannot be easily taken apart again, and most of the information about the inner workings of the program are lost during construction.

As applications and their support libraries grew, it became more and more advantageous to keep the support

libraries out of the finished application, rather than having the programmer pack them into the application, the application would go out at runtime, find the library and link it in. This allowed library upgrades to be achieved without recompilation of the executable and made the applications much smaller because they each avoided redundant library code. This design is the shared (or *dynamic*) library design that is pervasive in all modern operating systems.

Java takes the dynamic library concept one step further; every single class in an application is compiled into its own file, and these files are linked together on demand while the application is running. This makes Java applications much more flexible. If a particular class has a bug in it, for instance, the application vendor can ship an upgrade to that single class rather than the entire application. In addition, a programmer who is actively working on only a single class in her application need only recompile that class and rerun the application to see the changes take effect. There is no lengthy linking process to contend with, which often shaves minutes off every edit/compile/debug cycle.

This technique was possible in C and C++; in fact, some debuggers and many modern linkers use similar concepts to speed the development process. In Java, however, it is *mandatory*–and this changes the whole landscape of expectations and capabilities.

Java 1.0 supported the `Class.forName()` call, used to load a particular class on demand. An application would typically use this to load one of many classes that implemented a particular interface, allowing different application behavior depending on the environment. While very useful, this was just the tip of the iceberg.

Because each class must be easily located and linked into an application at any time, each class file is completely self-describing; all details about its exported interfaces are provided in the class file produced by the compiler for use by a Java Virtual Machine (JVM). In Java 1.1, Sun exposed those details through the *Reflection API* (see `http://java.sun.com/products/jdk/1.2/docs/guide/reflection/index.html`), allowing an application to ask questions about the available classes, such as what fields and methods they contain, as well as the ability to instantiate objects and call methods that are discovered.

This seemingly arcane set of features provides the foundation for the JavaBeans component management framework. Because the application can obtain full details of the workings of a class or object, the runtime environment can *automatically* determine how to work with a given object. The programmer doesn't need to do anything particularly special for the object framework to manage a Java bean.

Listing 1. Bean with Three Properties

```
/**
 * A bean that contains some properties.
 */
public class BeanWithProperties
{
   private int anInteger;
   private String aReadOnlyString = "Jim was here";
   private Object aWriteOnlyObject;

   /**
    * Creates a new instance of the bean.
    */
   public BeanWithProperties() {}

   /**
    * Returns the value of an integer property.
    */
   public int getAnInteger()
   {
       return anInteger;
   }

   /**
    * Changes the value of an integer property.
    */
   public void setAnInteger(int newValue)
   {
       anInteger = newValue;
   }

   /**
    * Returns the value of a read-only string property.
    */
   public String getAReadOnlyString()
   {
       return aReadOnlyString;
   }

   /**
    * Changes the value of a write-only object property.
    */
   public void setWriteOnlyObject(Object newValue)
   {
       aWriteOnlyObject = newValue;
   }
}
```

JavaBeans, the Easy Way

At its most basic level, the only requirement for a Java object to be used as a Java bean is to provide a public default constructor:

```
public class SimplestBean
{
  public SimplestBean() {}
}
```

Besides the constructor, a Java bean can provide one or more of the following:

- Named values called *properties*.
- *Events*, which the bean can either generate or listen for.
- *Methods* that operate on the bean; this includes all public methods an object implements.

Properties are defined by creating one or more

public *accessor methods* that conform to the following conventions:

```
public boolean
  getPropertyName()
public boolean
  isPropertyName()
public void
  setPropertyName(
  type newValue)
```

The first two are *getter* methods, used to retrieve a property value from the object. The third is a *setter* method, used to change a property value in an object. For example, property may be defined as read-only by providing only a getter method, or write-only by providing only a setter method.

Listing 1 shows a bean that provides three properties, `aReadOnlyString`, `anInteger` and `aWriteOnlyObject`.

A bean specifies its interest in events, or its ability to produce them, by adhering to a simple naming convention. A "something" event would be defined by creating a class named `SomethingEvent` (although it is good form to additionally derive the class from `java.util.EventObject`). For example, a class listening for `SomethingEvent` would implement the `SomethingListener` interface, which must be derived from `java.util.EventListener`. And a class that generates `SomethingEvent` would implement the following two methods:

```
public void
  addSomethingListener(
  SomethingListener newListener)
public void
  removeSomethingListener(
  SomethingListener oldListener)
```

Listing 2 illustrates the technique. These simple naming conventions provide enough information to create completely interoperable beans, and yet they can be learned in a few minutes and written with almost no additional programmer effort.

Introspector

While Java's Reflection package provides all the functionality necessary to build a complete description of the bean, it is quite low-level and difficult to use for this purpose. Thankfully, Sun has provided

Listing 2. JavaBeans Naming Convention

```
/**
 * An event signifying that it's time to go to bed.
 */
public class BedtimeEvent extends java.util.EventObject
{
    public BedtimeEvent(Object source)
    {
        super(source);
    }
}

/**
 * Interface used by beans that listen for bedtime events.
 */
public interface BedtimeListener extends java.util.EventListener
{
    /**
     * Called whenever it's bedtime.
     */
    public void bedtime(BedtimeEvent event);
}

/**
 * An object that generates bedtime events.
 */
public class BedtimeGenerator
{
    /**
     * The list of objects interested in bedtime events.
     */
    private Vector sleepyheads = new Vector();

    /**
     * Adds a new bedtime listener.
     */
    public void addBedtimeListener(BedtimeListener newListener)
    {
        sleepyheads.addElement(newListener);
    }

    /**
     * Removes an old bedtime listener.
     */
    public void removeBedtimeListener(BedtimeListener oldListener)
    {
        sleepyheads.removeElement(oldListener);
    }

    /**
     * Sends a bedtime event to everyone who's listening.
     */
    public void sendBedtime()
    {
        BedtimeEvent bedtimeEvent = new BedtimeEvent(this);
        Enumeration enum = sleepyheads.elements();
        while (enum.hasMoreElements()) {
            BedtimeListener listener = (
              BedtimeListener)enum.nextElement();
            listener.bedtime(bedtimeEvent);
        }
    }
}
```

Listing 3. A Simple Bean Inspector

```
import java.beans.*;

/**
 * Prints out the properties of a bean and their accessibility.
 */
public class PropertyPrinter
{
    public static void main(String[] args)
    {
        for (int i = 0; i < args.length; i++) {
            String beanClassName = args[i];
            Class beanClass;
            try {
                beanClass = Class.forName(beanClassName);
            }
            catch (ClassNotFoundException e) {
                System.err.println("I could not find " +beanClassName);
                continue;
            }

            // introspect the bean
            BeanInfo beanInfo;
            try {
                beanInfo = Introspector.getBeanInfo(beanClass);
            }
            catch (IntrospectionException e) {
                System.err.println("Could not determine bean information for " +
                                   beanClassName + ": " + e.toString());
                continue;
            }

            // retrieve the set of properties
            PropertyDescriptor[] properties = beanInfo.getPropertyDescriptors();
            if ((properties == null) || (properties.length == 0)) {
                System.out.println(beanClassName + " has no properties.");
                continue;
            }

            // print out property information
            System.out.println(beanClassName + " has the following properties:");
            for (int j = 0; j < properties.length; j++) {
                PropertyDescriptor pd = properties[j];
                System.out.print(pd.getPropertyType().getName() + " " +
                                 pd.getName());
                boolean readable = (pd.getReadMethod() != null);
                boolean writable = (pd.getWriteMethod() != null);
                if (readable && !writable)
                    System.out.println(" [read only]");
                else if (writable && !readable)
                    System.out.println(" [write only]");
                else
                    System.out.println();
            }
        }
    }
}
```

When run against our earlier `BeanWithProperties` class, it prints the following:

```
$ java -classpath ".:/usr/local/java/lib/classes.zip" PropertyPrinter BeanWithProperties

BeanWithProperties has the following properties:
int anInteger
java.lang.Class class [read only]
java.lang.String AreadOnlyString [read only]
java.lang.Object writeOnlyObject [write only]
```

a much higher level interface called the *introspector*. It is the job of the introspector to collect bean information, inferring it from naming conventions if necessary, and to package it up in a descriptive object called a `BeanInfo`.

Next month, we will take a detailed look at the introspector and bean information objects, but for now, Listing 3 shows a very simple bean inspector that just prints out the names and accessibility of bean properties.

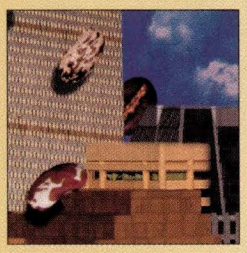
As you can see, the introspector inferred each of the properties, as well as supplying an implicit property, the bean's class. Using this information, it is not difficult to write bean management frameworks to manipulate the bean.

Details, Details

A close look at the `BeanInfo` and related objects shows there is much more information you can specify about your bean than just what can be inferred from the naming conventions. In fact, a programmer can completely override the naming conventions and augment them to terrific detail by supplying specific bean information structures. Once again, this is done through the use of a simple naming convention.

To manually create information about a bean with a given class, you should create a new class, `Class`**`BeanInfo`**, which implements the `BeanInfo` interface. The introspector will look for this class and, if it finds it, will not attempt to infer details about the bean.

Unfortunately, there is not yet a standard way of generating `BeanInfo` objects, and creating them by hand is tedious at best, so we will not cover it here. Sun has proposed extensions to `javadoc`, Java's documentation system, which could be used to automatically generate bean description objects of arbitrary detail, but no publicly available tools exist that implement it. For now, those of you who need to create commercial-quality JavaBeans will have to either create your `BeanInfo` classes manually or write a code generator to do it for you. Source and class files for all code in this article is available from `ftp://ftp.expert.com/pub/JavaClass/04.1999`.



***It is the job of the introspector to collect bean information and to package it up in a descriptive object called a* BeanInfo.**

Next month, we'll take an in-depth look at the introspector and build a simple dynamic bean framework. Stay tuned. ➸

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GIACOMO MARCHESI

CAD/CAM: Designing in Harmony

by Patrick T. Coleman, Staff Editor

From wire frames to finished goods, CAD/CAM systems are helping design and manufacturing orchestrate the full product life cycle.

An orchestra performs at its best only when its members work in a synchronized fashion. The musicians must each play their part in a proper dynamic relationship with one another; together, they perform the piece in time as dictated by the conductor. Hopefully, the result is an accurate reflection of the composer's original intention. If the violin is out of sync with the viola, the performance could turn into a dissonant mess. Or on a larger scale, imagine the chaos caused by the premature triggering of the cannons in Tchaikovsky's "The Year 1812" overture.

The manufacturing and engineering industries encounter similar challenges in bringing a product to market. When one part of the manufacturing process becomes isolated and works without consideration of the whole, problems can arise. For example, if an airplane engineer does not properly communicate the

design specifications of a plane's wing to the engine manufacturer, the result could be costly. The airplane engine might not fit properly or perform at the necessary level, resulting in expensive delays. Moreover, manufacturers must coordinate with raw material suppliers to ensure that their plants are fully equipped to build their products.

In an attempt to bring together the various parts of the manufacturing process, CAD/CAM products have been evolving from the delivery of design data to full product life cycle management. Daratech Inc., a CAD/CAM/CAE market research firm based in Cambridge, MA, refers to this as product process management (PPM). Bruce Jenkins, Daratech Vice President, says, "PPM not only encompasses the development and definition of the product geometry, but also the methodologies for managing and optimizing the process of creating the product."

Woodstock, Ontario-based Timberjack Group, a manufacturer of forestry machines, is moving toward a product and process life cycle management environment that stretches across its global enterprise. With three manufacturing plants located in Canada, Finland and the United States, the company wants to be able to standardize design data at each site, as well as manage product development information via a corporate extranet.

"We want to dramatically shorten our product development time and improve quality," says Tim Whitlock, manager of system support at Timberjack. "By the time we have achieved our goal, our environment will extend to our partners, our suppliers and our customers." In turn, the planned extranet will allow the company to exchange design and management data about its products.

Timberjack's first step was to standardize on Pro/Engineer, a CAD application from Parametric Technology Corp., Waltham, MA. Each CAD vendor's application views design data differently, therefore, by standardizing on a single application users can exchange design geometry without having to translate the data for use in multiple applications. Without such standardization, design files generated in Pro/Engineer, for example, could not be imported into AutoCAD from Autodesk Inc., San Rafael, CA.

Design data can be complex and can include everything from the measurement of parts to surface finish characteristics and other feature definitions. When transferring data from one CAD system to another, attribute data can often get lost in the translation, causing bottlenecks and lost information. In some cases, it forces engineers to redo work. Fortunately, Timberjack's suppliers and partners have also agreed to standardize on the Parametric application. "It's important to look at consistent information and not have to go through different translations to get access to data," Whitlock says.

Although standardization on a single CAD application platform has solved Timberjack's design data interruption problems, the company still needs to improve product management. For help in this area, Timberjack has placed a $1.4 million order with Parametric for its new Web-based integration suite, Windchill 2.0. Windchill is a workflow framework that is designed to manage product definition and life cycle management across an enterprise. Whereas product data management (PDM) systems tend to focus on managing product information within an engineering department, Windchill attempts to supply data to an entire organization. This includes product designers, manufacturers, supply chain managers and even

W3C Defines Formats for the Web

The World Wide Web Consortium (W3C) is focusing its attention on two specifications that have been used in the world of engineering and design for some time. With help from CGM Open Consortium Inc. (`http://www.cgmopen.org`), a nonprofit organization of vendors and users of Computer Graphics Metafile (CGM) technology–an ISO standard for the storage and exchange of two-dimensional graphical information–the W3C released the WebCGM Profile as a recommendation in January (`http://www.w3.org/Graphics/WebCGM`). The WebCGM profile offers an interoperable way to exchange dynamic, hyperlinked CGM data. The second specification, currently in the Working Draft stage, is for Scalable Vector Graphics, or SVG (see `http://www.w3.org/TR/WD-SVG`).

CGM is a graphics format used in the aerospace, defense, automotive and medical industries. It has been an ISO standard for vector and composite vector/raster picture definition since 1987 and a registered MIME type since 1995. In the same way engineers encounter interoperability problems between different commercial CAD applications, users of commercial CGM products also face interoperability problems. "Previously, there were several proprietary flavors of hyperlinked CGM. Each produced valid CGM files but they would not interoperate with other vendors' products," says Chris Lilley, activity lead for Web graphics at W3C.

CGM was originally introduced as a vector format but extensions have been made to include raster capabilities. Now, CGM is capable of offering combined raster and vector images. Hyperlinking is a key feature of WebCGM, allowing for links within multiple pictures in a document, as well as links to close-up views of images. In addition, links can be established between CGM files and HTML documents. This allows a file on an automobile, for example, to contain links to structural diagrams, wiring schematics, test results and parts lists.

The SVG Working Draft, on the other hand, is written in eXtensible Markup Language (XML) and is designed to be more flexible than bitmap rendering. Bitmap images are fully formed and defined pixel by pixel, whereas vector graphics comprise mathematical descriptions of curves and form. "If you enlarge a bitmap, it suddenly becomes grainy and doesn't scale," says Ian Jacobs, technical editor at the W3C. "The fact that [SVG] is scalable means you can enlarge your image and not lose quality."

Currently, the W3C is attempting to reconcile four previously submitted vector graphics submissions into a single SVG specification. Some of the planned features include flow-chart schematics; support for Precision Graphics Markup Language (PRML), used to display bar charts and logos; Vector Markup Language (VML), a text format for vector graphics; and DrawML, a Java class used to lay out diagrams. The W3C is presently soliciting public comment on the SVG Working Draft.–*ptc*

service employees performing maintenance and repair.

In addition, Windchill is able to link to a company's enterprise resource planning (ERP) application. "There is great benefit to be derived from not keeping product development an isolated island in the enterprise," says Jim Baum, executive vice president of engineering research and development at Parametric. "The opportunity to integrate these functions in the discrete manufacturing organization is one that is very real and it has tremendously demonstrable business benefits…cost, quality and time to market kinds of benefits."

Tuning CAD/CAM Standards

Not all manufacturers have the clout to influence suppliers and partners to standardize on one CAD application, however. Numerous companies have to deal with the headache of translating design data from one application to another. "Different brands of CAD/CAM/CAE systems seldom, if ever, work well together," says Daratech's Jenkins. "Data sharing is difficult, if not impossible."

To help alleviate this problem, several standards are being used to provide a way to allow disparate CAD/CAM/CAE systems to communicate using a common language. The two most widely used standards are the Initial Graphics Exchange Specification (IGES), which is maintained by the American National Standards Institute (ANSI), and the Standard for the Exchange of Product Model data (STEP), which is maintained by the International Standards Organization (ISO).

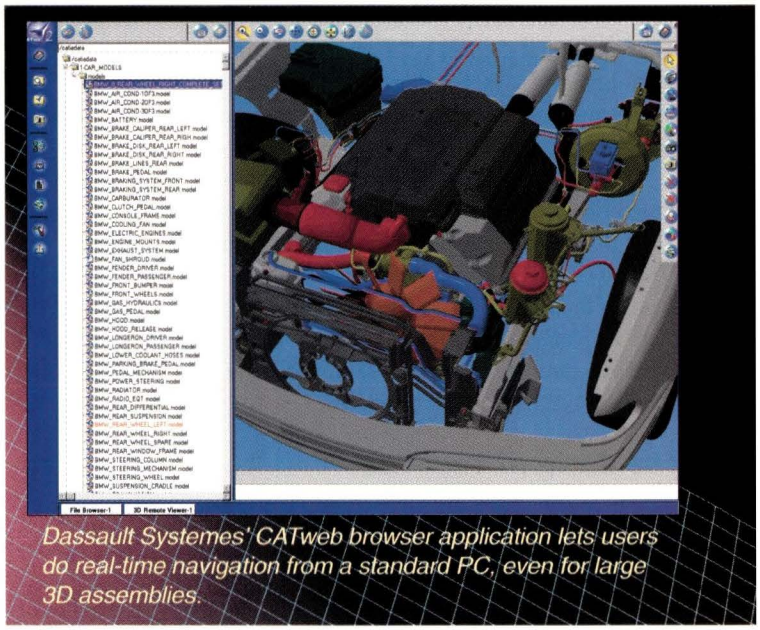
"The problem is these standards are simple definitions," says Jenkins. "It is up to the systems developers and vendors to implement these standards in their product lines, and to implement them well."

Industry watchers have long believed that vendors are not always the most enthusiastic proponents of standards. The theory is the vendor doesn't want to open its customer base and make it easier for people to adopt competing brands of CAD/CAM/CAE systems. "Vendors in general do not receive neutral standards with favor," says Gerry Graves, development group leader at PDES Inc., Charleston, SC, a joint industry and government consortium formed to promote the use of STEP, and owner of the IGES copyright. "Most of them look at neutral standards as somewhat of a threat. They would prefer to be able to have a captive market in a large corporation and have that company demand that all their suppliers use that CAD system."

IGES is older than STEP and more pervasive throughout the CAD/CAM industry. Both IGES and STEP define neutral data formats for the digital exchange of information among CAD systems. With IGES, users can exchange product data models in the form of wire frame or solid representation, as well as surface representation.

While updates are still being made to the IGES specification, the next release, IGES 6.0, will be the standard's last (a release date was not specified at press time). From now on it will be placed in maintenance mode, because PDES wants to promote and develop STEP.

"People use IGES to transfer geometry, and that works OK," says Jerry Sarfati, manager of partners support at Dassault Systemes, Burbank, CA, maker of CATIA, a leading CAD/CAM application. "But we believe that STEP is the way to go. It defines data in a new, better way."



Dassault Systemes' CATweb browser application lets users do real-time navigation from a standard PC, even for large 3D assemblies.

STEP improves on IGES in that it provides more information. In addition to providing the geometery data that IGES does, it also defines information relating to a product's entire life cyle–this includes data relating to parts and material. In this way, STEP reflects the goals of PPM. "We found that the industry today has begun to focus more and more on the supply chain," says PDES' Graves. "There are plans to support logistics and other life cycle activities. They're a little further down the road, but that's the direction [STEP] is heading."

In addition, STEP offers application protocols, called schemas, which are data models for specific industries–the automotive industry, for example, has its own version of STEP.

"STEP has application protocols that are domain-specific or industry-specific. Having an exchange that includes multiple domains is too hard," says Simon Frechette, a member of the methodology group at the National Institute of Standards and Technology (NIST), a government testing facility for both IGES and STEP. "The technology is different and, especially, the vocabulary is different."

While STEP has the capability to handle more information, IGES still has the upper hand in terms of the number of people using it. "As far as implementation support, IGES is a little better off than STEP," says Graves. "IGES is used fairly well by some companies, but I think in the next 12 to 18 months that will change."

American Mold and Engineering Co., Fridley, MN, designs and builds plastic injection models for products such as copiers and printers. The company prefers IGES over STEP for translating product design data when customers are using applications from vendors other than Unigraphics Solutions Inc. or SolidWorks Corp. American Mold uses either translators designed for specific applications, such as the free SolidWorks Converter for Pro/Engineer, or an IGES-based translation tool. Such translation tools take CAD application files and trans-

form them into either files readable by a different CAD program or neutral data files. "The vendors are tending to go toward STEP," says Tim Foreman, engineering manager at American Mold. "But we haven't had more success with STEP than we have with IGES."

There are rare cases when the company needs to translate design files with STEP. In these cases, Foreman says, American Mold turns to an outside service, CAD Potential Inc., Westminster, CO. CAD Potential converts STEP data into a format that can be used by the company's applications. "You can send them a Pro/E part and they'll send you the [Unigraphics] solid," says Foreman. "But none of our customers require us to run the same CAD/CAM packages."

The Song of the Web

The World Wide Web is another factor driving the move toward full integration of product data management. Companies like Timberjack are developing extranets or corporate intranets to encourage collaboration between engineering and manufacturing divisions. To that end, the CAD/CAM vendors are revamping existing products, or developing new ones, to leverage Internet technologies. "Effectively, all CAD/CAM/CAE developers are now rushing to Web-enable their offerings," says Daratech's Jenkins. "In most cases, they have implemented a fair degree of Web enablement."

For example, Dassault Systemes has added Inter/intranet capabilities to CATIA, the company's digital modeling environment. CATIA allows designers to create and simulate part/assembly designs and offers drafting capabilities. CATIA can also be used for product analysis by examining part stress. The company has also released CATweb, a browser application specifically designed to allow users to navigate intranets or extranets in real-time via their desktop. Dassault hopes to provide access to CAD/CAM data for management, purchasing, finance, marketing, sales and technical support personnel. "It's no longer just the guy that works eight hours a day doing designs that has access to this data. Now you're opening it up to your entire enterprise," says Dassault's Sarfati.

In March, Parametric acquired U.K.-based Division Group Plc. Division Group offers two key Web-based technologies: one is a high-end, virtual mock-up and simulation tool for engineers, and the other is an enterprisewide viewing technology that allows disparate users to view the same data simultaneously.

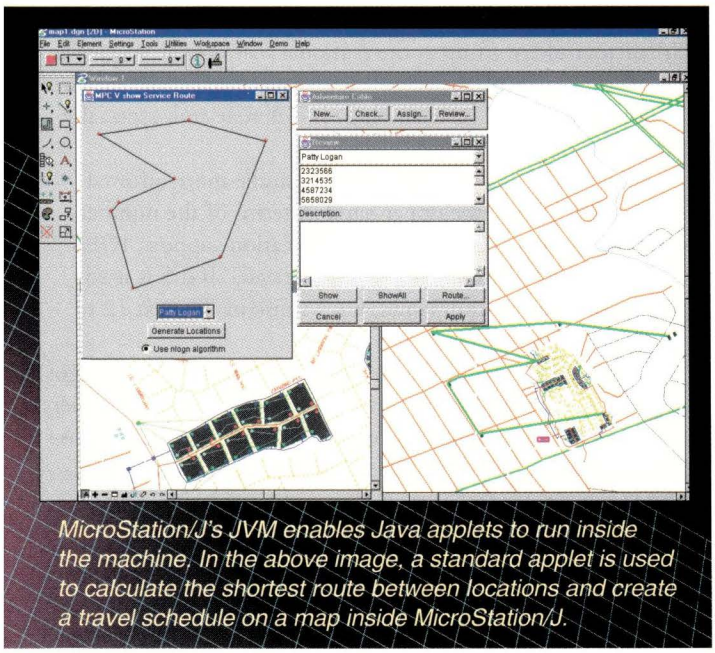
Another example of the move toward the Web is the partnership between Engineering Animation Inc. (EAI), Ames, IA, and Structural Dynamics Research Corp. (SDRC), Milford, OH. EAI is best known for its visualization software, VisView, which can display product data. VisView uses a Web client to provide access to draft or document information via a Java-based Web interface. SDRC makes Metaphase Enterprise, which tracks and manages product data associated with a product throughout the development process. The two companies have teamed up on the development of the Metaphase product line, which is integrated with EAI's visualization technology, to provide a Web-centric approach to team collaboration, visual design and analysis. So far, they have released two products: Metaphase Document Manager (Meta DM) and Metaphase Virtual Product Development Manager (Meta VPDM).

Division Group, Dassault Systemes, EAI and SDRC are providing products that offer the ability to add hyperlinks that can be used to track down geometric and nongeometric attribute data through visualization software. These hyperlinks can establish access paths between CAD models and noncompatible product databases residing on various platforms. "I think this is the biggest thing right now," says Ken Versprille, CAD/CAM analyst with D.H. Brown Associates Inc., a technology research firm based in Port Chester, NY, "[the] visualization of geometry and component models, [moving] right into the entire corporatewide database." (See "W3C Defines Formats for the Web, Page 56.)

Java is also beginning to play a larger role in the CAD/CAM space. Parametric's Windchill and Dassault's CATweb are examples of the kinds of products that make use of Java. "The whole Windchill infrastructure is built around Java," says Parametric's Baum. "The first line of code written for this project was a line of Java code."

Most leading CAD/CAM developers today have Java initiatives underway. Some companies, such as Bentley Systems Inc., Exton, PA, have made Java a centerpiece. Bentley offers MicroStation/J, a 2D and 3D engineering modeling package that is said to provide integration modeling for engineering and business applications. It was designed specifically for use on the Internet and corporate intranets. The MicroStation/J comes bundled with Sun Microsystems Inc.'s Java Virtual Machine (JVM), which allows it to run Java applications. The company touts its Java environment as a means to share applications and engineering components among multiple hardware platforms and operating systems.

"Most users that we talk to have a reaction ranging from curiosity and interest to avid enthusiasm for Java," says Daratech's Jenkins. "Most believe that Java is going to be one of the keystones of the computer architecture of the future."



MicroStation/J's JVM enables Java applets to run inside the machine. In the above image, a standard applet is used to calculate the shortest route between locations and create a travel schedule on a map inside MicroStation/J.

Boom Box vs. Orchestra

It's fitting that Sun's programming language would have a role in the engineering technical space because that's where the company's roots are strongly based. While Java is certainly one of the major themes, Sun is also pushing another strong message: It will remain a pure UNIX player in the technical hardware space. IBM Corp., Hewlett-Packard Co. and Compaq Computer Corp. all offer UNIX- and Windows NT-based workstations. Even Silicon Graphics Inc. has entered the NT workstation space with the release of its Visual 320 and Visual 540 systems in January.

Richard Talbot, product development manager for IBM RS/6000 workstations, says, "The emergence of NT or Windows as a player in this marketplace that has been dominated in the past by UNIX is a recent trend. In general, we have been focused on letting customers decide what system they want, and sell what we consider is the best UNIX or best NT."

With its pure UNIX position, Sun has developed a strategy that is reaping benefits. Sun's low-end Ultra 5 and Ultra 10 workstations, commonly known as the Darwin line, are comparable in price/performance to NT workstations; the Ultra 5 and Ultra 10 are priced starting at $2,495 and $4,295, respectively. Pricing for the new SGI Intel/NT systems starts at $3,395. "What Sun has done is said we can build cost-competitive UNIX workstations," says Peter ffoulkes, principle analyst for Dataquest Inc., a San Jose, CA-based market research firm. "They have removed a lot of the incentive to move to Intel-based NT."

ffoulkes adds that Sun is stealing market share from other UNIX hardware vendors because it offers both low and high end systems. The numbers reflect this. Since fourth-quarter 1996, Compaq/Digital, HP, IBM and SGI have all seen their UNIX workstation shipments decline. During the same period, Sun also began to see its shipments drop, but reversed the trend with the release of the Darwin product line in January 1998 (see "UNIX Workstation Shipments"). Pushing its low-end UNIX systems has paid big dividends for Sun.

"The Darwin product line is the highest volume workstation line in the history of Sun," says Kelly Perey, director of technical market development at Sun. "The primary markets those systems are going into are EDA [electronic design automation], mechanical CAD and software development, which are the traditional technical market space."

UNIX Workstation Shipments

Actual Number of Units Shipped

	Q4/96	Q2/97	Q4/97	Q2/98	Q3/98
Compaq	5,663	7,254	5,894	6,844	4,721
HP	32,751	26,630	24,608	26,604	23,990
IBM	30,916	18,911	22,209	10,630	13,022
SGI	19,404	20,792	16,701	20,080	13,459
Sun	82,608	77,493	65,125	88,951	88,407
Other	23,757	15,900	14,738	11,788	13,468

Source: Dataquest Inc., San Jose, CA.

Price is not always the most important issue when buying a system, particularly in the technical space. Performance is critical. Although NT vendors have made great strides–the new SGI Visual machines being a perfect example–they are still not UNIX systems. According to ffoulkes, UNIX systems can handle larger amounts of data better and, at the same time, have room to grow. In the area of floating-point performance, ffoulkes believes most UNIX systems go far beyond the level of Intel/NT-based machines. In addition, Solaris and other UNIX operating systems now offer 64-bit computing, which can help in large simulations because it can handle data structures four billion times as large as 32-bit computing.

Finally, UNIX systems, such as Sun's UltraSPARC line, offer better performance in terms of system bandwidth and the ability to move data around. "Intel has some bottlenecks there with its

800-MB/s peak with its front-side bus," says ffoulkes. "In comparison, with something like an UltraSPARC port architecture, which goes from 1.6 to 2 GB/s, you have the capability to handle bigger tasks."

The Move to NT

Most organizations need to evaluate the price/performance equation to find a balance, but the changing role of the engineer is pushing many companies toward the NT camp. A few years ago, it was not uncommon for an engineer to spend his entire day working in one design package. Today, engineers regularly switch between CAD software, office productivity applications and ERP systems. In light of this, NT vendors have made inroads with companies attempting to standardize on a single platform. In many cases, these companies have chosen NT because it allows office productivity applications, such as Microsoft Corp. Office, to be available throughout an entire enterprise.

Deere & Co., Moline, IL, maker of John Deere lawn mowers and tractors, is working to standardize all of its 300 on-site employees on one platform. Because Deere uses many of Microsoft's Office productivity products, including Word, the company has selected a Windows NT-based system. The fact that the CAD application used at the site, Autodesk's AutoCAD, no longer supports Solaris–just Windows NT-based operating systems–made the decision easier. "It was just a management decision to get everyone on the same platform," says Greg Gooch, engineering analyst with Deere & Co.

Groupe Laperriére & Verreault (GL&V) Inc., Montreal, Canada, maker of factory machines for the paper industry, also plans to standardize on Intel/NT-based systems. The company has offices in Montreal and Three Rivers, Canada, as well as Watertown, NY, and Atlanta, GA. The Montreal office has 11 Sun workstations, and there are 14 NT workstations at the other offices. Currently, the company has no problem transferring design data between offices and platforms because everyone is using Autodesk's AutoCAD. But, like Deere & Co., the company is faced with the problem that, as of Release 14, AutoCAD no longer supports Solaris. "We have to upgrade to 14 soon," says Francois Couture, CAD administrator at GL&V, "which means that we will be phasing the Sun stations out."

Couture adds, "It's too bad. I like the Sun platform better than the NT platform. Sun is much more stable. Once you get the machines set up right, they run."

This situation is not uncommon. Timberjack, too, has decided to phase out its HP UNIX boxes in favor of workstations using 300-MHz Intel Pentium II chips.

Despite NT's growing popularity, Danny Cooper, systems administrator at semiconductor manufacturer Texas Instruments Inc., Dallas, TX, doesn't believe the Microsoft operating system is reliable enough to run business-critical operations. Texas Instruments has deployed an intricate computer farm for the simulation of circuits. It's a centralized computing farm that uses Platform Computing Corp.'s Load Sharing Facility (LSF) software to schedule and manage CPU resources on the various engineers' desktops. For the price/performance, Cooper is certain the company's engineers will be able to conduct their design simulations with Sun hardware. "We generally have gotten what has the best performance for the cost," says Cooper. "For a while, that has been Sun."

The CAD market is in a constant state of evolution. Originally it was the replacement of the drafting board with the computer. This developed into automated drafting techniques that provided additional productivity. Eventually, this lead to 3D geometry modeling environments. Now, thanks to technology like STEP, IGES and the Internet, manufacturers are able to unite their operations and have engineers, designers, suppliers and business personnel work in concert to bring their products to market. What is certain is CAD vendors will continue to work toward developing applications that help advance the management of the product life cycle.

Companies Mentioned in this Article

Autodesk Inc.
111 McInnis Pkwy.
San Rafael, CA 94903
http://www.autodesk.com
Circle 130

Bentley Systems Inc.
685 Stockton Drive
Exton, PA 19341
http://www.bentley.com
Circle 131

CAD Potential Inc.
1490 W. 121st Ave.
Ste. 201
Westminster, CO 80234
http://www.cadpo.com
Circle 132

CGM Open Consortium Inc.
116 Defense Hwy.
Annapolis, MD 21401
http://www.cgmopen.org
Circle 133

Compaq Computer Corp.
P.O. Box 69200
Houston, TX 77269
http://www.compaq.com
Circle 134

Dassault Systemes
1935 N. Buena Vista St.
Burbank, CA 91504
http://www.dsweb.com
Circle 135

Engineering Animation Inc. (EAI)
2321 N. Loop Drive
Ames, IA 50010
http://www.eai.com
Circle 136

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
http://www.hp.com
Cirlcle 137

IBM Corp.
Contact local sales office
http://www.ibm.com
Circle 138

Microsoft Corp.
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Circle 139

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http://www.ptc.com
Circle 140

Platform Computing Corp.
3760 14th Ave.
Markham, Ontario
Canada L3R 3T7
http://www.platform.com
Circle 141

Silicon Graphics Inc.
2011 N. Shoreline Blvd.
Mountain View, CA 94043
http://www.sgi.com
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SolidWorks Corp.
300 Baker Ave.
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http://www.solidworks.com
Circle 143

Structural Dynamics Research Corp. (SDRC)
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Milford, OH 45150
http://www.sdrc.com
Circle 144

Sun Microsystems Inc.
901 San Antonio Road
Palo Alto, CA 94303
http://www.sun.com
Circle 145

Unigraphics Solutions Inc.
13736 Riverport Drive
Maryland Heights, MO 63043
http://www.unigraphics.com
Circle 146

World Wide Web Consortium (W3C)
MIT Laboratory for Computer Science
545 Technology Square
Cambridge, MA 02139
http://www.w3.org
Circle 147

Tcl Your Fancy?

by **IAN WESTMACOTT**, Technical Editor

This month, Computer Publishing Lab attempts to gain command of the TclPro development environment.

When John Ousterhout, author of the Tool Command Language (Tcl) and SunLabs distinguished engineer, left Sun Microsystems Inc. last year to start Scriptics Corp., he said the new venture would be billed the "Tcl Platform Company." Scriptics would develop products and services to lend credibility and stability to the successful scripting language he developed a decade earlier. With the launch of the company in July 1998 came its first commercial product, TclPro, a Tcl development environment. This month, we review TclPro Version 1.1.

Tcl is an interpreted scripting language with a simple syntax and few primitive constructs. Like Perl, Tcl scripts are cross-platform by virtue of being interpreted–the same Tcl script will run anywhere a Tcl interpreter is installed (although, as with Perl, it is possible to write nonportable scripts). Tcl was intended as a reusable command language to "glue" together different applications or tools into a single application; hence, its simple syntax. Tcl is rarely mentioned without Tool Kit (Tk), an extension for building GUIs onto Tcl scripts.

Tcl/Tk has helped to fuel recent trends in software components and component-based development. Rather than building monolithic applications specific to a problem or task, developers are building smaller, reusable components that are generic in nature. Components are independently functioning pieces of code (a kind of software transducer) that are prebuilt and pretested. These components are then used to assemble the problem- or task-specific application.

The idea is that most applications are based on the same basic blocks but may be organized in different ways. Tcl helps to assemble components into larger applications, and Tk helps to put GUIs on those applications.

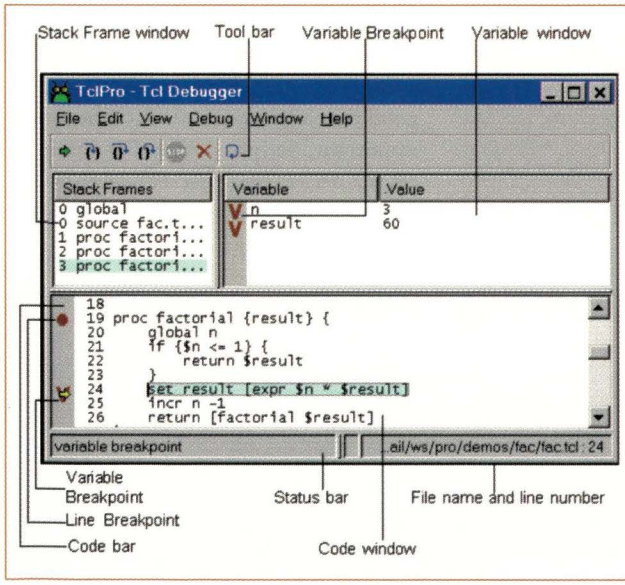

Figure 1. In addition to the open-source Tcl/Tk interpreters and extensions, TclPro provides four development tools: Debugger (left), Checker, Wrapper and Compiler.

Installation and Documentation

TclPro is supported on Solaris SPARC, HP-UX PA-RISC, IRIX MIPS, Linux x86 and Windows 95/NT x86 systems. All versions are included on the CD, and the license allows you to install TclPro on as many computers as you like, so long as you purchase one license for each developer that will use the product. The environment comprises Tcl 8.0 (Tcl interpreter), Tk 8.0 (GUI extension) and [incr Tcl] 3.0

(a core patch and extension for objects with classes and inheritance), a source-level debugger, a static code analyzer, a packaging tool and a byte code compiler. The [incr Tcl] installation includes [incr Tk] 3.0 (for "mega-widget" development) and [incr Widgets] 2.2 and 3.0 (object-oriented sets of mega-widgets) as well.

Installation is by way of a Tcl/Tk script on UNIX platforms and an install wizard on Windows platforms. Complete installation occupies approximately 45 MB and can be installed anywhere in the file system. You're given the option of installing Tcl, Tk and [incr Tcl] sources, in case you already have preferred versions installed. For documentation, TclPro includes a 100-page printed user's guide, which is also available in HTML and PDF format. UNIX-style man pages, a Windows Help file, a PDF format style guide and a PostScript format [incr Widgets] paper are also included.

Development Tools

In addition to the open-source Tcl/Tk interpreters and extensions, TclPro provides four Tcl development tools. The most substantive tool is the source-level debugger, TclPro Debugger. The GUI-based debugger provides all the usual features, including breakpoints, dynamic display of variable values and line and procedure stepping. The main window contains three panes that display the stack trace, procedure variable values and source code (see Figure 1). Clicking a procedure in the stack trace moves the source code cursor to the procedure call site and displays that invocation's local variable values.

As well as debugging local scripts, TclPro Debugger can also debug remote scripts; it can debug any script with which it can establish a socket connection. For example, you could connect to a CGI script running on your Web site and debug its generation of dynamic Web pages. Unfortunately, the provided demo of this feature failed on our machine.

Also included is TclPro Checker, a source code syntax checker (parser). In addition to checking syntax, the tool checks for portability problems between UNIX and Windows environments, and can provide upgrade and performance hints. For example, TclPro Checker will warn you if non-portable file names are used by the script and will suggest a resolution.

TclPro Wrapper can be used to bundle all the files that make up a Tcl application into a single executable file. Tcl scripts, libraries and data files are compressed using the Zip utility and then appended to the Tcl interpreter. When executed, the application knows how to access the appended files. As a result, you may distribute a self-contained and self-extracting binary, rather than a whole set of scripts and data files.

The fourth tool is TclPro Compiler, a Tcl compiler for Tcl scripts. It produces portable byte code. The compiled byte code will run anywhere Tcl runs. Compiling to byte code allows you to distribute Tcl applications without providing source code. Another advantage of compilation is improved runtime speeds and memory usage because the interpreter does not need to compile the scripts at runtime. For example, a 36-line script ran about 33% faster when compiled first.

Also provided are "Pro" versions of `tclsh` and `wish`, which incorporate the provided packages into the Tcl interpreter, as well as instrumentation used by the Compiler and Wrapper tools.

TclPro Version 1.1

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Mountain View, CA 94043

Phone
(650) 210-0100

Fax
(650) 210-0101

Email
sales@scriptics.com

WWW
http://www.scriptics.com

Price
$1,200 (single user)
$15,000 (department)
Price includes one-year update service (volume discounts available).

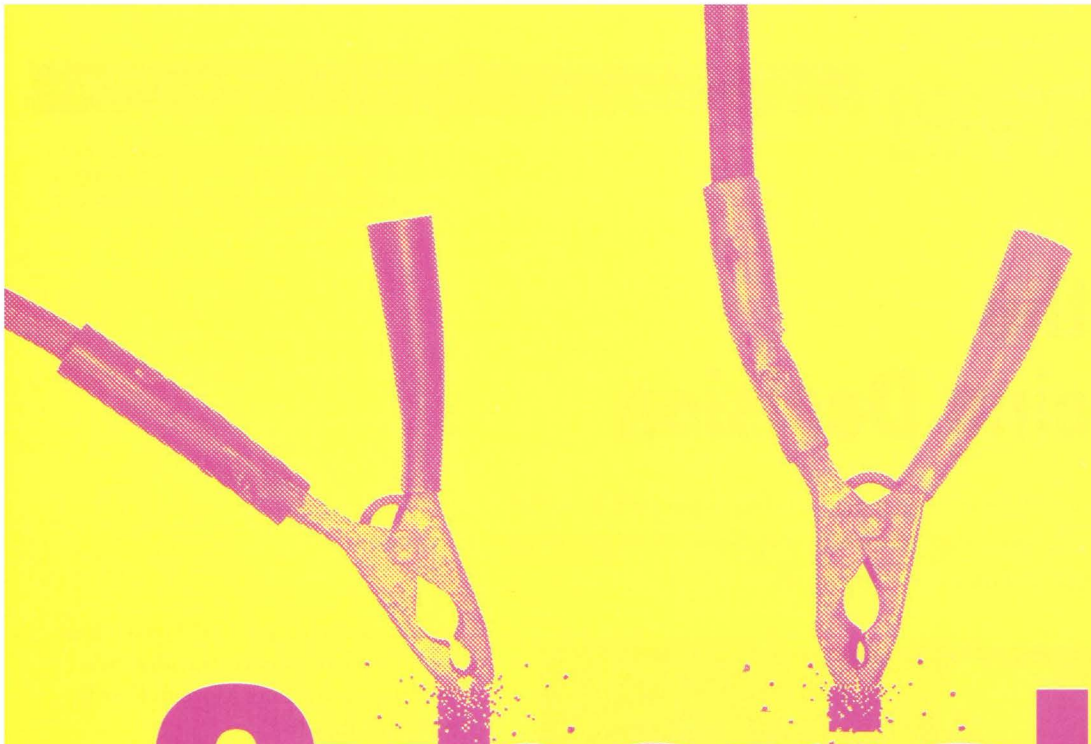
Best Feature
Visual source code debugger

Worst Feature
Price

Circle
150

Summary

If you're looking for a decent, reusable command language, then Tcl is definitely worth a look. With its simple syntax and open-source licensing, entry to Tcl development is easy. If you want to do production Tcl development, or commercial development, then TclPro can make the difference for a fast, clean project. Although the price is a bit steep, Scriptics' TclPro offers the entire Tcl/Tk open-source environment in a single integrated package alongside good development tools. Perhaps more important, Scriptics offers Tcl developers the reassurance that Tcl development will move forward in a coherent, open source forum. ⊸



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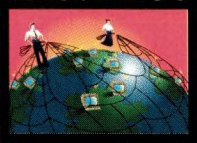
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A Big Bang for Business

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Making the Outsourcing Decision

Web site hosting is no easy task, especially when staff, business partners and customers demand 100% uptime. And, for most companies, the decision of whether to outsource or stay in-house isn't any easier.

Illustration by ERIN TERRY

Once a company decides to build a Web site, it must determine how to care for and feed its system. Small companies (50 employees or less) typically outsource this chore to a Web hosting supplier, while large companies (1,000 employees or more) tend to maintain their servers in-house. But for the vast number of companies somewhere in the middle, the decision is not as clear cut.

Outsourcing relieves companies of network administration tasks, reduces operating expenses, lowers personnel requirements and frees up staff to concentrate on other tasks such as content design. However, a corporation realizes these benefits only if it makes the right selection. The Web hosting company must have the resources to be able to maintain the servers so employees, business partners and customers can access information 24 hours a day, seven days a week.

Choosing the Right Supplier

The quality of content hosting services varies greatly. "Hosting services are available from established vendors, as well as start-up companies operating out of a university dorm room, so customers have to be careful when they make a selection," says David Cooperstein, senior analyst for telecommunications strategies at Forrester Research Inc., a Cambridge, MA-based market research firm. The selection process can be so difficult, in fact, that two organizations have developed certification systems to help companies identify reliable service providers (see "Hosting Companies Move to Certify Services," Page 67).

Adding to the complexity, high revenue growth rates have attracted an increasing number of Web hosting suppliers. Forrester Research expects U.S. revenue from hosting services to grow from $900 million in 1998 to $10 billion in 2002 (see Figure 1, Page 66).

At the same time, the entry barriers are low enough for any firm wanting to grab a portion of this market. "A company does not need much to get into the Web hosting business," says Jon Caputo, president of Sumo Inc., Sunrise, FL, a provider of Web-based resources. "As long as a company has a Web server and a line to the Internet, then it is off and running."

Outsourcing relieves companies of network administration tasks, reduces operating expenses, lowers personnel requirements and frees up staff to concentrate on other tasks.

The result is several thousand companies offering a wide range of levels of service. "The market is in an early adoption phase with suppliers making all sorts of claims and customers having difficulty sifting through all of the different services," says Forrester's Cooperstein, who divides available services into four categories. First, at the low end, some hosting firms handle Web pages for $25 per month or less, while companies like GeoCities, Marina del Rey, CA, offer

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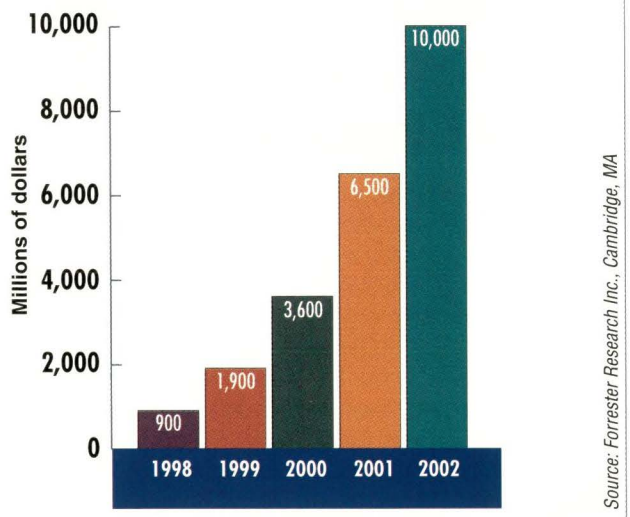
Figure 1. Estimated U.S. Revenue from Hosting Services



their hosting services for free to concentrate on advertising revenue. Second, some providers offer colocation services, where they manage a duplicate server on their premises. Third, dedicated services offer a higher degree of reliability. Fourth, at the high end, vendors offer full, end-to-end service with little or no downtime guarantees.

Software Solutions Net Inc., Denver, CO, discovered that even some of the large hosting companies have difficulty delivering quality service, however. The three-year-old company started out in the book publishing business, but eventually moved into software. It now sells a dozen Internet-related products. Software Solutions Net, which has 10 employees, relies heavily on its Web servers to support its business, and customers often download software directly from the site. Like most small companies, the firm doesn't have the staff, skills or infrastructure to oversee its Web servers around-the-clock.

The company started out using hosting services offered by America Online Inc. (AOL), Dulles, VA, only to find that on several occasions the AOL server was unavailable. "As we grew, we needed more reliability and better system response times than AOL offered," says T.J. Walker, president of Software Solutions Net.

Reliability problems can stem from a variety of factors, starting with the Web server itself. Many hosting suppliers employ a combination of RAID subsystems and load balancing or clustering to guarantee system availability. With RAID systems, fault tolerance is achieved by using hot spare disks and mirrored arrays, which ensure greater data availability and faster disk access. Load-balancing configurations route requests for data to the first available system. If one system is tied up with a complex database query, subsequent requests are rerouted to a partner system.

Network connections can be a second trouble spot. A Web hosting company must have sufficient bandwidth to move all of its requests from its servers to the Internet in order to reach clients and their users. Established suppliers have at a least one T3 line to the Internet, which offers 45 Mb/s of bandwidth.

However, one large pipe can be a weak point because if it fails, servers become unavailable. "I would not feel too comfortable with a Web hosting provider with only one link to the Internet," says Michele Pelino, senior analyst at the Yankee Group Inc., a market research firm based in Boston, MA. To increase network reliability, Web hosting companies can build links to multiple providers. If the main supplier has network problems, transmissions can be rerouted to a second carrier's network.

Building redundant links can be an expensive proposition, however, so some Web hosting companies have teamed up to share network resources. For example, AboveNet Communications Inc., San Jose, CA, Exodus Communications Inc., Santa Clara, CA, Sage Networks Inc., Cambridge, MA, and Web-2010 Inc., Longwood, FL, have combined their backbone infrastructures to form one network with the equivalent of 150 T3 lines.

Network redundancy was a key consideration when Software Solutions Net began looking to replace AOL as its hosting company in the summer of 1996. Walker saw an advertisement in a magazine for Web2010 and decided to try its services. He was impressed that the company advertised four separate T3 lines at its data center, each linked to a different Internet service provider (ISP). In addition, the hosting company seemed interested in Software Solutions Net's business. "Company president James Shaver actually took the time to help us design our site," Walker says.

Software Solutions Net performs a lot of file downloads, transmitting as much as 20 to 30 GB of information per month, and has found the Web2010 hosting service to be reliable. "There have been a few isolated problems: A DNS [Domain Name System] server went down for about half an hour one day, but the servers are up almost all of the time," Walker says. Because of the reliability, the company has recommended Web2010 to its customers.

Digital Dog Design Inc., a developer of Web sites based in Nashville, TN, tells a similar tale. Founded in 1994, the company began working with Web hosting services from AT&T, New York, NY, but soon became disillusioned. "There were a lot of reliability problems...we could not get to the server as often as we would have liked," says Larry Blackenship, company president.

Digital Dog Design talked with other service providers and was impressed with Web2010. "The firm [Web2010] did not treat hosting as a low-priced commodity," says Blackenship. "Instead, the company was interested in the value added features that would help to insure that our site was available."

Digital Dog Design has since built a few hundred sites and its customers have used Web2010 in three out of every four cases. According to the company, approximately 100 customers relied on the hosting service in fourth-quarter 1998, and there was only one instance of a site going down during that period. "A user deleted some information and that knocked a server off-line," Blackenship says.

Yet, not all corporations feel comfortable handing Web hosting functions over to a third party. "Large companies think they understand their system and application require-

ments better than outside firms, and keep hosting functions in-house," says Yankee Group's Pelino.

Application design can also be a factor. Increasingly, companies are building sophisticated Web applications that tie the servers to corporate information, which is often housed in back-end databases. There can be performance benefits to keeping the host and database in close proximity.

Better response times may also result. Connections between a corporate database and a Web server may be susceptible to factors such as slow line speeds or saturated routers. Locally connected hosts are not nearly as susceptible to these problems and, as a result, management chores are simplified. Replicating an entire database to a provider's premises is usually not a realistic option because keeping the two systems in sync can prove difficult. Also, a lot of information must travel between the two sites. Many companies feel their databases contain information that should always be under their control.

A Mix-and-Match Solution

Rather than all-or-nothing propositions, some companies mix in-house and third-party Web hosting. For instance, Inprise Corp., a Scotts Valley, CA-based programming tool and database management system supplier with 750 employees, has eight servers that support Internet applications running at its home office. About half the company's revenue comes from foreign sales, and these customers frequently access the company's Web site to perform tasks such as software downloads. "Our international customers were complaining about poor response time," says Chris Malatesta, global communications service manager at Inprise.

In the summer of 1997, the company looked for a solution and selected Digital Island Inc., a Honolulu, HI-based company that specializes in international Web hosting. Digital Island's network has 28 private peering points that speed connectivity to 16 countries: Australia, Brazil, Canada, Mainland China (including Hong Kong), France, Germany, Israel, Japan, Mexico, The Netherlands, Russia, Singapore, South Korea, Taiwan, the United Kingdom and the United States.

"Before, users had to make as many as 20 hops to get to our site," says Malatesta. "Now, they are on after only one." The change reduced customer complaints from 180 per week to virtually zero, while download traffic rose 400%, according to Inprise.

Quote.com Inc., a Mountain View, CA-based company that provides financial information over the Internet, also mixes internal and outsourced network support. "We do most of the hosting ourselves because we have invested a lot of time, money and effort to add levels of reliability not found with hosting services," says Kaj Pederson, vice president of engineering at the company.

Quote.com wants to come as close as possible to having its site constantly available, so the company has augmented its hosting capabilities with services from Exodus, a leading hosting supplier in the financial community. Founded in 1994,

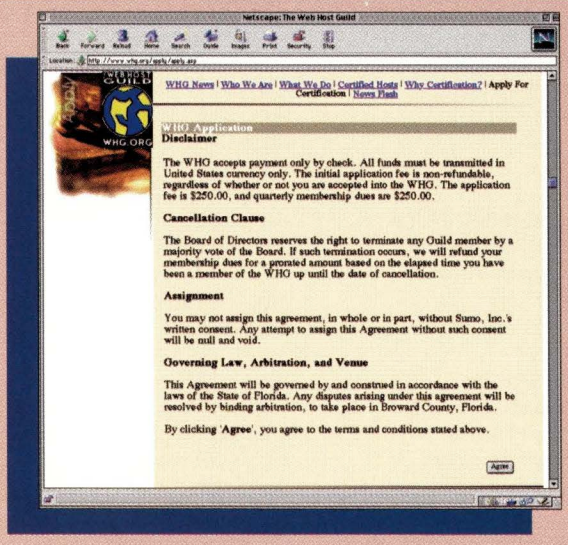
Hosting Companies Move to Certify Services

All Web hosting suppliers claim to offer high levels of service and reliability, but until recently, the only way to determine whether such claims were true was to try them out. The Web Host Guild (WHG), Sunrise, FL, and VeriHost, Fayetteville, NC, both founded in the fall of 1998, were formed to help corporations sort through these claims. The two organizations have established minimum guidelines for items such as backup power supplies and time to respond to an inquiry, so firms can feel comfortable with a hosting service. For a fee, both organizations conduct independent tests to insure that vendors accurately portray their capabilities, and then certify acceptable Web hosting services; basically, an Internet version of the Good Housekeeping Seal of Approval.

The two companies have similar business models with a few slight differences.

Web Host Guild candidates complete an application that outlines their computer and network infrastructure. The organization will then set up alias accounts with the hosting company to test items such as reliability and responsiveness. Once approved, a host provider can list its services at a Web site, the InternetList.com, where companies can go to compare different services.

VeriHost certification candidates must complete an application that requires detailed financial and business reference data and information about their technical capabilities, including security features. Once an application is received, an independent accounting firm verifies business and financial information and legal firms check on any trademark, service mark or copyright claims. Once



certified, companies can display the VeriHost seal of approval, but this service does not offer any search capabilities.

The initial response to the services has been positive. "Users need a better method of finding a hosting service than going to a search engine and trying to sift through a couple thousand entries, and we provide it," says Jon Caputo, president of Sumo Inc., a Sunrise, FL-based Internet company and operator of the Web Host Guild's Internet list site. Contact the organizations directly for service fees.–*pk*

Exodus focuses on high-end collaborative management services, such as performance monitoring and site management, to help companies proactively manage their operations. In addition, it offers sophisticated security features, including around-the-clock secured access, video camera surveillance and an extensive alarm system, which monitors items such as power, lighting, temperature sensors and fire suppression services. Quote.com uses the services to supplement its management tools, as well as provide redundant Internet connections.

While large companies continue to perform many of their own hosting chores, there has been some pressure to let third parties take over. "Departments are taking more control of Web application development," says Forrester's Cooperstein. "Many do not want to wait for the IT staff to get its system up and running, and hand the work over to a third party."

In addition, corporations find the required maintenance difficult. "With the pace of change on the Internet so fast, companies discover that they do not have the expertise needed to keep their sites updated," Cooperstein says.

Companies realize that hosting requires a lot of hard work. "Web hosting requires constant auditing and updating," says Blackenship at Digital Dog Design. "I would say that 25% of the firms we have dealt with started out hosting their own sites and changed their minds within three months."

In some instances, the initial decisions were based on political rather than technical or administrative considerations. "Hosting often sparks a turf war between the IT and end-user departments," says Blackenship. "In one case, the cost of maintaining the system internally was twice as high as using an outsourcing agency, but the company followed that course anyway."

When examining Web hosting providers, companies find many different types of providers offering these services. "Initially, we started out offering dial-up access and found that our customers were asking us to offer hosting services," says Chris Atkins, director of product management for Web hosting at MindSpring Enterprises Inc., an Atlanta, GA-based ISP/hosting company.

Because the hosting market has been growing, and that growth is expected to continue, other suppliers have turned their attention toward it. Yahoo! Inc., Santa Clara, CA, for example, moved into this space in January with its acquisition of GeoCities. In addition, telecommunications suppliers have been gobbling up hosting firms and computer suppliers have been adding Web hosting to their service repertoire.

The increased competition has lead to lower prices. "We have been surprised that some of our competitors lowered pricing because there hasn't seemed to be any business reason to make the change," says MindSpring's Atkins.

Price cuts coupled with additional competition often lead to market consolidation, and a number of acquisitions were completed in 1998. Sage Networks developed its business by purchasing a dozen hosting companies. To stay independent and profitable, several hosting companies are concentrating on add-on revenue, such as advertising, services and systems integration. "E-commerce has been an area of great emphasis," says Yankee Group's Pelino.

Yet, not all Web hosting firms have a bleak outlook for the future. "We designed our business model around hosting services; [we] operate a lucrative business, and have no interest in branching into other services," says MindSpring's Atkins. "There are 10 million small businesses in the U.S. and only 500,000 are on the Web, so the hosting market has tremendous potential."

Whether MindSpring can thrive with a hosting focus should become clear during the next few years. "Web hosting is in an early phase of evolution but is maturing quickly," says Yankee Group's Pelino. "In a couple of years, market leaders will emerge and the factors that lead to their success will be clear. But right now, it's wide open."

Companies Mentioned in this Article

AboveNet Communications Inc.
50 W. San Fernando, Ste. 1010
San Jose, CA 95113
http://www.above.net
Circle 151

America Online Inc. (AOL)
22070 Broderick Drive
Dulles, VA 20166
http://www.aol.com
Circle 152

AT&T
32 Avenue of the Americas
New York, NY 10013
http://www.ipservices.att.com/wss
Circle 153

Digital Island Inc.
1132 Bishop St., Ste. 1001
Honolulu, HI 96813
http://www.digisle.net
Circle 154

Exodus Communications Inc.
2831 Mission College Blvd.
Santa Clara, CA 95054
http://www.exodus.net
Circle 155

GeoCities
4499 Glencoe Ave.
Marina del Rey, CA 90292
http://www.geocities.com
Circle 156

MindSpring Enterprises Inc.
1430 W. Peachtree St. N.W.
Ste. 400
Atlanta, GA 30309
http://www.mindspring.net
Circle 157

Sage Networks Inc.
215 First St., 6th Floor
Cambridge, MA 02142
http://www.sagenetworks.com
Circle 158

VeriHost
2405 Robeson St.
Fayetteville, NC 28305
http://www.verihost.com
Circle 159

Web2010 Inc.
159 Sabal Palm Drive
Longwood, Fl 32779
http://www.web2010.com
Circle 160

The Web Host Guild
10001 N.W. 50th St., Ste. 111
Sunrise, FL 33351
http://www.whg.org
Circle 161

Yahoo! Inc.
3420 Central Expressway
2nd Floor
Santa Clara, CA 95051
http://www.yahoo.com
Circle 162

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

Load-Testing Tool Gets Jolt

Mercury Interactive's load-testing tool, LoadRunner, can now evaluate applications using BEA Systems Inc. BEA Jolt, a Java-based interface that extends BEA Tuxedo middleware over the Internet. Users can use LoadRunner 5.0 to evaluate and predict the behavior and performance of an application before being placed online, the company says. LoadRunner is priced starting at $40,000 and runs on most enterprise operating systems, including UNIX and Windows NT.

Mercury Interactive Corp.
1325 Borregas Ave.
Sunnyvale, CA 94089
http://www.merc-int.com
Circle 171

Software for Secure Web Site Management

Version 1.2 of IPnetWatcher, Web-based management software for monitoring applications that run on secure Web servers–including business-to-business electronic commerce, corporate extranets and transaction-based financial services–is now available from Avesta Technologies.

New features include the ability to automatically discover underlying infrastructure components (such as IP and NT services, or SNMP devices), fault-management capabilities that ensure appropriate alarms are sounded when a problem is detected and service-level reporting tools to create customized reports on the availability of the site that can be embedded into email and sent to the appropriate personnel. In addition, a Secure Transaction wizard creates simulated end-to-end transactions and a Secure Link Test wizard discovers and reports on the type and status of URLs, Avesta says.

IPnetWatcher is said to monitor sensitive sites securely, supporting 10 security algorithms, Secure Sockets Layer (SSL) v3 and cookies as a form of authentication. Version 1.2 also supports integration with Trinity, Avesta's own service-level management suite, and Computer Associates International Inc. Unicenter TNG. IPnetWatcher runs on Solaris and Windows NT and is priced starting at $5,000.

Avesta Technologies
2 Rector St.
New York, NY 10006
http://www.avesta.com
Circle 172

Enterprise Server Upgrade

Although Netscape Communications is in the midst of being taken over by America Online Inc. (AOL), the company continues to update its product line. The latest release is Netscape Enterprise Server 3.6, which includes support for multiple processes and process moni-

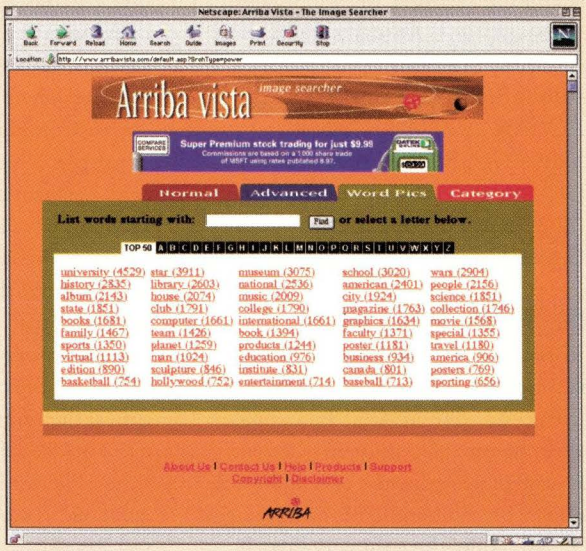
Search Engine for Images

The Arriba Vista search engine, from Arriba Soft, is said to retrieve Web-based images according to parameters such as topic, origin, color and file size. It also offers users the ability to search by keyword or category via its Word Pics feature. Word Pics contains a list of the 50 most common keywords (determined by Arriba), as well as an alphabetical list of hundreds of other keywords. Arriba Vista can also display thumbnail views of the images, the company says.

The software interface is installed on an Internet service provider (ISP) or corporate Web site, with the actual search processed on the Arriba Soft Web site.

The maximum price for the search engine is $79,000 per year, with future fees declining based on the number of hits delivered to the Arriba Soft Web site. Arriba Vista can be used alone or in conjunction with the company's Arriba Express media management software.

Arriba Soft Corp.
200 E. 5th Ave., Ste. 108
Naperville, IL 60563
http://www.arribasoft.com
Circle 170



tors. This support is designed to provide fail-over protection if and when a Web application crashes, the company says. The software comes with server monitors that automatically restart failed systems.

In addition, Netscape has enhanced the server's performance and scalability and has added new management tools that support SNMP Version 1 and 2. These management tools work with other network management systems such as Hewlett-Packard Co. HP OpenView, Tivoli Systems Inc. TME and Computer Associates International Inc. Unicenter TNG, the company says.

Netscape Enterprise Server 3.6 comes with Netscape Directory Server software and is available on Solaris, HP-UX, AIX, IRIX, Digital UNIX and Windows NT. Pricing starts at $1,295.

Netscape Communications Corp.
501 E. Middlefield Road
Mountain View, CA 94043
http://www.netscape.com
Circle 173

Commercial Support for Open-Source Perl

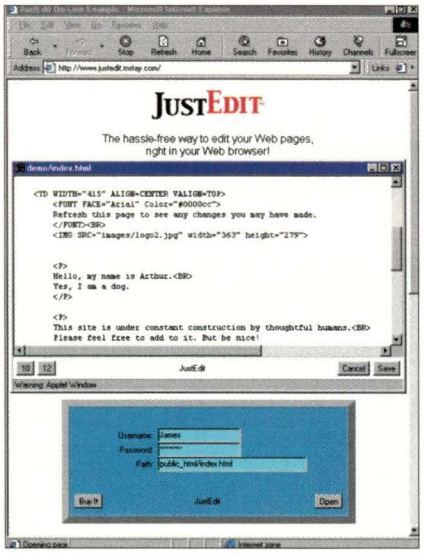
Organizations that would like to devote more resources to programming in Perl, but are reluctant to use open-source software, can now purchase support from ActiveState Tool.

The program, PerlDirect, provides subscribers with validated and quality-assured releases of Perl and Perl extensions, advice and support, a Y2K test suite and the *PerlAlert* weekly bulletin, the company says. Annual subscription rates start at $12,000.

ActiveState Tool Corp.
P.O. Box 2870 Main Station
Vancouver, British Columbia
Canada V6B 3X4
http://www.activestate.com
Circle 174

Edit HTML with Java

JustEdit, from Mainstay, is a Java applet used to modify a Web site's HTML code. The JustEdit Java applet needs to be included only on a single Web page of a site for the user to be able to launch JustEdit and enter the changes in HTML code, the company says. It doesn't require a server-side application,



scripts, CGIs or plug-ins. JustEdit allows changes to be made in Web content from any browser. A name/password combination is required for read/write access. JustEdit costs $49.95.

Mainstay
591-A Constitution Ave.
Camarillo, CA 93012
http://www.mstay.com
Circle 175

Java Load-Testing Tool Announced

JavaLoad 1.0, a new Java-based load-testing tool from Sun Microsystems, is designed to enable end-to-end load testing of enterprise applications across large heterogeneous computing environments. JavaLoad software uses reusable components, which enables developers to quickly construct tests from existing test components, Sun says. It also provides support for benchmarking hardware and for stressing an integrated system.

With JavaLoad, administrators can construct "virtual users" to automatically perform a list of tasks, including invoking Java and other applications. Once a "virtual user" is defined, it can be replicated throughout the network to simulate "real" usage loads. In addition, the software can access, monitor and report on the testing of client response times, the number of application server users or database server data access times. All test information obtained by JavaLoad is stored in the JavaLoad Central Repository, including the program and data files that comprise the load tests, as well as all result data generated from the load sessions. Pricing for JavaLoad 1.0 starts at $75,000.

Sun Microsystems Inc.
901 San Antonio Road
Palo Alto, CA 94303
http://www.sun.com
Circle 176

Sapphire/Web Supports AS/400

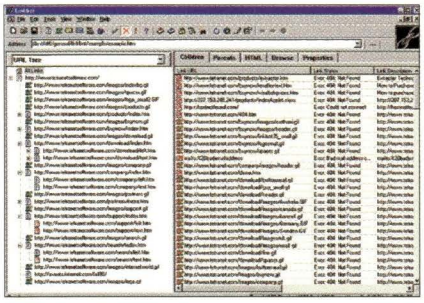
Bluestone Software's Sapphire/Web now supports the IBM Corp. AS/400 platform. The AS/400 operating system, OS/400, joins a fairly comprehensive list of operating environments that are already supported by Sapphire/Web, including OS/390, Linux, Solaris, AIX and Windows 95/98/NT.

Sapphire/Web is a Web application server used for the development, deployment, integration and management of enterprise applications, the company says. It comprises five components: Sapphire/Universal Business Server (UBS), the application server deployment architecture; Sapphire/Developer, a development environment; Sapphire/Application Manager (SAM), an application and interaction management system; Sapphire/Enterprise Deployment Kit (EDK), the object and component integration facility for Java, CORBA and COM objects; and Sapphire/Integration Modules (SIMs), prebuilt modules that extend Sapphire/UBS and Sapphire/Developer. Contact vendor for pricing.

Bluestone Software Inc.
1000 Briggs Road
Mount Laurel, NJ 08054
http://www.bluestone.com
Circle 177

Automated Web Site Testing Tool

Canadian company Tetranet Software has introduced Version 4.0 of Linkbot Pro, an automated Web site testing tool. This latest release includes several new features, such as JavaScript parsing capabilities and HTML 4.0 support. Linkbot tests for HTML syntax validations, produces graphical reports with trends statistics and provides Web development teams with information on needed site repairs, the company says. Linkbot also offers



a Web site monitoring capability with immediate error notification via email, pager or SNMP trap. Linkbot Pro 4.0 runs on Windows 95/98/NT and is priced starting at $295.

Tetranet Software Inc.
135 Michael Cowpland Drive
Ste. 400
Kanata, Ontario
Canada K2M 2E9
http://tetranetsoftware.com
Circle 178

Java Tool to Enhance Web Calendars

Timecruiser Computing has introduced Eventcruiser 2.0, a Java-based calendaring and group-scheduling application for publishing news and events via corporate intranets and Web sites. Eventcruiser offers several features, including the ability to highlight events using a scrolling ticker tape and to make static calendar-based events come alive with audio, video and graphics, the company says. Eventcruiser 2.0 offers multiple levels of security, different views of events (by day, week or month) and an online event search capability, which enables users to search the event repository by keyword or date, Timecruiser says.

Eventcruiser 2.0 runs on any server equipped with a Java Virtual Machine (JVM). Contact vendor for pricing.

Timecruiser Computing Corp.
333-A Rte. 46, 2nd Floor
Fairfield, NJ 07004
http://www.timecruiser.com
Circle 179

Internet Content Delivery Platform

Spyglass has unveiled Prism 2.2, a content delivery platform that converts Internet-based data into formats suitable for handheld devices, televisions and mobile phones. Prism provides dynamic content conversion and is designed to optimize data delivery according to network bandwidth and latency constraints, the company says. Prism reportedly converts content into the appropriate format for specific devices. For example, it can convert HTML into Wireless Markup Language (WML), the markup language for Wireless Application Protocol (WAP)-enabled cell phones. In addition, Prism can convert GIF and JPEG files into Wireless Bit Map (WBMP) files, another WAP format. Prism 2.2 is available on Solaris 2.5.1 and Windows NT. Pricing is determined by the scope of the project; contact vendor for estimates.

Spyglass Inc.
1240 E. Diehl Road
Naperville, IL 60563
http://www.spyglass.com
Circle 180

Server Integrates Back-Office Data

OpenConnect Systems has unveiled the OC://WebConnect Enterprise Integration Server, which is designed to address the integration of existing back-office systems with the Web. The product reportedly provides an integrated development and deployment environment to facilitate Web-based application integration, deployment and management. It enables companies to build server-based applications through a simple drag-and-drop environment, allowing easy creation of Web-based applications that integrate with all host applications and data repositories, the company says. Pricing for OC://WebConnect Enterprise Integration Server starts at $45,000.

OpenConnect Systems Inc.
2711 LBJ Freeway
Dallas, TX 75234
http://www.oc.com
Circle 181

Searches Hit the Bulls-Eye

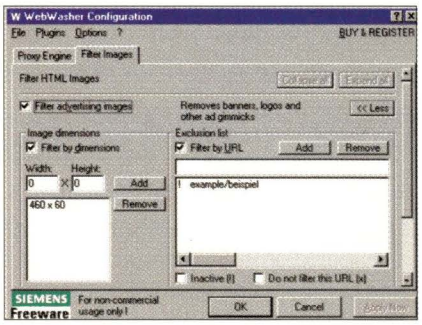
IntelliSeek has enhanced BullsEye, its Web searching, managing and tracking software. The latest version, BullsEye 1.5, comes with software agents that track specific information, such as entertainment, news, books, software and business topics, the company says. BullsEye 1.5 is said to tap into more than 450 search engines and databases on the Web and is capable of tracking and managing data on specified search topics. In addition, a workgroup feature allows users to share searches and information among groups of people, the company says.

BullsEye 1.5 runs on any browser and costs $49. A BullsEye Pro version for researchers and corporate knowledge professionals is available for $149.

IntelliSeek Inc.
1 Crowne Point Court, Ste. 470
Cincinnati, OH 45241
http://www.intelliseek.com
Circle 182

Software to Block Advertising

End users and Web site managers who want to filter out Web-based advertising might consider WebWasher, a browser add-on from Siemens that removes advertising and pop-up windows from Web sites before they are downloaded, the company says.



WebWasher can speed the loading of Web pages and reduce the demand for network bandwidth by 45%, the company says. In addition, the software is easily configurable, requires less than 1 MB of hard disk space and does not modify existing Internet settings.

WebWasher runs on Windows 95/98/NT 4.0 and works with Netscape Communications Corp. Navigator or Microsoft Corp. Internet Explorer. Commercial licenses cost $29 per user (it's free for personal use and to educational institutions).

Siemens AG
Wittelsbacherplatz 2
D-80312
Munich, Germany
http://www.siemens.de/en
Circle 183

NEW PRODUCTS

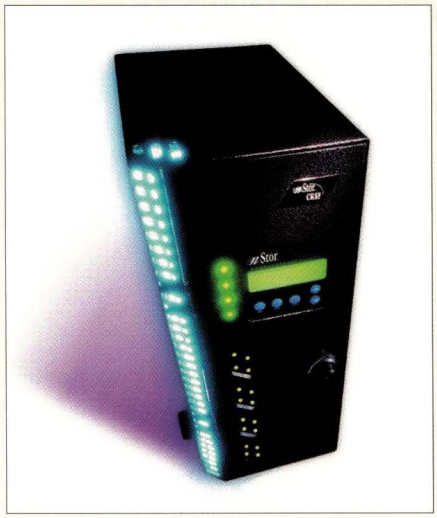
The product descriptions are compiled from data supplied by the vendors. To contact them for more detailed information, circle the appropriate reader service number on the card located elsewhere in this issue.

Fibre Channel Storage

nStor has announced two Fibre Channel storage systems–NexStor 18F and CR8F. Targeted at document imaging, online transaction processing and data warehousing, the NexStor 18F is designed to maximize the number of gigabytes of storage per cubic inch and houses 18 disk drives (each with either 9 or 18 GB of storage), providing up to 324 GB of storage in a single rack, nStor says. Its rack-mountable enclosure features a cableless, passive, dual Fibre Channel Arbitrated Loop (FC-AL) backplane that is engineered to incrementally boost performance and availability through a modular design that provides the maximum level of reliable fault tolerance and performance.

Other features include data transfer rates up to 200 MB/s, support for up to 126 external devices, dual power cords and cable lengths up to 30m (with a copper interface) or 10km (using fiber optics). Pricing for an 18-bay enclosure with two power supplies, two power cords with cable locks, two LRC boards and three high-performance cooling fans is $8,249. The price includes one-year nVantage next-day, on-site service.

The CR8F storage subsystem delivers



FC-AL performance (up to 200 MB/s) in a low-cost Just-a-Bunch-of-Disks (JBOD) configuration, or in combination with an optional PCI Fibre Channel RAID controller. The CR8F is aimed at large network environments with high-end servers and mission-critical data, such as the video and broadcast industries, the company says. It comes in either an external eight-bay tower or rack-mountable enclosure based on the FC-AL interconnect standard and currently ships with eight 9- or 18-GB disk drives, providing up to 144 GB of high-performance storage per enclosure.

For maximum stability, the CR8F is said to support 126 devices per loop and more than 2 TB of storage on a single arbitrated loop (interconnecting 16 enclosures) and cable lengths up to 30m (with a copper interface) or 10km (using fiber optics). Pricing for the CR8F starts at $8,359 for a configuration with three 9- or 18-GB disk drives with slide rails,

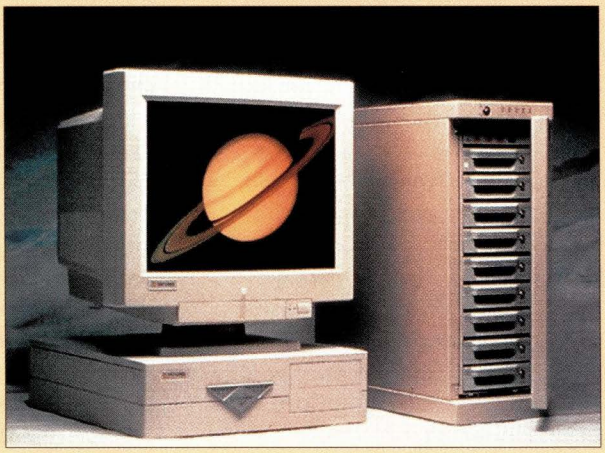
New 400-MHz Workstations from Tatung

Tatung Science & Technology has introduced two systems based on the Sun Microsystems Inc. 400-MHz UltraSPARC-II microprocessor: COMPstation U2400 and COMPstation U60-2400. The U2400 is an SBus-based Sun Ultra 2-compatible workstation, while the U60-2400 is a PCI-based Ultra 60-compatible system. Standard configurations for both systems include dual 400-MHz UltraSPARC-II processors, 128 MB of RAM, 9 GB of hard disk storage and Solaris 7 preinstalled.

The desktop COMPstation U2400 supports Creator3D graphics and is aimed at cost-conscious users working with complex, interactive three-dimensional graphics visualization. It offers up to 2 GB of memory and features SMP capabilities. Pricing for the U2400 starts at $17,720.

The U60-2400 is available in both tower and rack-mount configurations. It supports one 33-MHz 32-bit PCI device; two 33-MHz 64-bit PCI devices; and one 66-MHz 64-bit PCI device. A 64-bit UPA slot is also available for add-ons such as Sun's Creator or Elite3D graphics cards.

Other standard features include Ultra Wide SCSI, two serial ports, one parallel port and a 100-BaseT Ethernet interface. The tower model is equipped with a PCI graphics card and offers up to five drive bays for incorporating two standard 3.5-inch hard drives, a 5.25-inch CD-ROM drive,



a 4mm or 8mm tape drive and another peripheral such as a 3.5-inch floppy drive. Suggested list pricing for the COMPstation U60-2400 starts at $17,900 for a standard tower configuration ($18,130 for a rack-mount version).

Tatung Science & Technology Inc.
1840 McCarthy Blvd.
Milpitas, CA 95035
http://www.tsti.com
Circle 100

power supplies, cooling fans, two hot-swappable LRC I/O cards and one-year nVantage next-day, on-site service.

nStor Corporation Inc.
450 Technology Park
Lake Mary, FL 32746
http://www.nstor.com
Circle 101

Web-Based SNMP Tool

The Taboret network management tool from Arinc now features a Web-enabled interface, allowing administrators to perform on-the-spot problem solving of SNMP devices.

Taboret's new interface is said to allow users to quickly develop management applications that will run in virtually any environment, including Solaris, HP-UX, AIX and Windows NT. It also features full integration with IBM Corp. NetView and Hewlett-Packard Co. HP OpenView network management platforms. Pricing for Taboret starts at $15,000.

Arinc Inc.
100 Bayview Circle, Ste. 2000
Newport Beach, CA 92660
http://www.taboret.com
Circle 102

Fibre Channel RAID Arrays

Building on its announcement of the Enterprise Network Storage Architecture (ENSA), Compaq's StorageWorks division has unveiled two Fibre Channel RAID arrays, the StorageWorks Enterprise Storage Array 12000 (ESA12000) and RAID Array 8000 (RA8000) systems.

Both products are based on a common architecture that values high I/O and bandwidth, the company says. Both work within storage area network (SAN) environments in Fibre Channel Arbitrated Loop (FC-AL) configurations through the use of a Fibre Channel hub and, in the coming months, Fibre Channel switches.

The two RAID arrays differ in terms of enclosures and extensibility. The RA8000 is contained in a pedestal enclosure for departmental use, supporting a maximum of 24 18-GB drives (72 drives, if the units are connected).

The ESA12000 is designed for data center-type environments, each housing 72 18-GB drives. These units can be hooked together through FC-AL hubs and switches to create a virtual storage pool of up to 1,096 pairs of controllers, the company says.

Host interconnect support for the StorageWorks units includes FC-AL on Solaris, IRIX, HP-UX and Windows NT. Ultra SCSI support exists for Digital UNIX, OpenVMS and AIX. Additional platform and host interconnect support is expected second-quarter 1999.

Pricing ranges from $.20 to $.13 per MB for a single-controller RA8000 solution and from $.27 to $.17 per MB for the ESA12000.

Compaq Computer Corp.
P.O. Box 692000
Houston, TX 77269
http://www.compaq.com
Circle 103

Create/Publish in XML

Longtime SGML publishing tool vendor Arbortext has broadened its product scope to include support for eXtensible Markup Language (XML). The company's latest product, Epic, reportedly addresses the needs of companies under pressure to create information for distribution across multiple media, including print, CD-ROM and the Web. With Epic, Arbortext hopes to ease the flow of information throughout an organization, the so-called "Enterprise Product Information Chain," via a common set of tools and automated systems.

Epic's authoring client is based on the company's AdeptEditor, which is used to produce structured XML and SGML documents. The Epic document editor allows for hierarchical views of information in WYSIWYG format. Epic can read documents in Microsoft Corp. Word format, through an automatic data conversion facility, and automated publishing is available to HTML files, HTML Help, CD-ROM and the Web from a single document source. Epic also minimizes the need for data conversions and faciliates electronic reviews, or "redlining," through a common browser, the company says.

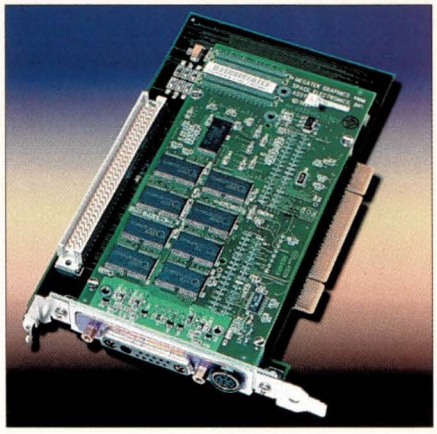
In addition, Arbotext has designed vertical applications based on Epic for the telecommunications and computing industries. For these industries, Epic produces documents in Telecommunications Interchange Markup (TIM) and DocBook formats, respectively.

Epic runs on Solaris, Digital UNIX, HP-UX, AIX and Windows NT. An entry-level configuration, supporting 65 users, costs $85,000.

Arbortext Inc.
3 University Office Park
95 Sawyer Road
Waltham, MA 02453
http://www.arbortext.com
Circle 104

Graphics Board for Sun Workstations

Megatek Graphics has introduced a high-performance PCI graphics accelerator for Sun Microsystems Inc. workstations. The EclipsePCi graphics accelerator offers resolutions of 640-by-480 to 1,280-by-1,024 pixels and 8-, 16- or 32-bit color per pixel for Solaris 2.5.1/2.6-based systems. The EclipsePCI includes a built-in Sun 4/5 keyboard port, enabling multiple users to interface directly with the server without the addition of client workstation, and comes with either 2 or 4 MB of EDO DRAM.



An EclipsePCI with 4 MB of memory and a keyboard port costs $1,695.

Megatek Graphics
A division of Space Electronics Inc.
4031 Sorrento Valley Blvd.
San Diego, CA 92121
http://www.spaceelectronics.com
Circle 105

System Speeds File Access

LSC's Quick File System (QFS) is designed to resolve file system performance bottlenecks. Using enhanced volume management, such as disk striping and metadata separation, QFS achieves performance numbers that match the raw

device speeds of high-end servers and disk hardware, the company says.

QFS provides intelligent file management capabilities, file system consistency and volume management without sacrificing performance. It can process direct I/O and create large file systems across RAID farms. In the event of a system interruption, users have fast access to data because QFS automatically retains consistency, eliminating the need to perform a time-consuming file system check, LCS says.

QFS provides a standard UNIX file system interface and can either be implemented as a stand-alone file management system or integrated with LSC's core storage management product, SAM-FS, for a complete online, near-line and off-line storage management configuration, the company says. The product runs on Solaris (including 7) and is priced starting at $25,000 for a single-server license.

LSC Inc.
9957 Valley View Road
Eden Prairie, MN 55344
http://www.lsci.com
Circle 106

Multicomputer Switch Controller

The Keemux-S KVM (Keyboard-Video-Mouse) series of switches from Network Technologies is said to allow one user to access and control as many as 32 computers from a single keyboard, monitor and mouse. Designed to operate with Sun Microsystems Inc. systems, Keemux switches can be cascaded to create a switch with a 128-port capability that operates from a single control point, the company says. The Keemux-S series of switches is specifically aimed at Internet, enterprise and financial/banking applications that would benefit from the ability to consolidate computer access at a single location, eliminating redundant cables, keyboards and monitors.

Dedicated internal microprocessors emulate a keyboard and mouse presence to each attached computer, allowing all computers to boot error-free. Attached computers can be located up to 250 feet from a Keemux switch, which is controlled through either push buttons on the front panel or a keyboard. LEDs on the front panel indicate the currently

selected port and mode of operation. In addition, there are three optional control methods: Liquid Crystal Display (LCD), Wired Remote and On-Screen Display, which enhance functionality based on the specific network environment.

Pricing for the Keemux-S KVM switches starts at $600 for a two-port unit (price includes a one-year warranty).

Network Technologies Inc.
1275 Danner Drive
Aurora, OH 44202
http://www.networktechinc.com
Circle 107

Fast Workgroup Printer

IBM has introduced the Infoprint 40 workgroup printer. The new printer can reach output speeds of 40 pages per minute (ppm) and offers a standard print quality of 600-by-600 dpi or a high quality of 1200-by-1200 dpi, the company says.

Infoprint comes with a feature for generating multiple copies that can be collated and stapled. The printer can also be integrated with IBM's Infoprint Manager and Network Printer Manager, enabling print job management. It comes with 16 MB of memory and an electronic module in the toner cartridge, which tracks the number of pages printed. This module provides feedback to the user or network administrator regarding the toner's status, the company says.

Infoprint 40 can handle paper sizes from postcard-size (3.92-by-5.75 inches) to A3/Ledger (11-by-17 inches). It costs $3,799 and supports most enterprise-level operating systems, including Solaris, AIX, S/390, OS/400, Mac OS and Windows.

IBM Corp.
Contact local sales office
http://www.ibm.com
Circle 108

SPARC-Based File Server

The Aerial Ultra AXi SuperServer from PerifiTech is designed to host mission-critical Solaris network environments, while providing fault tolerance through redundant, hot-swappable components. Based on Sun Microsystems Inc. UltraSPARC-IIi 270-, 300- or 333-MHz processors, the SuperServer features six PCI slots, one 10/100BaseT Ethernet port and support for 1 GB of ECC memory. The integrated, intelligent Aerial array provides more than 630 GB of RAID storage (including levels 0/1, 3 and 5), using hot-swappable Ultra Wide SCSI 3 hard drives, the company says.

List price for the SuperServer starts at $10,299 for a tower configuration with a 270-MHz processor, 1,128 MB of memory and 9 GB of disk storage.

PerifiTech Inc.
1265 Ridge Road
Hinckley, OH 44233
http://www.perifitech.com
Circle 109

Performance Management Software Unveiled

TeamQuest has released TeamQuest Alert performance management software, which reportedly allows a user to manage multiple systems from a single workstation, while the software simultaneously self-configures by automatically finding all servers on the network where performance data is collected.

TeamQuest Alert can communicate the health status of up to 200 systems, the company says. In the event of a network problem, a detailed report is generated listing the events leading up to the problem. TeamQuest Alert comes with a data collector that gathers statistics on CPU, I/O, memory and disk space usage, network file system status and the performance of database applications. The data collector is integrated with several management consoles, including Boole & Babbage Inc. Command UNIX and Command/Post, Hewlett-Packard Co. HP OpenView, IBM Corp. NetView/6000, Sun Micorsystems Inc. SunNet Manager and Tivoli Systems Inc. Enterprise.

TeamQuest Alert client software runs on Solaris and Windows 95/98/NT. Ser-

ver-side support includes Solaris, Digital UNIX, HP-UX, AIX, Sequent DYNIX/ptx, IRIX and Windows NT.

TeamQuest Corp.
2410 Third Ave. S.
Clear Lake, IA 50428
http://www.teamquest.com
Circle 110

Web App Server Out

Compuware has entered the Web application server market with the launch of Uniface WebApplication Server. Designed as a server environment for deploying Web applications, it supports BEA Systems Inc. Tuxedo and IBM Corp. Encina transaction processing middleware. It comes with built-in interfaces for connecting to IBM, Informix Corp., Oracle Corp. and Sybase Inc. databases, as well as Software AG Adabas, Microsoft Corp. SQL and IBM Virtual Storage Access Method (VSAM) and Information Management System (IMS). Uniface comes with an HTML page designer, built-in Unified Modeling Language (UML) interfaces and load-balancing capabilities. It also provides version control for group projects, Compuware says.

Uniface WebApplication Server supports COM+, CORBA and JavaBeans component models, and communications standards such as the Internet Inter-Orb Protocol (IIOP) and Remote Method Invocation (RMI). It uses HTML 4.0 enriched with JavaScript and Cascading Style Sheets (CSS) as its presentation interface and integrates with a wide range of Internet standards and Web functionality, including SMTP, Post Office Protocol (POP3) and Lightweight Directory Access Protocol (LDAP).

Uniface WebApplication Server is available on Solaris, AIX, HP-UX, SCO UNIX, Digital UNIX, OpenVMS, OS/400, OS/390 and Windows NT.

Compuware Corp.
31440 Northwestern Hwy.
Farmington Hills, MI 48334
http://www.compuware.com
Circle 111

Upgrades, Enhancements, Additions...

◆ TMSSequoia has released Prizm Plug-in for the IBM Corp. RS/6000 platform. Prizm Plug-in works inside a Netscape Communications Corp. Web browser to provide improved image display of TIFF, JPEG and other scanned images, the company says. The plug-in is also said to work well with raster engineering drawings. Prizm Plug-in reportedly offers users various display features such as zoom, rotate, pan, adjust, scale-to-gray, stretch-box zoom and magnifying glass. The plug-in supports TIFF Group 4, JPEG, GIF, CALS, C4 (JEDMICS) and other bitonal and color image formats. Prizm Plug-in for RS/6000 runs on AIX 4.1.5+ using Netscape Navigator or Communicator 4.05+. In addition, TMSSequoia offers versions that run on Solaris, Digital UNIX, IRIX, HP-UX, Mac OS and Windows 3.1/95/98/NT. Prizm Plug-in costs $59.95 for a single-user copy (contact vendor for volume discounts). **TMSSequoia**, 206 W. 6th Ave., Stillwater, OK 74074, *http://www.tmssequoia.com.* **Circle 112**

◆ Tango 3.5 Application Server from Pervasive Software is now available for Solaris systems. This is said to enable Web developers who have used Tango 3.5 Development Studio for Windows or Macintosh to deploy their applications on Solaris without rewriting their applications' code. Designed to enable scalable, cross-platform deployments, Tango Application Server for Solaris provides a comprehensive set of ODBC drivers to access, manage and display underlying database content. Tango allows developers to integrate Perl, JavaScript, Java classes and JavaBeans to facilitate the integration of other applications into Tango solutions. The Tango 3.5 Application Server costs $6,995. **Pervasive Software Inc.**, 12365 Riata Trace Pkwy., Austin, TX 78727, *http://www.pervasive.com.* **Circle 113**

◆ RealSecure 3.0 from Internet Security Systems (ISS) now offers host-based intrusion detection capabilities, providing customers with fast detection of attacks at the network level, as well as identification of unauthorized access attempts at the system level, the company says. RealSecure 3.0 confirms an attack's success or failure and tracks the extent of the intrusion as it unfolds across the enterprise, ISS says. RealSecure comprises two components–Detectors and Managers. Detectors are intelligent modules that provide security policy enforcement through automated detection of both external and internal threats. These modules, which come in the form of either a Network Engine to monitor network traffic and/or System Agents to monitor operating system log entries and key system files for indications of unauthorized entry, are designed to be installed at strategic locations throughout the network. Managers provide easy configuration of Detectors, as well as detailed management of the data generated by Detectors. RealSecure Network Engine costs $8,995 and a five-pack of System Agents costs $750. First-time customers are also required to purchase a one-year maintenance contract for $1,800. **Internet Security Systems Inc.**, 6600 Peachtree-Dunwoody Road, Bldg. 300, Atlanta, GA 30328, *http://www.iss.net.* **Circle 114**

◆ Iona Technologies has announced Version 2.0 of OrbixTalk middleware for enterprise messaging. This latest version introduces features such as fault tolerance, version independence, unattended operation and an increased range of integration hooks. In addition, OrbixTalk 2.0 features a suite of complimentary products, including Orbix, OrbixTalk IIOP Gateway and OrbixTalk MessageStore, providing a complete off-the-shelf solution for middleware messaging, the company says. OrbixTalk 2.0 is available on Solaris, HP-UX and Windows NT platforms. It costs $11,000 for the UNIX version and $6,500 for the NT version. **Iona Technologies Inc.**, 60 Aberdeen Ave., Cambridge, MA 02138, *http://www.iona.com.* **Circle 115**

◆ Version 2.0 of the AC200 and AC300 bandwidth management products from Allot Communications is said to integrate several new features for managing and tracking limited network bandwidth. Two key features are Bandwidth Accountant, which provides usage-based IP accounting, and Cache Enforcer, which redirects network traffic to local cache servers. Each is sold separately for $2,995 each. Additions to the basic product include improved fault tolerance in bridge mode (through support of the spanning tree algorithm) and the ability to replicate network policies on multiple AC platforms. AC200 costs $6,995 (without the added modules) and AC300 costs $12,995. **Allot Communications Inc.**, 292 E. Main St., Los Gatos, CA 95030, *http://www.allot.com.* **Circle 116**

◆ Software Emancipation Technology has released Version 7.0 of its Discover development and management software. The new version includes support for Java and Oracle Corp. SQL, and tight integration with Microsoft Corp. Visual Studio 6.0. Thanks to support for Java and SQL, Discover 7.0 enables software professionals to build source code models in multiple programming languages. The integration with Visual Studio enables developers to use Discover within Visual Studio desktop environment on any Windows-based PC. Discover 7.0 supports C, C++ and Java source code, Oracle embedded SQL and PL/SQL. It runs on SunOS, Solaris, HP-UX, IRIX and Windows NT, and is priced starting at $3,000 per seat. **Software Emancipation Technology Inc.**, 15 Third Ave., Burlington, MA 01803, *http://www.setech.com.* **Circle 117**

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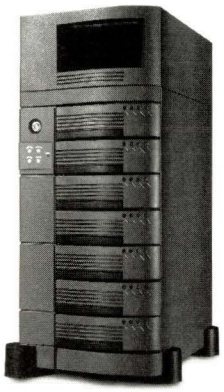

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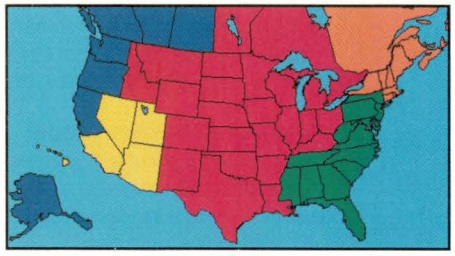

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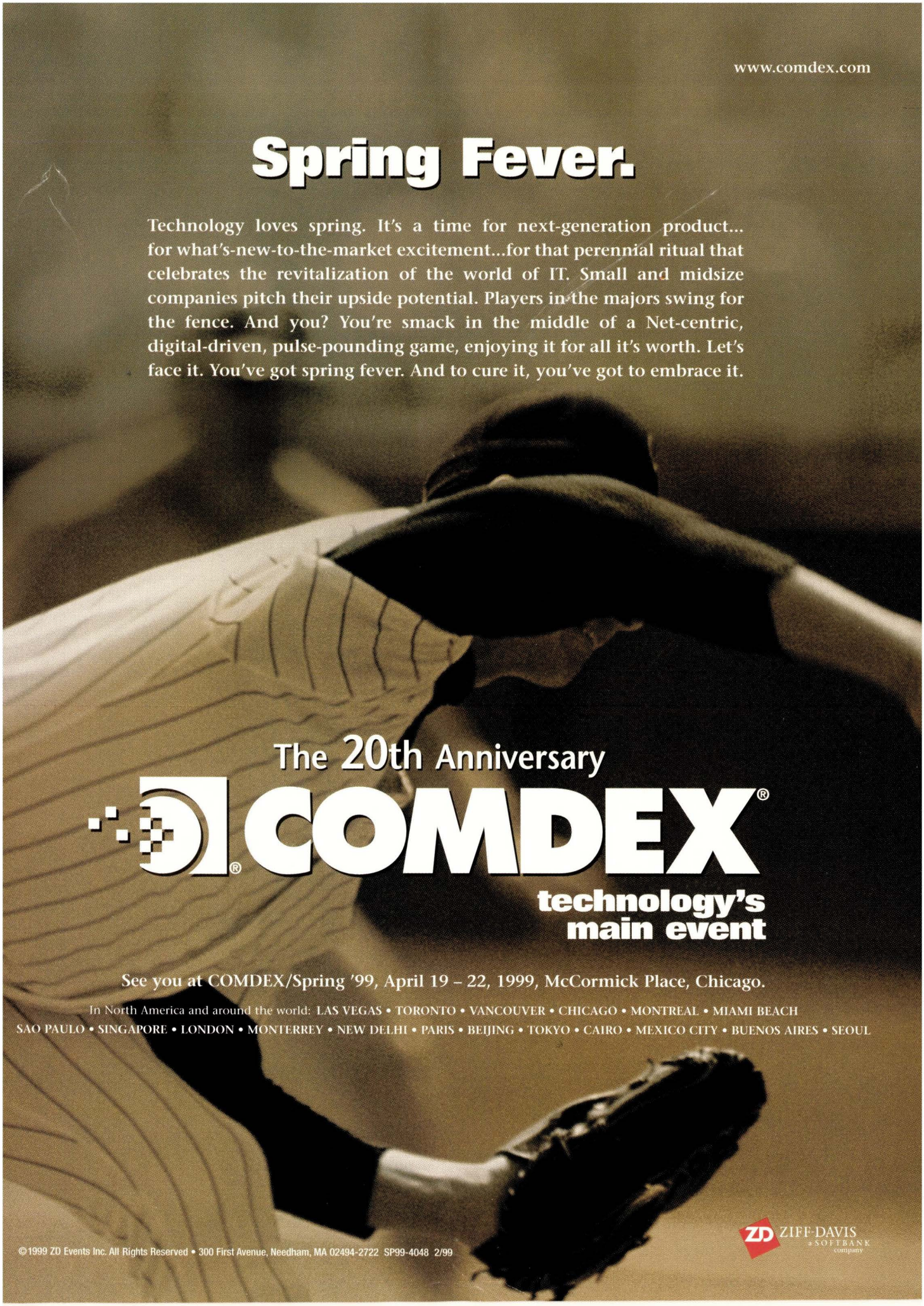
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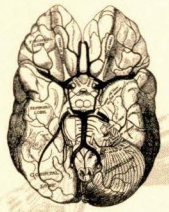
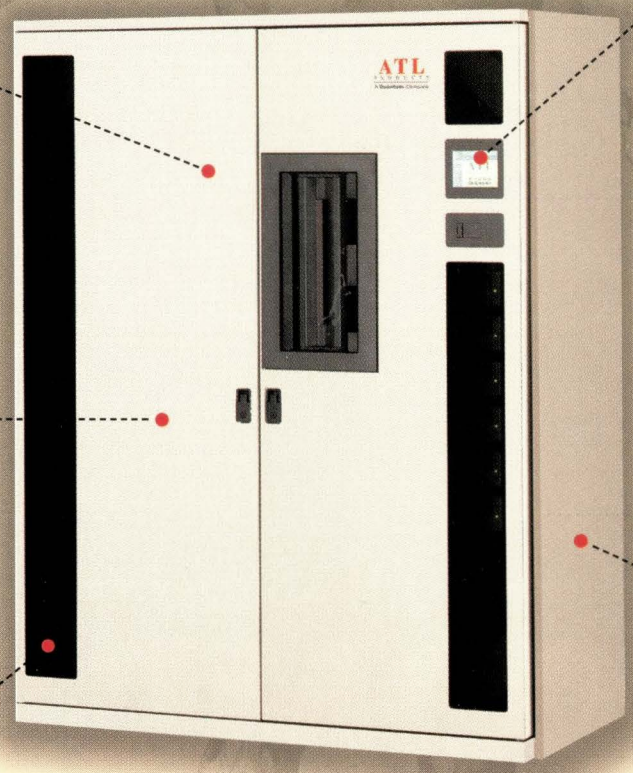
I. The Brain – *Much like "some" human brains, the P3000 has a massive capacity to store and move information. This intelligent library has a native capacity of 11.4 terabytes and blazing performance of 288 gigabytes per hour.*

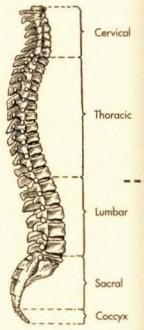


II. The Eyes –*With local and remote browser GUIs, you'll see the industry's most powerful DLTtape library is incredibly easy to use.*



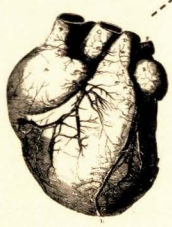
III. The Skeleton –*The human body has two arms and two legs. The P3000 delivers the same high availability (HA) design with redundant AC cords, power supplies and fans. Plus, the power supplies, fans and DLTtape drives can be hot-swapped.*

VII. The Spine – *The backbone of the P3000's design is a PCI expansion bus supporting SCSI interface, Fibre Channel, tape array and server PCI cards –"future proofing" your library with a modular upgrade path.*



Divisions of the Spine

IV. The Nervous System – *The complex nervous system of the P3000 is designed to support multiple concurrent network, SCSI and fibre channel connections, so each library can be shared by NAS, SAN and direct-connect environments.*



VI. The Heart–*The heart of the P3000 is the IntelliGrip precision cartridge handling system which will pick-and-place cartridges for years without skipping a beat.*

V. *Like a well-tuned body, The P3000's reliability, redundancy, ease of use and modular upgrades all add up to low total cost of ownership (TCO).*

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