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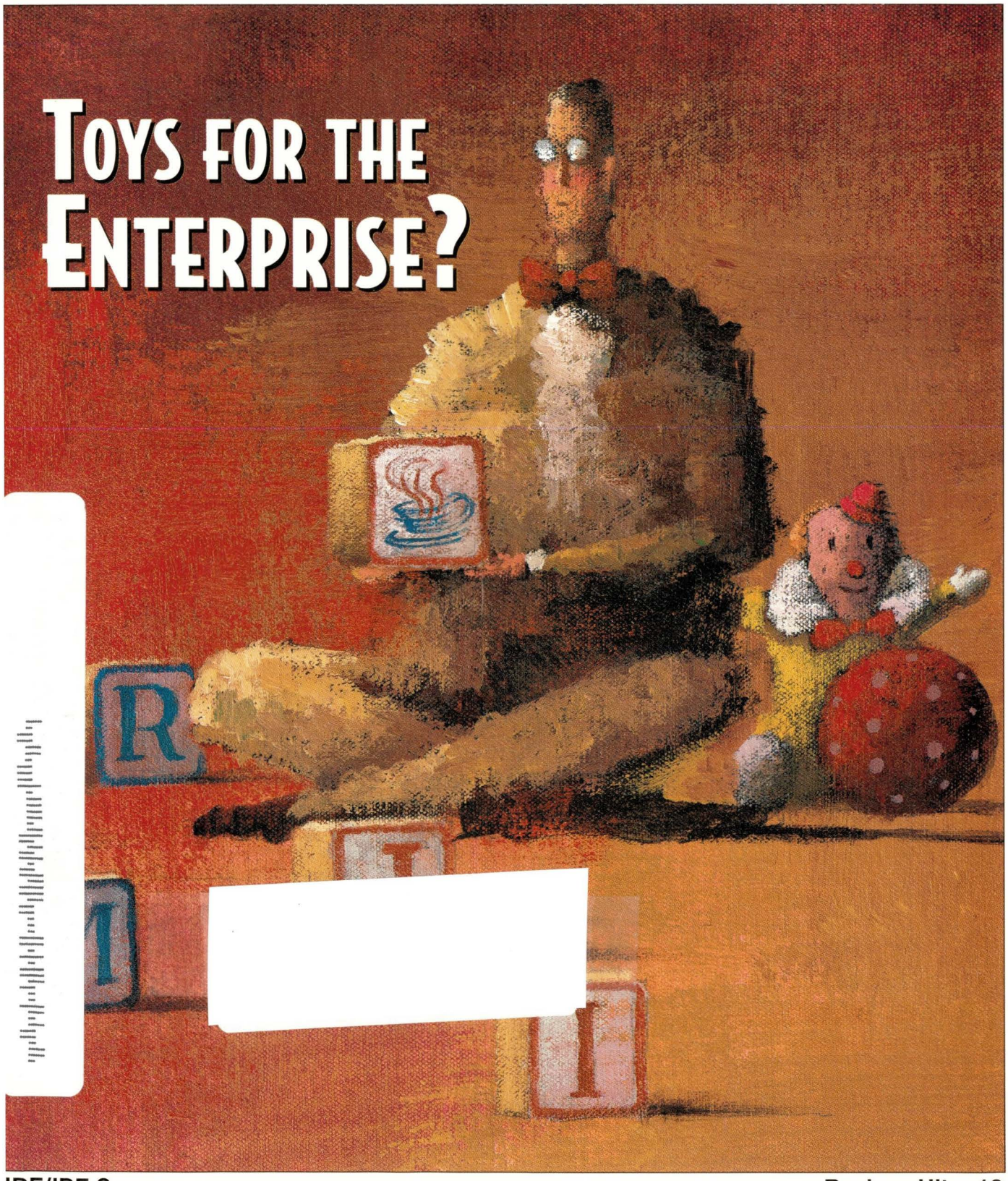

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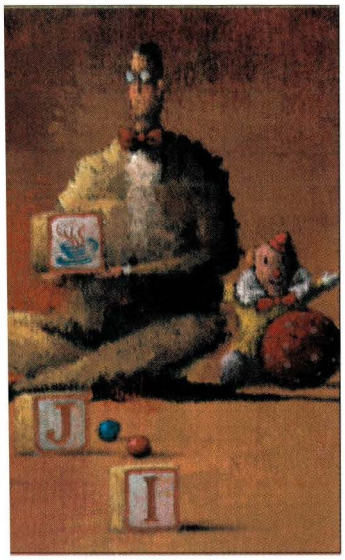

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Columns

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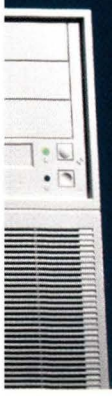

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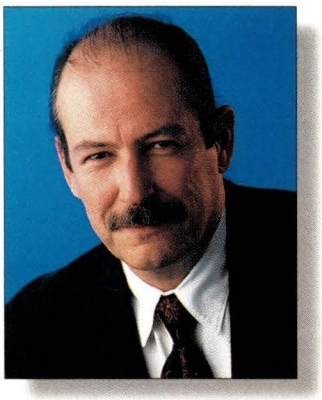

Oh No, Java Again

Despite its naysayers, Java continues to attract migrators. This migration, unlike others in the news, is not taking place overnight. But it is happening. According to a June survey of 50 Fortune 1,000 companies, conducted by Forrester Research Inc., Cambridge, MA, 52% say Java will have a "critical" or "important" impact on their overall software development strategy for the coming year.

Not bad for a young language.

In this month's cover story, "Toys for the Enterprise?," Page 48, staff editor Suzanne Hildreth explores how business is taking to Java. "At first, Java was just some enormously hyped thing that, when people actually tried it, was kind of disappointing. But now people are building and deploying real heavy-duty production apps. And if you're not doing it in Java, it's up to you to explain why," says Jeremy Sevareid, senior consultant for Random Walk Computing Inc., a New York, NY-based consulting and software development firm specializing in the financial services industry. According to Sevareid, this Java development is going on to the exclusion of other language development. "In financial companies, we see almost no new C++ development; all the new stuff going forward is in Java," Sevareid says.

So what events have spurred this rapid adoption? In addition to the usual suspects like modularity, reusability and so on, an assortment of APIs useful for constructing enterprise applications–including Java Database Connectivity 2.0, the Java version of SQL for access to relational databases; and the Java Naming and Directory Interface, for accessing and updating LDAP-compliant directories–have helped developers build robust applications with development cycles measured in Java years rather than man years, according to Sue. Also, the emergence of well-behaved Java IDEs might have had some influence. Be sure to check out Maureen McKeon's survey of Java IDEs on Page 56.

SW Expert finally got its hands on an Ultra 10 with PCi. Be sure to read Ian Westmacott's review of the Windows box on a card. Our system–an Ultra 10 with a 440-MHz UltraSPARC-IIi processor, 2-MB cache, 256-MB RAM, Elite3D m6 graphics adapter, 21-inch color monitor, SunPCi card and Solaris 7–turned out to be a barn burner for just under $9,000.

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Can SGI Win with Linux?

SGI is throwing its hat–and much of its shirt–into the Linux ring. In August, the Mountain View, CA-based server and workstation vendor announced a new server product and unveiled portions of its future road map for making the company a contender in the Linux market.

The troubled company–which recently announced layoffs and the surprise departure of chief executive officer Rick Belluzzo, who was subsequently hired by Microsoft Corp.–rolled out a new four-way server, the 1400L, which comes loaded with SGI Linux Environment 1.0 with Red Hat 6.0, based on the Linux distribution from Red Hat Inc., Research Triangle Park, NC. The 1400L, aimed at Internet service providers (ISPs), telecommunications companies and research and engineering users, is priced at $7,935 for a base configuration with one 500-MHz Intel Corp. Pentium III Xeon processor, 256-MB memory, 9-GB hard drive, two PCI buses and seven PCI slots. At the same time, SGI announced a sister product to the 1400L, the 1400M, which supports Windows NT and is aimed at the manufacturing and entertainment markets. The new servers are the first to be released in a new line of SGI 1000 servers based on the Intel IA-32 chip architecture. The next products to be released will be a two-way server and an eight-way server, both due out within the next 10 months, SGI says.

Alex Spence, product manager for SGI Internet Systems Group, says the new Linux server will offer UNIX customers greater software availability than they would get on SGI's traditional IRIX platform. "It will broaden our product mix by broadening our application availability with applications we weren't able to port to IRIX in the past," Spence says.

Greg Weiss, analyst with D.H. Brown & Associates Inc., a Port Chester, NY-based computer industry research firm, agrees. "SGI's biggest challenge was always getting a broad range of applications to show up on their niche flavor of UNIX [IRIX]. With Linux, they could get a much broader mix of applications. That would help them break out of the technical server market and into the commercial server market–something they've tried to do off and on for the past three or four years," Weiss says.

LISA VAN DUSEN

SGI, which first announced its commitment to producing Windows NT-based servers in April 1998, isn't moving away from NT on its low-end product line, said Beau Vrolyk, senior vice president of SGI Computer Systems Business Unit, during an August teleconference announcing organizational changes. Rather, the company is supplementing it with an option for UNIX customers.

"Linux is substantially different [than NT] in that it actually provides a very low-cost, high-quality operating system to satisfy the needs of UNIX computer buyers," said Vrolyk. "What Linux has going for it is a mass adoption over the last 18 months. It now has more than 12 million users, making it the most popular UNIX operating system anywhere. Our customers are asking for it, and it's a much better technology for our customers than any of the proprietary closed versions of UNIX, and one that allows us to leverage a completely open standard and get away from these proprietary closed environments."

SGI's IRIX operating system, which qualifies as one of Vrolyk's "proprietary closed versions of UNIX," will likely be retired if SGI pursues Linux on the high end, as well as the low end of the server market. "SGI has committed to using Linux as its next-generation operating system; they haven't gone so far as to place IRIX in maintenance mode, but I think the writing is on the wall," says Matthew Nordan, analyst with Forrester Research Inc., Cambridge, MA.

SGI could be looking at introducing a line of high-end, Linux-based systems down the road. "They will bring Linux into high-end SMP systems," says D.H. Brown's Weiss. "For example, there are these [Intel 64-bit] Merced chips coming out and SGI has said it plans to use them. It's pretty reasonable to assume the company's next-generation NUMA [Non-Uniform Memory Access] mach-

ines are going to be built on Merced, not MIPS [SGI's RISC-based processors that are supported by IRIX]...SGI has basically committed itself to Linux as a strategy, and it has indicated that their other strategies–like IRIX–are definitely secondary."

While SGI has committed to producing MIPS chips through 2002, it has not announced plans for MIPS after that. But SGI has published plans to deliver new MIPS-based systems that can be upgraded to IA-64 systems. "We're looking forward to a new product in about nine months, which will support both the MIPS and the Intel CPUs," said Vrolyk. "That architecture will give us a 2x performance improvement and about a 30% reduction in cost."

SGI's customer base of graphics and scientific users could give it an edge in both the low- and high-end Linux server markets, says Forrester's Nordan. "SGI has a unique opportunity because of its technical and scientific computing base. It is much easier to push Linux to a research lab that has folks who use Linux at home than it is to sell it to a commercial customer who cares more about the long-term viability of the OS than on solving a problem for a particular project," Nordan explains. "IBM could not say tomorrow, 'Oh, we will keep supporting AIX, but we're going to throw all our weight behind Linux.' Customers would abandon them in droves."

SGI staked its claim as a serious participant in the Linux community in May by offering its XFS file system to Linux programmers under an open-source license. That makes SGI the first major vendor to contribute a large piece of proprietary technology to the Linux code base and could potentially give SGI a greater role in determining the future direction of Linux development, according to D.H. Brown's Weiss.

"The general rule in the Linux community is the guy who makes the code, makes the rules. And SGI is the first company to donate a serious chunk of code," Weiss says. "However, it's easy to put code out there for people to use; it's another thing to get your code accepted as a standard in the Linux community. SGI is still trying to make that happen."–*sjh*

Sun Conjures First MAJC

This month, Sun Microsystems Inc., Palo Alto, CA, will unveil the first chip based on its Microprocessor Architecture for Java Computing, or MAJC (pronounced "magic"). Announced in August, MAJC is a multiprocessor chip architecture designed for networked devices that need to process media-intensive data, such as video servers, digital set-top boxes, screen phones and in-car global positioning system (GSP) receivers.

LISA VAN DUSEN

"It's really a chip designed for a new set of market needs," says Jeff O'Neal, group marketing manager for Sun Microelectronics. "We see an emerging set of needs for a media-rich experience. From a technical perspective, that means handling a lot of different data types that are not traditionally thought of as being handled in a compute environment–audio streams, video, speech [and so on]."

To handle all those media-heavy data streams, the first implementation–code-named Café–will boast two 500-MHz processors on a single die, or silicon chip, both sharing an L1 data cache and using a Direct Rambus DRAM memory design (by Rambus Inc., Mountain View, CA), operating at up to 800 MHz. A second version of Café will be targeted to run at 700-MHz per processor. The 6-gigaFLOP (six billion floating-point operations per second) Café will also come with two I/O buses based on Sun's high-speed Ultra Port Architecture (UPA). Each bus will have a data transfer rate capacity of 1.6 GB/s, making it particularly useful for devices specializing in online processing of encrypted data or graphics. "With that I/O capability...what you're really talking about is processing at wire speed, or what some people call 'throughput computing,'" says O'Neal. Wire-speed computing is the ability to process information at the physical capacity of the hardware, without any latency. This kind of I/O capability could make the chip useful in networking or storage equipment.

The MAJC architecture supports a multiprocessor design, capable of accommodating two, four, eight, 16 or more processors per die, although current semiconductor technology limits it to eight processors per chip. "It's designed to be extremely scalable," says O'Neal. "And the idea is that the processor will scale up to allow very complex systems to be made over the next 20 years; or it can scale down. With a multiprocessor system on a chip, there's going to be all kinds of new devices you can approach because you'll have the silicon there at a low enough cost to do some pretty amazing things."

The MAJC architecture also provides Digital Signal Processing (DSP) capabilities for handling analog-based media data, such as voice or graphics, that has been converted into a digital form. That makes MAJC ideal for applications like IP telephony or universal modem access concentrators, says Will Straus, president of consulting firm Forward Concepts Co., Tempe, AZ. "This machine is very, very powerful," says Straus. "It's frankly more powerful than any workstation or server chip on the market right now. It's totally different from their server workstation architecture. So it's

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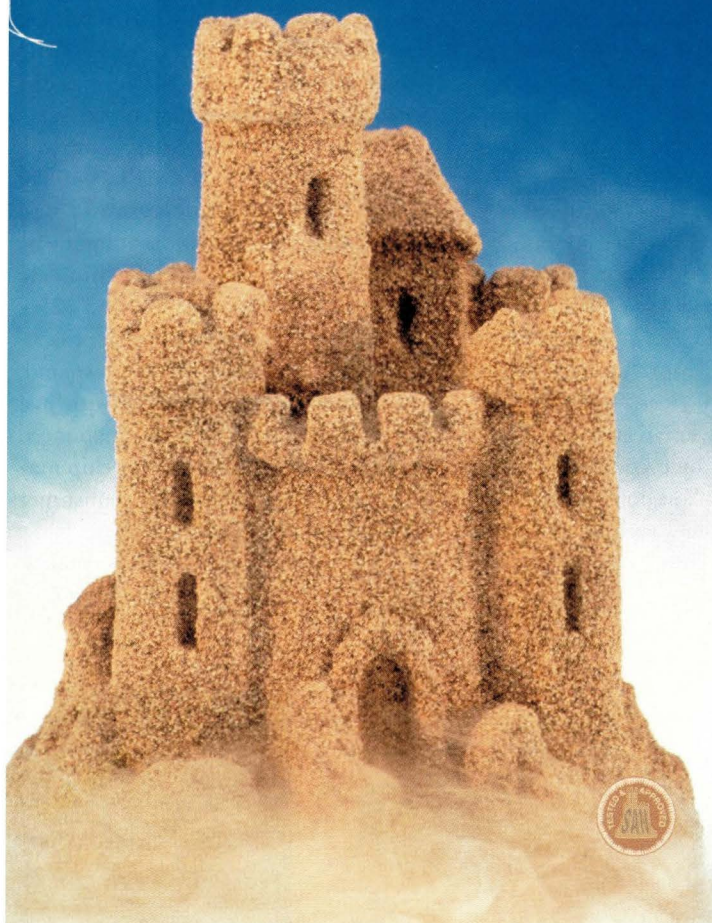

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certainly plowing new ground."

But MAJC is not likely to show up on corporate desktops; at least not for the time being. O'Neal stresses that the processor is not intended to be a replacement for Sun's SPARC chips, and will not be used in general UNIX workstations. But MAJC could be used as a DSP within a UNIX workstation, he says. According to Marc Tremblay, a Sun Distinguished Engineer and Chief Architect of MAJC, Sun does not see a good market opportunity for MAJC as a new workstation or server platform. "The last thing ISVs need right now is a new microprocessor architecture. So we're not going to go to software vendors and say, 'Port to this architecture,'" says Tremblay. "We're saying, 'Continue porting to the Java platform, and MAJC will accelerate all that.'"

Sun would not, as of this writing, disclose which operating system vendors would be supporting MAJC. However, O'Neal says Sun's ChorusOS, a real-time operating system designed for the telecommunications space, is one likely operating system for MAJC. Straus considers Sun's JavaOS another natural candidate. "JavaOS is one of the possibilities, and something with this amount of horsepower could really make the JavaOS leap tall buildings." That would be a boost for JavaOS, which suffered a setback in August when Sun and IBM Corp. reportedly abandoned an effort to develop JavaOS for Business.

Unlike PicoJava, Sun's embedded Java microprocessor architecture announced three years ago, MAJC is not a byte code engine, but is capable of processing compiled Java and C/C++. PicoJava, says O'Neal, is aimed more at embedded, single-function devices. "A byte code engine has a very small memory footprint. It sees Java byte code and it executes it," he says. "You don't have all the complexity that comes with an operating system and a JIT [Just-In-Time compiler]. So you're getting performance at the lowest possible cost."

While PicoJava hasn't garnered much support in the industry, it could benefit from the introduction of MAJC, says Rob Enderle, vice president of desktop and mobile technology for market research firm Giga Information Group, Norwell, MA. "PicoJava isn't dead yet, but it certainly isn't trending toward a robust life right now. MAJC has the potential to add life to that initiative."

Samples of the first MAJC chip will be made available to OEMs in the first half of 2000, O'Neal says, and will be shipping in production volumes by the end of the year. MAJC chips are expected to cost between $50 and $250, with this first implementation approaching the high end of that scale. A second, scaled-down version–possibly with just one processor–is likely to be announced in the latter half of 2000. That chip may be designed for interactive, consumer applications, says Sun's Tremblay.

"We expect yearly announcements, but of fairly radically different chips," Tremblay says.–*sjh*

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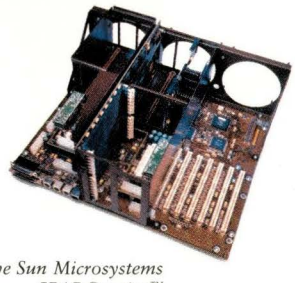

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Big Blue Releases its Shark

IBM Corp., Armonk, NY, began rolling out pieces of its Seascape architecture in 1997, but it wasn't until this summer that the heart of the storage system was unveiled. IBM's Enterprise Storage Server (ESS), aka Shark, introduced at the end of July, offers from 420 GB to more than 11 TB of storage capacity while supporting the building-blocks approach implemented with Seascape.

"Seascape is an architecture and a vision," says David Hill, senior analyst for Boston, MA-based market research firm Aberdeen Group Inc. "The Enterprise Storage Server is the major implementation of that vision. The translation of the vision into reality."

One of the key design aspects of ESS is its ability to share data across multiple platforms and operating environments, IBM says. The same data used with an application on one type of server can also be used by another application on an entirely different platform. The ESS is designed with two four-way RISC symmetric multiprocessing (SMP) processors and works with S/390, AS/400, UNIX and Windows NT machines. It provides added flexibility by supporting various interfaces, including ESCON, Fibre Channel and Ultra SCSI. "This combination of performance, openness and flexibility is unprecedented in the world of high-end disk storage systems," says Ron Kilpatrick, general manager of IBM Storage Division.

Other features include copying services, such as IBM's Peer-to-Peer Remote Copy (PPRC) and FlashCopy functions, and Parallel Access Volumes technology, which enables multiple I/Os from any operating system to simultaneously access the same volume. In addition, ESS uses redundant hardware components and RAID 5 (striping with distributed parity) disk arrays.

ESS has been introduced at a time when storage is becoming even more important. "Shark is part of a trend going on in many parts of the storage market," says Robert Gray, research director of storage systems for International Data Corp. (IDC), a Framingham, MA-based research firm. "We are seeing more value moved into storage. Shark is properly positioned by IBM as a storage server, meaning that it does something more

Building on its storage architecture, IBM introduces Shark–aka Enterprise Storage Server (ESS)–into the Seascape environment.

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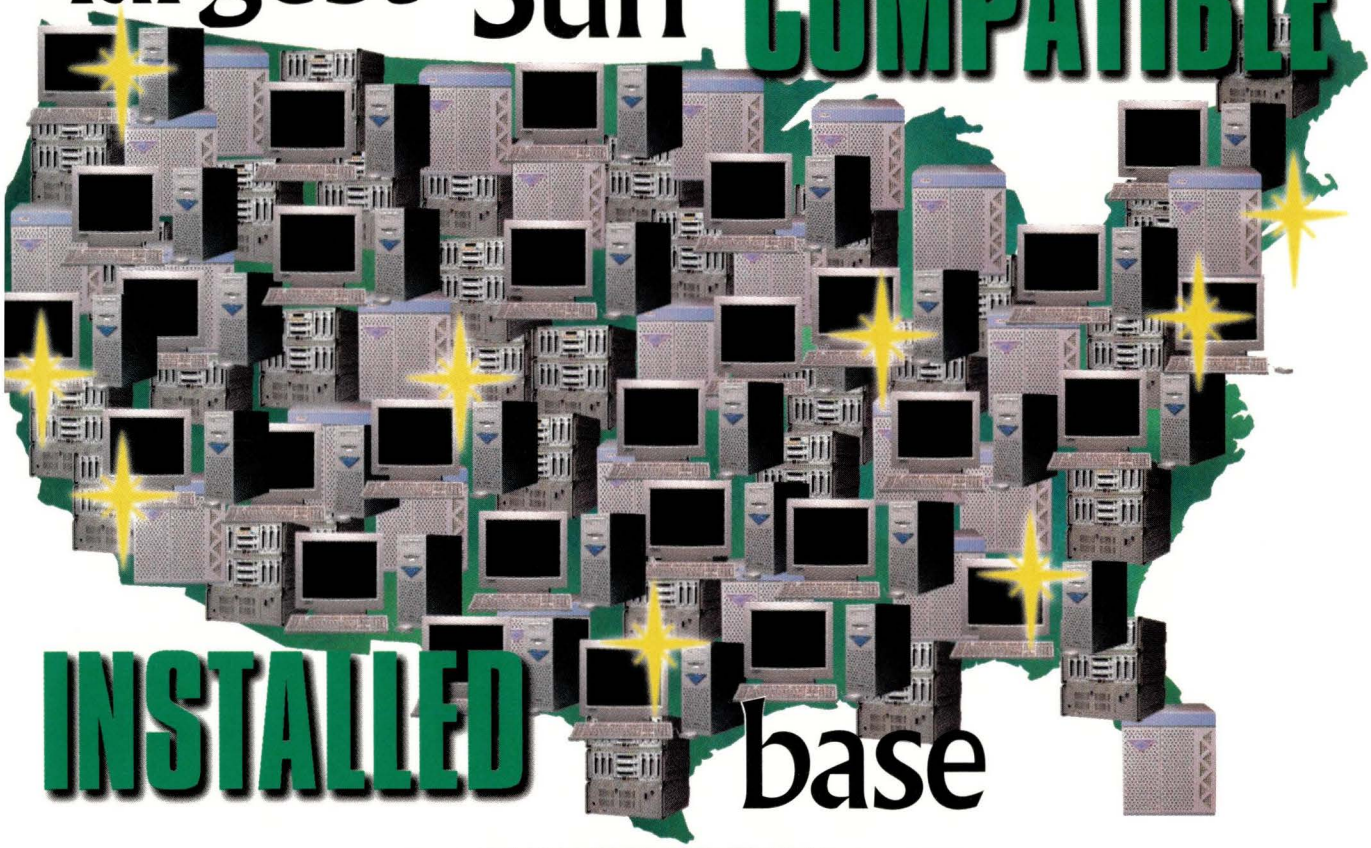

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than applied block- and volume-level management."

One of the issues driving advances in storage is the growing importance it has within businesses. Electronic commerce and Internet businesses, for example, require reliable and sophisticated storage systems. Without dependable hardware and storage capabilities, such companies are at risk. Online auctioneer eBay Inc. is one company that has been troubled with unexpected outages during the past few months, including a failure on August 6, when the site was off-line for 14 hours. eBay says the outage was the result of hardware problems.

"eBay is based on the data that is stored on a couple of Sun servers. If you loose the servers, as has happened several times, people get pretty nervous," says Gray. "This is not a bricks-and-mortar store front."

The increased investment in storage and the potential for further growth hasn't been overlooked by industry pundits. An IDC report published in June predicts that revenue in the network-attached storage market alone will increase from $540 million in 1998 to $5.1 billion by 2003.

Furthermore, the competitive landscape of the storage market has seen dramatic changes this year. Mergers have been commonplace since January, with Palo Alto, CA-based Sun Microsystems Inc.'s purchase of Maxstrat Corp., Milpitas, CA, followed in March by Andataco Inc., San Diego, CA, selling a controlling interest to nStor Corp. Inc., Lake Mary, FL. Further vendor consolidation occurred in April with the merger of Box Hill Systems Corp., New York, NY, and Artecon Inc., Carlsbad, CA. Then in August, a major storage announcement was made when EMC Corp., Hopkinton, MA, purchased Data General Corp., Westboro, MA. "Data General's products have proven technology leadership in the midrange storage market, but have lacked the global distribution and support needed to achieve their full market potential," says Michael Ruettgers, EMC President and Chief Executive Officer.

As long as organizations continue to have high storage needs, analysts say we can expect to see further market consolidation and further advancements in storage technology.–*ptc*

Server-Side IMAP

Sendmail, the popular mail transfer agent (MTA) from Sendmail Inc., Emeryville, CA, will now offer message store and access technology from MessagingDirect Ltd., Edmonton, Alberta. The commercial version of the open-source MTA will also benefit from MessagingDirect's support of Post Office Protocol (POP) and Internet Message Access Protocol (IMAP).

"It's a good marriage," says Don Pare, chief executive officer of MessagingDirect. "Sendmail has a made-to-order channel already in place, and to leverage that channel they need to offer additional value."

MessagingDirect offers software that stores email on a server and allows users to access these messages through various email packages located on the desktop. This message store and access capability will be embedded within the Sendmail MTA. But not only does this technology add value to Sendmail's product, it also provides long sought after IMAP support. According to Paul Hoffman, director of the Internet Mail Consortium, an industry trade group located in Santa Cruz, CA, this is a significant development in the deployment of IMAP industrywide. "We have been waiting for years for IMAP to take off," he says. "We've got IMAP on all the clients out there, but the question has been when will ISPs and companies start to deploy IMAP on the server?"

POP has been the email standard deployed in Internet service provider (ISP) settings, but it is limited in the world of Internet business, says Pare. "POP has traditionally been what the ISPs have used, but as you move into messaging being the foundation for conducting serious business, POP just doesn't cut it," he says. "There is no control and there is no security. There's nothing."

IMAP coupled with the MessagingDirect technology, on the other hand, does offer additional functionality over POP, says Pare. It provides mobility, tracking, storage, backup, recovery and security features. Plus, says Pare, IMAP allows for integration with other business communications systems. "IMAP is robust enough for commerce through messaging. POP is not even close."

While people like the Internet Mail Consortium's Hoffman believe this is a watershed day for IMAP, some industry analysts are scratching their heads wondering why this hasn't happened sooner. "If you want your platform and you want your messaging business to be aggressive and considered strategic, shouldn't you have been here a long time ago?" asks Darcy Fowkes, research director for Boston, MA-based market research firm, Aberdeen Group Inc. "What took so long?"

According to MessagingDirect's Pare, ISPs and organizations weren't in need of these types of products. But with the ever-growing importance of the Internet in business, companies today want IMAP support. "As companies move toward messaging-based e-business, that's when they start to work with us," Pare says.–*ptc*

IBM Rolls Out Linux Server

In August, IBM Corp., Armonk, NY, unveiled a new member of its Netfinity server line. The Netfinity 3000 is certified to run Linux distributions from Red Hat Inc., Research Triangle Park, NC, Caldera Systems Inc., Orem, UT, TurboLinux Inc., Brisbane, CA, and S.u.S.E. GmbH, Nürnberg, Germany, as well as Windows NT. Aimed at Internet service providers (ISPs) and application service providers (ASPs), the low-end server is priced starting at $1,765 and supports up to two 600-MHz Pentium processors. IBM is also in the process of obtaining certification from KeyLabs Inc., Lindon, UT, for all of its Netfinity servers on the four major Linux distributions. "IBM has been good at improving their support for Linux over time and this is another step along that path," says Greg Weiss, analyst with D.H. Brown & Associates Inc., Port Chester, NY.–*sjh*

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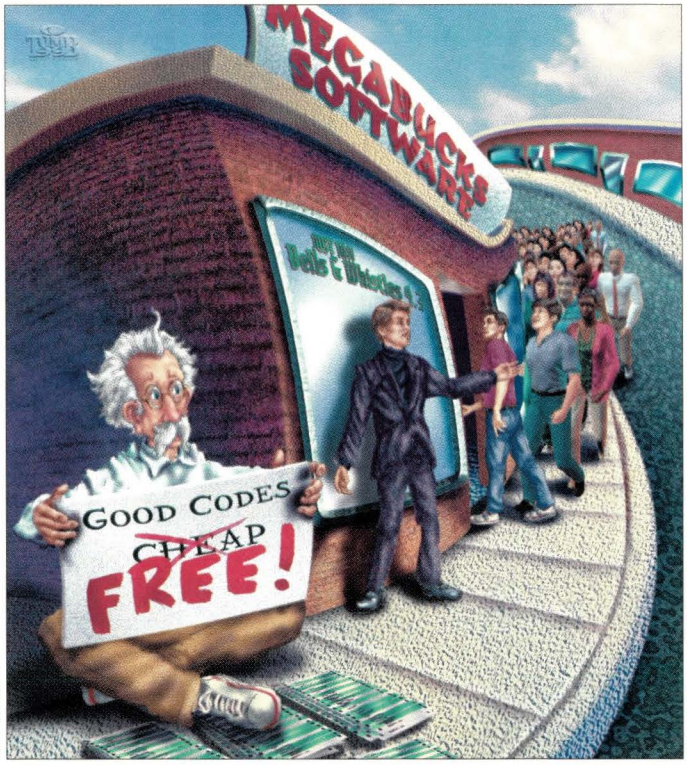
Circle No. 10

Ask Mr. Protocol

by Michael O'Brien



TOM BARRETT

"Information wants to be free."
– Richard Stallman

"It ain't free, but I hope you didn't pay retail."
– Uncle Mortie

"Unseen in the background, Fate was quietly slipping the lead into the boxing glove."
– P.G. Wodehouse

Mr. P. Tilts the Playing Field

Q: *Hi there. I failed to convince someone recently that sometimes you shouldn't give out your source code. I wouldn't have eaten had I not sold the software I wrote, yet my friend dressed in a tuxedo couldn't understand. I was wondering: Is it true I should always give away my source code and set up a CVS server once it's more than 2 or 3k big, or is it really not evil to sometimes give the source code only to the person for whom you wrote it?*

I really am having a hard time with this. If all source is free and open, when do the developers get paid?

A: First, I must congratulate you on your reality. The irascible gentleman who normally asks the questions around here, or tries to, suffers to a lesser degree from the same symptomatic and chronic condition of irreality which so plagues the unfortunate Mr. Protocol. Consequently, I can assure you that Mr. P. is very glad you asked.

Mr. Protocol's view of software is colored, like all his other views, by his Net-centric existence. To him, software is either something that emits packets, or something that emits data which are, in turn, encapsulated in packets. He has never understood, for instance, the saying, "the apple never falls far from the tree." He does believe in apples, because he eats them (when Big Stuf Ding-Dongs are temporarily unavailable), and he also believes in trees, ever since a piece of one fell on him. As a devout believer in strong typing, he therefore also believes in apple trees. What he does not believe in is apples falling from trees. Instead, he views apple trees as sources of apple streams, emitting apples at a seasonably varying rate.

He once attempted to engage the Farm Workers Union in a dialog on apple transport protocols, to no good effect. Being naturally too clever for his own good, he attempted the dialog at various levels, eliciting a variety of responses ("We believe you may be a candidate for institutional care."), none of them satisfactory in his eyes ("I'll show you a streaming protocol, you walking cheeseball!"). I arrived just in time to halt the dialog before a layer violation occurred ("Come back here!"). I had to take him down to the Big Stuf factory to watch Ding-Dongs being made before he felt better. They really are emitted in a continuous stream (from a great big machine), which made him feel much better. Unfortunately, I didn't. Those things are packed so tight with materials better left unnamed (no thanks to FDA regulations) that they don't ride out on a nice, orderly conveyer belt, but instead follow a nearly flat ballistic trajectory from the Dong Compressor (Big Skweez Corp. #D9) machine to the packing department. "Emitted" and "stream" are very good terms, as it happens. When I got home, I read the package closely. "Do not taunt Big Stuf Ding-Dong," it read.

But back to your question.

Mr. Protocol was nonplussed by it, as he is by most economic questions, and

so was I. It is extremely rare to encounter anyone wearing a tuxedo who is so far over on the question of open-source software that he doesn't get the necessity of selling it. I don't think anyone has ever seen Richard Stallman wearing a tuxedo, so it couldn't have been him.

The whole software market is screwy and getting screwier every day. No one's ever really understood it. For a long time, everyone was sort of in agreement as to how it worked. The only question, which was only raised occasionally, was "Why?"

"Why are we paying for this billet of dodo bricks that calls itself a software system? It has never worked, and it costs us more every quarter to bring in vendor representatives to tweak it. The fact that the vendor rep's car has 'Lying sack of dodo bricks' painted on the side doesn't make me feel any better."

Software, like all information, has always had the peculiar property that it can be sold endlessly without ever leaving the hands of the vendor. The fact that it is intangible does make for some strange marketing values. Intangible information has historically always been free, at least in the United States. Radio and television news is paid for by sponsors. You get to hear or watch it for free, but you also put up with commercials. You pay for a newspaper, but that's tangible. Software is just information, how can it be so expensive?

Lots of people have argued about this. Maybe it would help if we thought of software as rocks. You want a rock garden. You pay a lot of money for rocks, artfully arranged. Now, there are a lot of rocks out there. You can go out to a lot of places and pick up all the rocks you can carry, and take them home with you. Yet you wind up paying a lot of money to someone to go get rocks for you and make them look like a garden. Why is this?

Two reasons: First, he has a great big heavy-duty truck and you don't. Second, he knows how to make a pile of rocks look like a pretty garden, and you don't. If you have your own truck and a fearless sense of the artistic, there's nothing stopping you from going out and getting your own five tons of rocks and making art in your yard. But it'll take you a while to find good rocks, and it'll be a lot of hard work.

Same thing with software. They have the bits and you don't, and they know how to arrange the bits and you don't. "Oh yes I do," you say, "and I want to arrange my own damn bits."

Fair enough. That's what the open-source software movement is all about. Even if you don't know how to arrange all the bits, you might know enough to be able to rearrange bad bits into good bits.

That's the difference between rocks and software. For every rock in your garden, you have to go to Rocks 'R' Us and haul a unique rock back. Software companies make money by making just one really great rock, and then duplicating it *ad infinitum.* Aside from that, it's not that different. You pay for knowledge and haulage.

The open-source model is a model for creating great software, and secondarily eating. The traditional model is a model for eating, and secondarily creating great software. It's all a matter of priorities, but both involve continuing to eat through the creation of software. From an economic point of view, there's nothing wrong with either one, unless of course you're an economist who happens to be hard over in one direction or the other. The nasty thing about experts is that there's always one who'll give you a hard time, but then the nice thing about experts is that you can always find one who'll agree with you. As an expert, of course, he's unlikely to be wrong.

The Internet makes the open-source model feasible. Berkeley UNIX, from which the BSD derivatives flow, couldn't have been created without the Internet, as sizable chunks of BSD UNIX were written outside Berkeley. Now, Internet commerce is coming into its own, and both the cathedral and the bazaar are having an effect.

Commerce on the Internet today, both for software and for tangible goods, has a thrillingly ad hoc air about it. Initially, of course, the Internet was not designed for commerce. Commerce, in fact, was the one thing that was absolutely *verboten.* All of the Internet services were set up to support every sort of activity except commerce. Now, the Internet is required to grow ten thousandfold, while reorienting itself into a commercial structure. The strain is showing.

The governance of the Internet has slowly been formalized, as and when necessary, a process that is continuing. What is remarkable is how free the process has been from the sorts of problems one would expect in a development the size of the Internet. This is probably not due to a sudden access of broad-mindedness on the part of the giants and pip-squeaks of commerce, but because no one can quite figure out where their advantage lies. In the case of the Internet Corporation for Assigned Names and Numbers (ICANN), which is supposed to take on the governance of the Domain Name System (DNS), the pip-squeaks in particular have been making a lot of noise filing suit anytime it looks like they might make a buck. For the most part, though, the Internet Engineering Task Force (IETF), which oversees the standards process, has suffered only from its own internal lack of civil debate, a characteristic that has driven many fine minds as far away from the standards process as they can get. Blatant commercial attempts to influence standards have generally been met with a uniformly hostile response.

That may be changing. While the creation of software has seen a more libertarian turn in the open-source movement, Internet standards have seen developments that are not exactly in the public interest.

The Dark Side

One group that is not about to join the open-source movement anytime soon is Cisco Systems Inc. Having eliminated its founders in the usual brutal fashion once the venture capitalists packed the board with sharp businessmen, the company has built upon solid technical beginnings to dominate the Internet backbone in the same way Microsoft Corp. dominates the desktop. If Cisco is no more friendly to the ideals of open-source software than Microsoft, it does not suffer from the same image problems because it is far less visible. About all one can say is that its products are far, far more stable than those of Microsoft. Cisco routers work. All day, every day.

If Cisco has not been a source of sweetness and light, it has at least not joined the forces of darkness (a view not shared by certain of its founders, however) until recently. At a recent trade show, Cisco demonstrated software which, for the most part, is

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useful only to high-speed Internet providers such as cable modem companies and Digital Subscriber Line (DSL) providers.

Until recently, high-speed Internet connections were the exclusive province of corporations that wanted high-speed data flowing in and out in support of business: large technical data files being transferred, employees doing research on the Web, that sort of thing. The providers to these companies had no interest in marketing anything other than a high-speed data connection. Aside from that, the providers were invisible.

Much as home consumers of cable modem and DSL providers might wish the same, it ain't necessarily so. Cable modem companies in particular expect to make a large percentage of their moolah as "portals," that is, as providers of a slam-bang one-size-fits-all home page for their users. They want to be content providers in all possible senses. They not only provide content to the user by shipping it over cable, they provide content to the user by producing the content the user sees. It's as if a television station owned and produced all the shows it broadcast. In the early days of television that's exactly what happened. Gradually, broadcasters and networks settled out, with networks creating content and broadcasters distributing it, and each half supplying advertising.

The Internet is still at the one-size-fits-all stage, but its technology is rather more complex than the television folks, whose digital networks don't extend to the TV set. Therefore, some chicanery is starting to creep in at the edges, *videlicet* Cisco's little number.

Cisco announced a new technology available in its routers, which would enable a high-speed connection provider to selectively place a throttle on packets flowing from a competitor's Web pages, thereby assuring that their own content pages would possess an insuperable advantage in speed (if not quality) over their competitors' pages.

Of course, as soon as users found out about this (that is, after it hit Slashdot, `http://slashdot.org`), there was an unholy uproar, to which Cisco replied, "What? *Whaaat*? It's their own network, after all! We're just letting them set policy!"

The funny thing is, a hard barrier against a Web site is already a matter of policy and has been for years. It might be debated as censorship, but it's not debated as a matter of simple fairness. Previously, providers shipped everyone's content on an equal footing, if they shipped it at all. Cisco's latest product gives everyone a chance to de-level the playing field, to tilt it, at least locally, to their own advantage.

This is profoundly unsettling. America Online Inc. (AOL) has been lobbying furiously to gain access to the cable networks, to act as its own high-speed provider, as well as a dial-up provider. No one is seriously considering rate-metering on dial-up connections. They're so miserably slow that they need all the help they can get, from all sides. A cable modem's T1-equivalent speed is another matter. If AOL were providing cable modem access, does it seem reasonable that it would feed Excite's or AltaVista's portal page as fast as NetCenter (which AOL owns) if it could get away with making its own four or five times faster, guaranteed?

In retrospect it seems odd that, in all the years since William Gibson coined the term "cyberspace" in his novel *Neuromancer*, no one ever gave any thought to the corridors down which all those fearsome bits were traveling. Corporate data fortresses, black ice, data hounds, network warfare, and yet all of cyberspace was seen as neutral.

Apparently, it isn't going to play out that way. Apparently, the people who own the roads want to regulate the traffic. There is no economic reason why this model of "most-favored-nation" status on the Internet shouldn't pervade all of the high-speed service providers who also want to be content providers. Bandwidth regulation is a much-needed tool, especially where things like streaming services are concerned, but this ownership-dependent rate differential is not something that was foreseen. It doesn't seem too likely that the U.S. government is going to jump in and stop it either, because it (quite rightly) is keeping its hands off for now. The Internet is changing far faster than the government's ability to regulate it, even if some high-speed providers are looking extremely greedy.

And they're not the only ones. It's getting to the point where anybody who sells you anything wants to own a piece of you forever, it seems.

Consider the recent development in the war against software piracy. The latest scheme is that the software vendors will be able to send a nastygram to your machine, which will cause your commercial software to disable itself if the vendors think you might be pirating it. To which Mr. Protocol responds: Get real. How likely is it, in any other line of work, that you would buy plant machinery from a vendor who was able to come in at will and shut your plant down just because he thought you might be doing something he didn't like? Talk about poison pills! It'd make a good one. You wouldn't want to own your own company, let alone anyone who might be thinking of taking you over. Mr. Protocol makes the cogent observation that if ever there were a marketing tactic suited to boost the fortunes of the open-source movement, this is it.

Free market forces may put an end to both of these trends. Some bandwidth providers will advertise themselves as "bandwidth-neutral." The open-source movement is certainly going to cover the bases in terms of common office software. If Office 2001 comes with an on/off switch that Microsoft can flip, KDE or Gnome sure won't. (One wonders, actually, how this poison pill is supposed to traverse a corporate firewall. Mr. P. sees a large opportunity for cat-and-mouse here.)

You ask if you should be allowed to sell software you've written in order to eat. To which Mr. Protocol replies: Surely, as long as you don't plant a bomb in it. ⊸

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

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

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

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PAUL SCHULENBURG

Common Gateway Interface

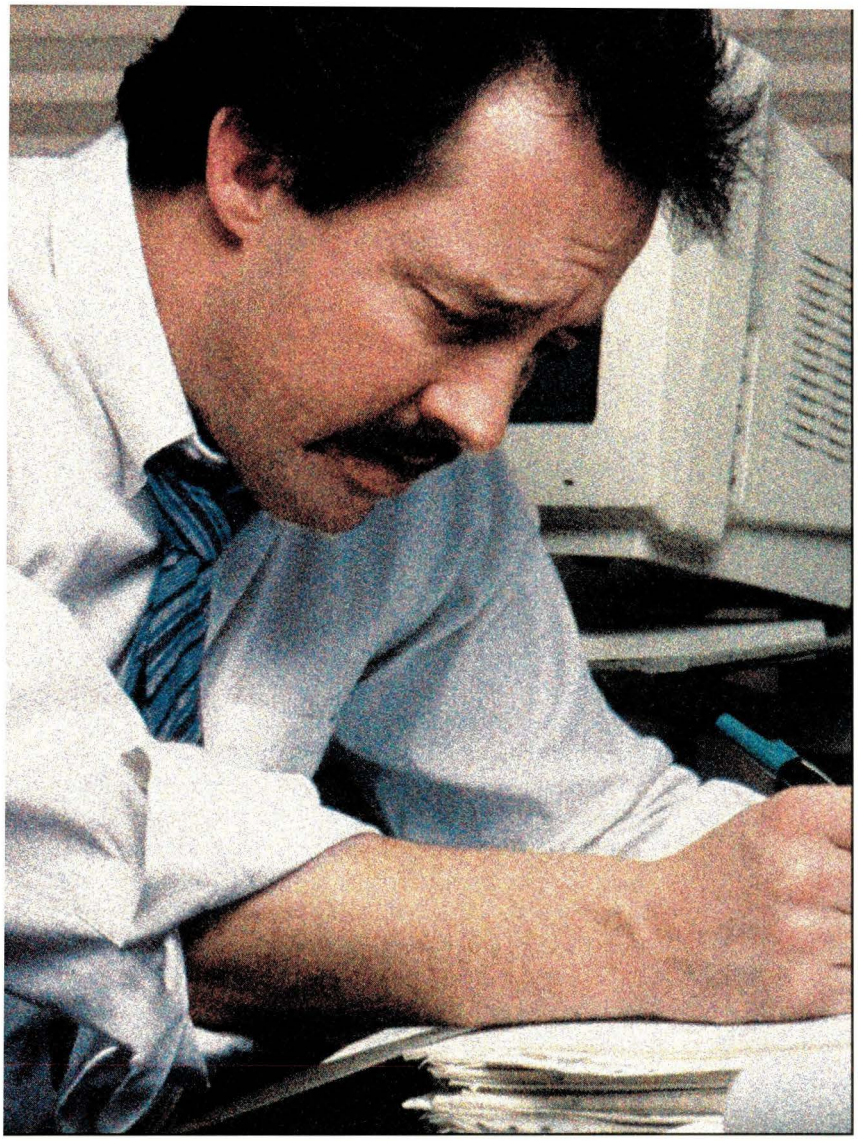
This time last year, I came out as a Perl programmer with an article that gave you the basics of Perl ("Getting Started with Perl," October 1998, Page 22, `http://sw.expert.com/C2/SE.C2.OCT.98.pdf`). I started to learn Perl because I wanted to create interactive forms for the Web. Scripts supporting the Web are often called CGI scripts because they use a standard interface supposedly supported by all Web servers, called the Common Gateway Interface. (Just in case you are a little thrown by the "supposedly" in the previous sentence, I haven't come across a Web server yet that doesn't support CGI. I also haven't looked at all the Web servers in the world.) CGI defines an environment in which any process is run by the Web server. A process run by the server can be written in any language. We talk loosely about "CGI scripts" because it's usually more convenient to write them in a scripting language. CGI dictates the inputs to any process that the server runs and proscribes its output. This article examines the CGI interface and how scripts fit into the system.

Before looking at how CGI scripts work, we need to look a little at HTTP, the Hypertext Transfer Protocol, which is the fundamental method of communication over the Web. The job of a Web server is to respond to an HTTP request from a client. If the request is for a file, perhaps holding HTML, an image, movie or sound, then the server will find the file and send it.

HTTP is a text protocol, messages consist of an initial line, which is either a request from a browser or a response line from the server, followed by more data. The "more data" may be a file, and the type of information in that file is specified using the conventions adopted for MIME. MIME stands for Multimedia Internet Mail Extension and started out as way of sending more than just text via electronic mail. The protocol was picked up as a convenient technology to manage file typing by HTTP. Unlike many Internet protocols, HTTP is fairly bidirectional. For example, most of the time, the message contains a file that is sent by the server to the client, and MIME is used to find out how the file should be displayed. However, the client can also send a file to the server using the same protocol elements.

Many Web servers are set up so that when an HTTP request from the browser asks for a file with the suffix `.cgi`, then the server will not send the file. Instead it will expect to find an executable program and will run it. The job of the program is to generate appropriate output. Web servers can also be configured so that a request for a file in a particular directory, or directory tree, will be executed as a script. This special directory is often called `cgi-bin`.

Web servers have adopted the "special directory approach" for security reasons. It's dangerous to allow Joe Random-User to run programs on your



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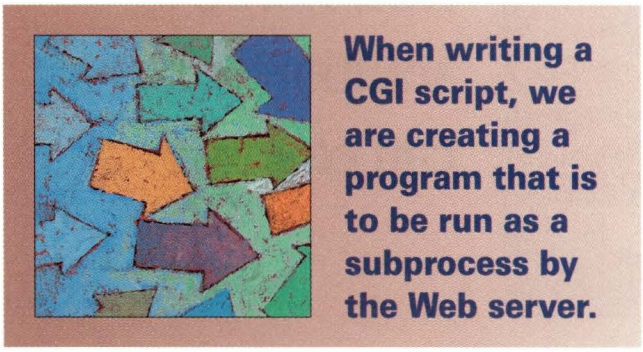
machine, even if they are your programs, so most Web servers place constraints on CGI scripts that are intended to promote safety. It's good practice to hide scripts so that they may be executed but not downloaded. I generally place my scripts outside the tree of files that can be downloaded by a browser.

Of course, hiding the script contents is an example of "security by obscurity," which is generally a poor foundation for real security. However, it does prevent Joe's close friend, Arnold Bad-Guy, from examining the scripts in order to find security holes.

When writing a CGI script, we are creating a program that is to be run as a subprocess by the Web server. We need to find a way of getting information from the server into the running script. There are a finite number of ways that are used to supply a subprocess with data. The first that springs to mind is the use of program arguments. Actually, CGI scripts don't use program arguments, probably because the solution was considered "too UNIX," or because the standards that have been set for program argument styles are too restrictive.



When writing a CGI script, we are creating a program that is to be run as a subprocess by the Web server.

The second method of passing data from a process to a child process is via the "environment," a set of *name=value* pairs that are inherited by the child from its parent when the child is created. UNIX usually uses the environment for storing useful pieces of global context information that processes may need to know. The *name=value* structure of the environment is a good match for the data that comes from the form that the user has filled in using their browser. Each input box or input feature (like a checkbox) on a form is given a name and will be given some value by the user that needs to be tied to this name and sent to the Web server.

As a final method of sending data into a child, we can pass the subprocess an open file and ask it to read data from that file descriptor. This technique is used commonly in shell redirection. For example,

```
$ ls -l /bin | more
```

will cause the shell to run the `ls` command and divert its output into standard input of the `more` command. The `more` command is passed an open file descriptor and reads the data; it's actually oblivious to the source of the data it is processing. As we shall see, passing an open file is used by CGI scripts in some circumstances.

The Protocol

When the client sends a request to the server that results in the execution of a script, the server will preload several environment variables that the running CGI script will inherit and can later inspect. CGI specifies the names of several of these variables as "standard" parts of the CGI protocol. Your server may provide other environment variables. I often run a simple shell CGI script containing the shell's `set` command to dump out the environment variables that are provided by the server, usually to check that I know the correct name of a particular variable (see below).

I am not going to list the variables here, but I will talk about them generally. The information splits into three categories. First, there are variables that tell the script something about the server being used to run the script. For example, the script can find out the port number the server is using. This may be useful if you have two parallel servers using the same source tree, but one is a secure server and the other uses normal nonencrypted communication. Your CGI script is able to test the port number and do different things for users of each server.

Second, there are some variables that give the script basic information about the browser and system that made the request for the data. So, for example, the script can identify the remote IP address or the type of browser. It cannot identify the person at the other end, nor their email address.

Third, there are variables that contain information about the current transaction. As I said, HTTP uses the MIME protocol to exchange typed information about data blocks, and the MIME type of the incoming data is made available to the script in the `CONTENT_TYPE` variable.

The designer of the form that calls the CGI script has two choices, `GET` and `POST`, that define the way information from the form is passed to server. The `METHOD=` parameter specifies the choice to the `FORM` HTML element placed on the Web page. Each method uses a different way to send the user's form information to the server when the submit button is pressed.

The names `GET` and `POST` refer to commands in the HTTP protocol. When a browser asks for a regular page it sends a request like the following:

```
GET /main.html HTTP/1.1
```

The above request is asking the server for the page `/main.html` and indicating that it's able to cope with Version 1.1 of the HTTP protocol. If all is well, the server will respond with a message containing the appropriate data.

When the browser is told to send data from a form using a `GET` method request, it will send a `GET` request and will add a question mark along with the form contents to the end of the URL in the `GET` statement. It creates an extended URL containing the address of the page and the parameters to be sent to the script. If there are a great many *name=value* pairs on the form, or the values are large, then this initial request to the server could be larger than it can comfortably deal with. Also, when the URL is processed by the server, any string following a question mark ends up in an environment variable (`QUERY_STRING`) that is made available to the CGI script. It's

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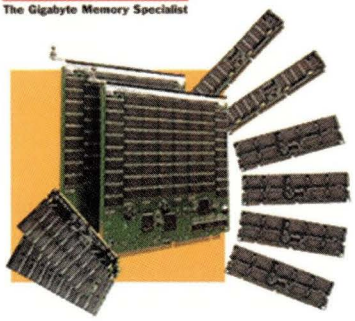

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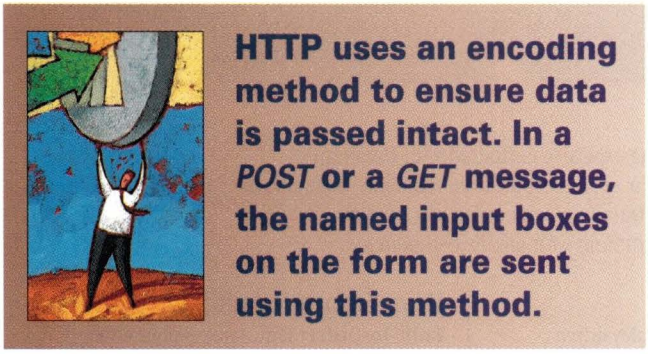
desirable to limit the space taken up by environment variables.

So for larger forms, the `POST` method is preferred. Here, the data from the form is not sent as part of the URL, but follows the initial request line as a MIME-encoded file in the body of the message that's sent to the server. Because uploaded data is MIME-encoded, the server knows the size and the type of data and will pass these values into the script using the environment variables: `CONTENT_LENGTH` and `CONTENT_TYPE`. In addition, the script expects to read the set of parameters sent by the form from its standard input channel. It's the server's task to ensure the data that's been sent from the browser is made available to the script ready to be input and scanned for *name=value* pairs.

There's one further complication to both the `GET` and `POST` methods. I mentioned that HTTP is a text protocol, and using text to convey information has its own problems. It's often the case that in any text application we have to "steal" characters to use in the application itself. Think about the UNIX password file: it uses the colon character to separate fields, and this means we can't have a login name that contains a colon. The colon is a "stolen" character.



HTTP uses an encoding method to ensure data is passed intact. In a *POST* or a *GET* message, the named input boxes on the form are sent using this method.

To get around this, HTTP uses an encoding method to ensure data is passed intact. To encode the data for use in URLs, character spaces are replaced by plus signs (+) and any nonalphanumeric character is replaced by a percent sign (%), followed by the two-digit hexadecimal representation of the character. You'll sometimes see this when people have home pages related to their account name that are accessed by the UNIX convention of tilde (~) followed by their user name. Their URL might be

```
http://www.domain.com/~pc
```

but is sometimes written in encoded form as

```
http://www.domain.com/%7Epc
```

Actually, most encoding routines pass more than alphanumeric characters through transparently. They tend to also send underscore, backslash, minus and period untranslated, so URLs contain the characters we expect to see.

In a `POST` or a `GET` message, the named input boxes on the form are sent using this encoding method. The names and values are encoded, and each pair is made into a string of the form *name=value*, these strings are then concatenated into one string, where each pair is separated by the ampersand character (&). For example, a `POST` method form that contains two variables `NAME` and `PHONE` will send its data as

```
NAME=Joe+Random&PHONE=890+8394
```

The `GET` method will add this string to the URL, after a question mark. The `POST` method will transmit this string as part of the HTTP protocol, and the script will read it from its standard input channel.

Output from the Script

The job of the Web server is to send a response to the user's request. CGI scripts are responsible for sending back a file of data to the client. The Web server arranges things so the standard output of the script will send data to the client's browser. However, the output needs to be MIME-encoded and a script needs to start by sending a MIME header that specifies the type of data that is to follow. The MIME header is separated from its data by a blank line, so if you look at Perl CGI scripts that send HTML, you'll often see them start with

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

which specifies that the data that follows is HTML. Notice that there is an extra blank line output by this statement. The header of the message is separated from the body of the message by a blank line. Having output the header, the script can now happily send further HTML statements.

I talked earlier about writing a CGI script that will dump out all the environment variables set by the server. We can now do that; it's a shell CGI script:

```
#!/bin/sh
echo 'Content-type: text/plain'
echo
set
```

You need to place this script in your `cgi-bin` and name it, say `shset`. The script is executed by the shell. We are using the standard `#!` magic character pair at the start of the file to tell the system that this is an executable file. To work, the script needs to have execute permission set:

```
chmod +x shset
```

The script prints the MIME header line, a blank line and then uses the standard shell command to dump the values of the environment. You can now call this from a browser by typing a URL like the following:

```
http://www.domain/cgi-bin/shset
```

You'll get a screenful of information that shows you the various values that are established for CGI scripts by your server.

Because the CGI script is actually supplying part of the HTTP protocol that is sent back to the browser, it's easy to

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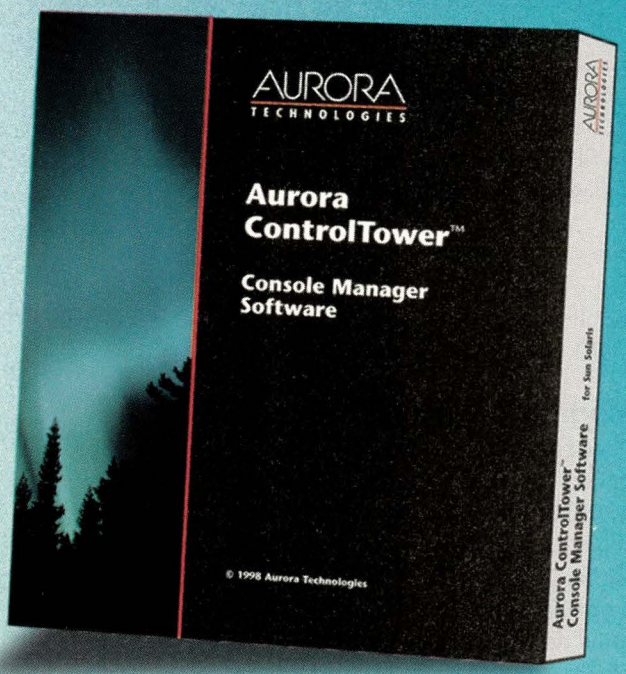

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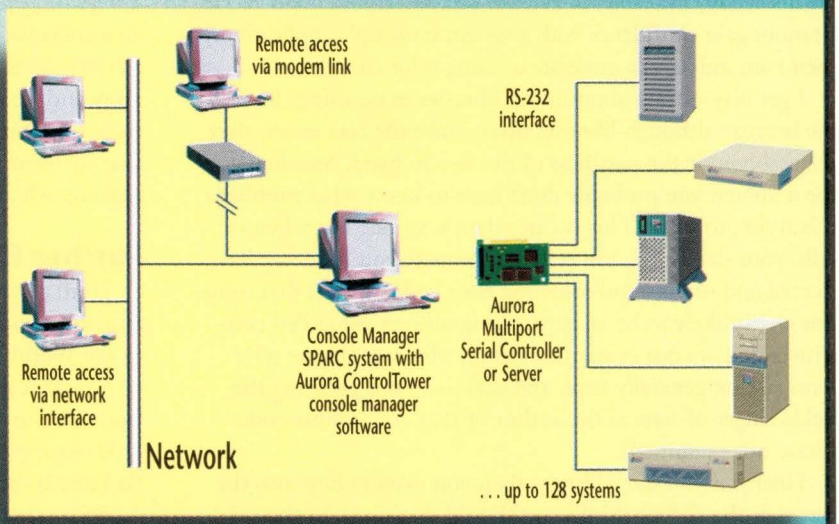

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make it use extra capabilities of the HTTP protocol. For example, when I create pages that say "Thank you for submitting that data," I generally tell the browser to wait for 10 seconds and then head off to some other location, perhaps the home page of the server or the page the user was viewing before they began filling in the form. Doing this is easy, you add a line like the following into the header:

```
Refresh: 10; URL=//http.domain/index.html
```

I generally output this before the `Content-type` statement. The URL needs to be absolute for this to work.

Decoding CGI Arguments

I don't have the space here to go into the nitty-gritty of decoding URL arguments. If you look at the books mentioned at the end of this article, you'll find some example scripts that will do it for you. Perl now has a standard module that can do all the hard work, called `CGI.pm`. I don't use this personally, for a number of reasons.

I find that it's actually very hard to get a handle on how to use the `CGI.pm` library for simple applications. Ideally, I need to see and understand some working code, and the examples I seek are not readily available, or at least, I haven't found them yet. If I cannot gain confidence with a system for simple applications, then I am unlikely to graduate to using it for complex ones.

I get very queasy about using libraries to do things for me because although libraries often make the task easier, they inevitably hide the nastiness of the task in hand. So when you use a library, you probably don't have to know what problems it is trying to solve. This is fine when it works. But when it fails, your debugging job is harder because you suddenly have to read and understand someone else's code. Worse, that someone else is likely to be an expert programmer using Perl constructs that are not exactly blindingly obvious. (Please note I am talking generally here, and definitely not pointing the fickle finger of hate at the author of `CGI.pm`, whose code I have not examined).

Finally, if you use a library, then you need to buy into the way that the author thinks you should do things. In the case of `CGI.pm`, this means that you write a program that contains both the code to generate the look of the form and the same code that understands the data, checks it for veracity and performs the main action of the form. I feel the approach leads to too much stuff in the script, and the separation between the "look of the page" and the "action of the page" isn't sufficiently clear-cut.

Please don't send me hate mail complaining that the CGI library is perfectly OK for you and it's easy to use. I am sure that this is correct; mileage varies.

Actually, to read form arguments you only need around 15 lines of Perl, and you can find those lines in all of the books I refer to below. The first routine decodes the URL format, changing the hexadecimal encoded values into "real" characters. The second routine deals with `POST`ed arguments. It reads several bytes from its standard input channel where the Web server places the `POST` values. The routine knows how many bytes to read because it can examine the `CONTENT_LENGTH` variable in the environment using Perl's standard `ENV` associative array.

My routine for decoding `POST` input was acquired from a book (undoubtedly one in the list below) at some time in the past. It first reads all the data into a string and then splits this string into an array of strings using the ampersand character as a separator. It now has several *name=value* strings that it needs to process further. It splits each of the parameter strings into two separate variables at the equals character (=) and applies the decode URL routine to both variables. Finally, it stores the argument into an associative array, so I can access the value of a box on the form using some code like the following:

```
if ($FORM{NAME} eq "")
```

If you are bewildered by all this talk of associative arrays, don't be. An array in a programming language is an object that can hold several values, and we normally access those values using a numeric index. An associative array is a similar object, a single variable that can hold several values, but the values are accessible by using a name or text string as the index. Associative arrays are well suited to storing form parameters because they allow us to access the value by using the name part of the *name=value* pairs. In Perl, we tell the language we are using an associative array by using the curly-brace syntax. So the `$FORM{NAME}` statement above says: `FORM` is an associative array and we want to look up the value that's associated with the string `NAME`. The dollar symbol (`$`) at the start tells Perl that we want to treat the result as a single entity, in this case a string, which we test against the null string.

Further Reading

Until recently there was not much information readily available about HTTP and its workings. I used to surf over to the World Wide Web Consortium (W3C) site at `www.w3.org` to look at the standards documentation. I still do this from time to time. Another source of basic information I use is *Managing Internet Information Services* by Cricket Liu, Jerry Peek, Russ Jones and Adrian Nye (published by O'Reilly & Associates Inc., 1994, ISBN 1-56592-051-1). This book is quite old now and some of its information is a little dated. I am also using a recently updated publication by O'Reilly & Associates entitled *Webmaster in a Nutshell*, 2nd Edition (by Stephen Spainhour and Robert Eckstein, 1999, ISBN 1-56592-325-1), which contains a comprehensive and concise description of HTTP and also has some CGI programming information. There are a great many books with samples of CGI programming.

The *SW Expert* editing team point out a good starting point on the Web is `http://www.ncsa.uiuc.edu`, the information is somewhat dated but otherwise OK. ⊸

***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`.

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Circle No. 16

by Æleen Frisch

LOUISE GOLDENBERG

What's New in SP5

This month, as promised, we will be looking at some of the new features introduced into Windows NT by Service Packs 4 and 5 (remember that SP5 is simply a bug-fixed version of SP4 and introduces no new functionality of its own). Be sure to consult the service pack's Readme file for a complete list of new features and additional information about some of those mentioned here.

New Events

SP4/5 introduce three new events within the Event Log facility:

- System Version Event (event type 6009): This is created each time the system is booted. Its description includes the operating system version that is running; for example, "Microsoft (R) Windows NT (R) 4.0 1381 Service Pack 5 Uniprocessor Free."
- Clean Shutdown Event (event type 6006): This is logged whenever the system is shut down normally. Note that the description provided for this event is not as explicit as it could be: "The Event Log service was stopped." However, you can always recognize it by its event type number.
- Dirty Shutdown Event (event type 6008): This is generated automatically as a result of any abnormal system shutdown or crash (for example, owing to a power failure). Such events are actually recorded during the system start-up process when no Clean Shutdown Event is present. The description for this event includes the most recent last alive time stamp, a value stored in the system registry that is updated periodically by the operating system (and is always immediately flushed to disk). The default interval for these updates is five minutes. You can also specify a different time period by creating the `HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Reliability\TimeStampInterval` registry key (type `DWORD`) and setting its value to the desired number of minutes.

These events are obviously quite useful for tracking system start-ups and shutdowns themselves and also for correlating other events to a specific system session. The operating system version information in the System Version Event can also be used by post-processing programs when analyzing the data.

Limiting User Profiles

These service packs also allow administrators to specify a maximum size for user profiles. Please note that user profiles are saved user environments that may be restored automatically each time the user logs in and may optionally follow the user from workstation to workstation (via the roaming profiles feature). As such, they include a variety of desktop, system tool and applications settings. Left unchecked, the user profiles can become quite large and consequently consume a significant amount of network bandwidth resources.

Limits on user policy size are set via the System Policy facility (specifically with the System Policy Editor). The

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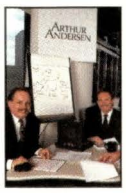

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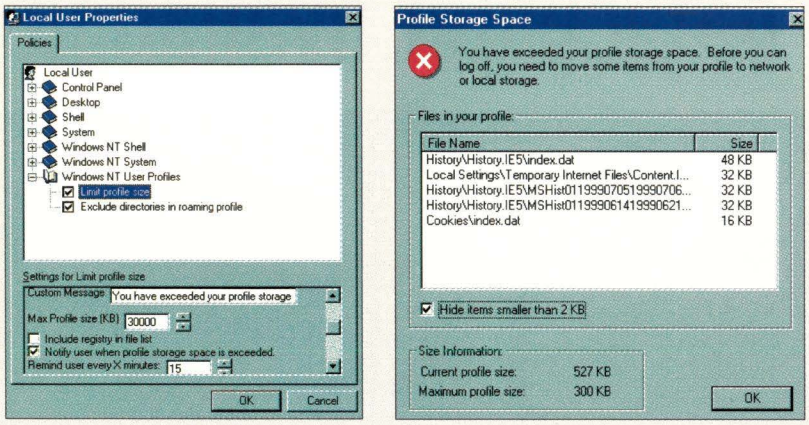
Figure 1. User Profile Quota Settings



settings for user profile quotas are user-based settings, and thus may be specified for individual users and groups, as well as via systemwide or domainwide defaults. The specific settings are accessed via the Windows NT User Profiles menu item. It contains two groups of settings and is illustrated in the left dialog in Figure 1.

The Limit Profile Size item allows you to specify the maximum size of a user profile, whether or not to notify the user when this limit is exceeded, as well as the message text and reminder interval to use when such messages are enabled. The default values are listed in Figure 1. The maximum size of a user profile is 30 MB, and users who exceed it are notified every 15 minutes using the indicated default message (displayed in full at the top of the right-hand dialog).

The second dialog is what is displayed when a user tries to log out while her profile still exceeds the maximum allowed size. The area in the middle of the dialog lists large files within the profile, indicating potential areas where its size may be reduced. The Size Information box at the bottom of the dialog allows the user to compare current and maximum profile sizes.

The service packs also include the `proquota` utility. When run, this utility checks the current size of the user profile and displays an error message if it exceeds the maximum allowed size. On the other hand, if the profile is within the specified limits, the program exits without comment.

Security Configuration Manager

By far the most significant addition to Windows NT introduced with SP4 is support for the Security Configuration Manager (SCM). This facility serves as a preview of a standard feature of Windows NT 2000, and its installation is optional.

The SCM is a more complex and sophisticated facility for specifying and applying a standard set of security settings to a single Windows NT system or a group of systems. It also has the ability to compare the current state of a system with any saved group of settings and to report on discrepancies between them. Before we consider it in more detail, let me provide a brief but emphatic caution: This facility is in a preliminary form (it has many bugs), cannot be easily uninstalled and is completely unsuitable for production systems. Install it only on test systems where you can experiment without risk.

Within the SCM, collections of system security-related settings are known as templates, and various standard templates are provided with the facility (they attempt to implement commonly desired system configurations). Templates contain specifications for almost every aspect of system security, drawing together information formerly spread out among may different operating system facilities. The settings include the following:

- System Policy
- Password Policy
- Account Lockout Policy
- User Rights
- Ownership/permissions for important files and directories
- System Auditing Policy
- Event Log facility configuration
- Services configuration
- Registry Key values
- Registry Key permissions

The SCM facility is used to create and edit templates, to apply them to a system (or group of systems) and to analyze compliance with them for one or more systems (note that most of these activities are designed to be performed automatically via the Active Directory facility in Windows NT 2000). The `secedit` utility provides a command-line interface to some SCM functionality.

The SCM is not installed by default when you apply either SP4 or SP5 and, in fact, usually must be downloaded separately from the Microsoft Corp. Web site (`http://support.microsoft.com/support/ntserver/Content/ServicePacks/sp4_central_40.asp#SCM`); it is also included on the CD containing SP4. In order to install the SCM, the system must be running SP4/5, as well as Internet Explorer 3.01 or higher. The actual SCM interface exists as part of the Microsoft Management Console (MMC) facility, Microsoft's unified systems administration environment.

Once you download the SCM software archive (the file name for Intel-based systems is `scesp4i.exe`), execute the archive file to unpack it. Then run the `mssce.exe` command to install the facility. Answer "yes" to the prompt asking whether to install MMC as well (unless you already have it on the system).

Once installed, you access the SCM facility by running the `mmc.exe` command, which starts an MMC console session. The first time you do so, you will need to load the SCM snap-in: select the **Console=>Add/Remove Snap-in** menu path and then choose Security Configuration Manager from the list. If you then save the current MMC console configuration, the SCM will be present and active every time you run `mmc.exe` and open that configuration.

Regardless of whether you are examining the current system configuration

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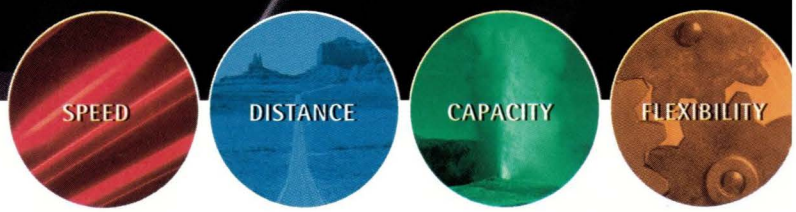

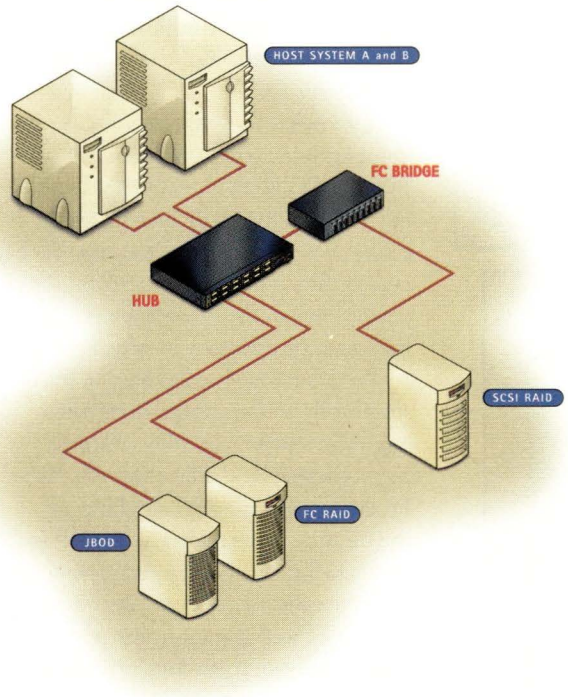

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or a SCM template, individual settings within the collection are divided into a number of high-level subsets, each of which can be navigated like a directory tree; as usual, terminal nodes within this pseudo-tree represent individual system settings. Double-clicking on a setting allows you to view its value and potentially modify it. When you are examining the current system configuration, you also have the option of comparing its state to that specified in whatever template has been applied to it (these applied settings are collectively referred to as the Local Security Policy Database).

The results of such a compliance analysis are shown in Figure 2. This dialog shows the comparison of current and saved Password Policy settings. Of the six items that make up this group, only two of them match the specified value. All the other current settings are less restrictive than those in the stored configuration. Now the systems administrator has the option to automatically modify one or more of the currently active settings to match their target values.

We have room only for a very brief overview of the SCM here. You can get more information about to the SCM facility and its associated tools from the white paper entitled "Security Configuration Tool Set," which is available at `http://www.microsoft.com/windows/server/Technical/security/default.asp`.

Modified ACLs

The new security model present in Windows NT 2000 also includes a substantially modified file system protection scheme. In particular, access control lists (ACLs) are quite a bit different than they are under Windows NT 4.0. Some of these differences are illustrated in the dialogs shown in Figure 3.

Figure 2. SCM System Compliance Analysis

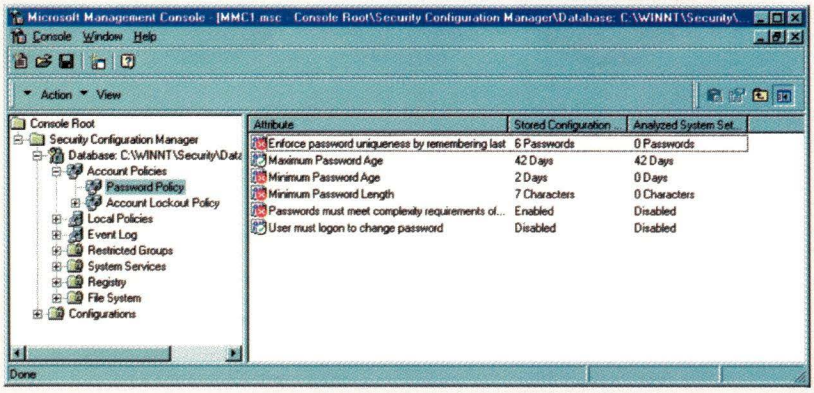
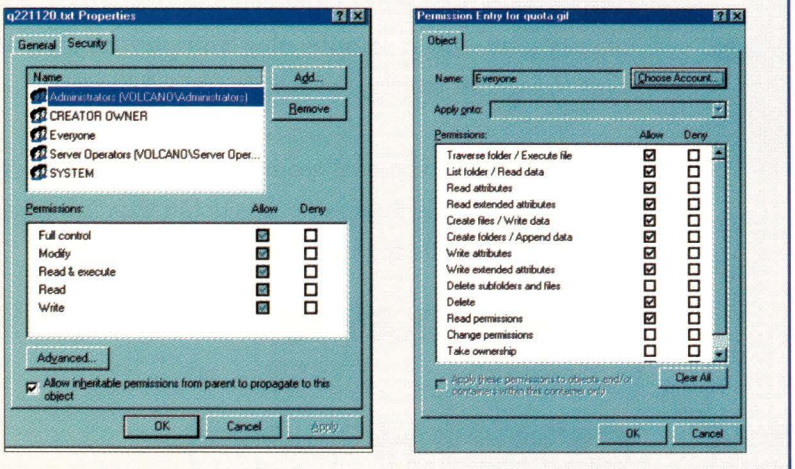


Figure 3. NT 2000-Style ACL-Related Dialogs



The illustration on the left shows the resulting dialog when you examine a file or directory's permission settings (for example, via its context menu). As you can see, the new dialog is fairly simplified with respect to the current version. For example, the individual permissions comprising the named permissions sets are no longer listed explicitly.

In this case, we are examining the permissions for the highlighted group, Administrators, and the box in the center of the dialog indicates what they are. Note that there are two possible settings associated with each permissions set–Allow and Deny–reflecting the fact that under the new scheme, individual permissions may be explicitly denied to a user or group. Thus, any given permission can potentially be granted to, denied to or unspecified for a given user or group. In order to receive access to an item, a user must be both granted and not explicitly denied permission to that item. Thus, when a permission is both granted and denied, the denial takes precedence, and a permission that is neither explicitly allowed nor explicitly denied isn't granted. For example, in the dialog we are considering in Figure 3, the Administrators group has been granted all of the permissions sets for this file.

Permission inheritance is also more complex under the new scheme. Notice that the checkbox in each case is shaded gray. This indicates that a permission setting has not been explicitly set for the current file, but rather flows from the permissions of the object's parent, in this case, the directory in which the file resides (a setting that has been applied specifically to the current item will appear in a white checkbox). This is also indicated by the fact that the Allow Inheritable Permissions checkbox at the bottom of the dialog on the left is checked. This is the way ACLs generally work: permissions always flow down from an object's parent unless you explicitly override them for the individual object. In more concrete terms, this means that file permissions in general derive from their directory location, not just at the time the file is created, but continuously throughout its lifetime,

unless you override this inheritance. Obviously, this is a significant change from current versions of Windows NT.

The right-hand dialog in Figure 3 illustrates the much expanded set of basic permissions that can be applied to files and directories, and each of these can be explicitly granted or denied. These new permissions are much more specific than those used currently and seem designed for even greater control over the exact forms of access (or lack of access) a user or group may have for a specific file or directory.

Other New Items in SP4/5

We will conclude this discussion of new features by briefly listing a few others present in the service packs that may be of interest:

- The Domain Name System (DNS) server port number may be changed (previously it was hardwired to port 53).
- The security privilege (`SE_Security_Name`) must now be held in order to view and manage the Security Event Log (this privilege is granted by default to the Administrators group). Users and programs must possess it to process the logs.
- Manual removal of dynamic Windows Internet Naming Service (WINS) database records via WINS Manager is now possible.
- Support for Distributed Component Object Model (DCOM) tunneling via the HTTP protocol port (known as the "Tunneling TCP" protocol).

Last but not least, these service packs contain numerous bug fixes. As we noted last time, in the case of SP5, this includes corrections for a couple of significant security problems introduced by SP4, so be sure to install the former if you have applied the latter. ➵

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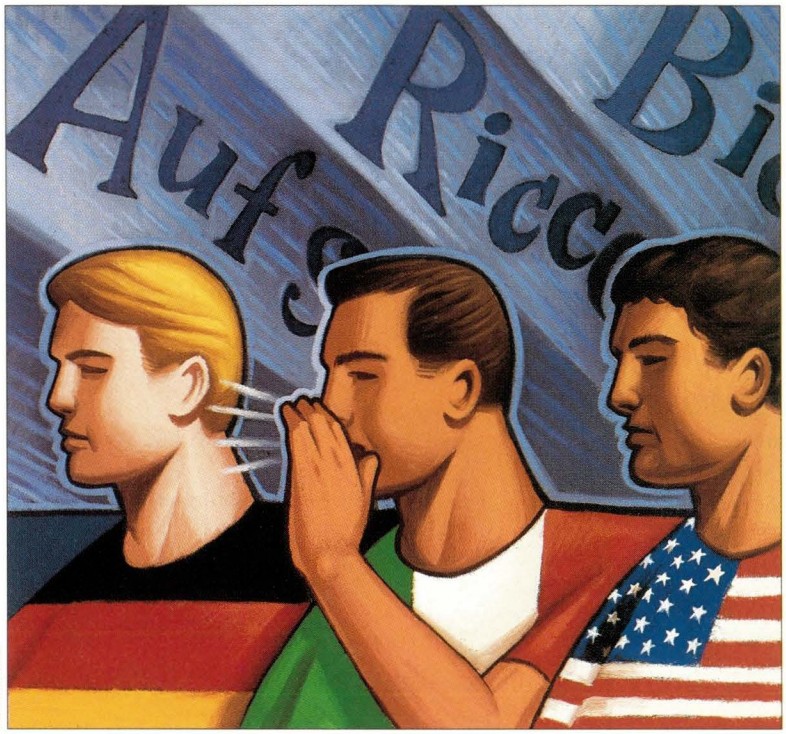
by Jeffreys Copeland and Haemer



ALEX GROSS

"Therefore is the name of it called Babel; because the Lord did there confound the language of all the earth."
– Genesis 11:9

"The Babel fish is small, yellow and leechlike, and probably the oddest thing in the Universe... The practical upshot of all this is that if you stick a Babel fish in your ear you can instantly understand anything said to you in any form of language."
– Douglas Adams, *Hitchhiker's Guide to the Galaxy*

Babelfish

For years, we have been writing, in this magazine and elsewhere, about internationalization: how to write programs that are multilingual.

Unfortunately, we are not yet as multilingual as our software. Haemer recently found the following note in his incoming email:

Sehr geehrter Herr Dr. Haemer! Herzlichen Dank fuer Ihre Einladung am Donnerstag, die ich dankend annehme Wie Sie vorschlagen, werde ich die Kunstwerke an Ihren Waenden studieren. Dann koennen wir uns auch weiter ueber solche Themen wie Religion, Literatur und Philosophie unterhalten. Ich bringe Salat. Bitte schicken Sie mir directions to your Haus.

Herzlich, Ana

Haemer speaks no German. What to do, what to do?

If you've never clicked on the little [**Translate**] link in AltaVista, this is the time to try it out. Doing so takes you to `http://babelfish.altavista.com`, home of a server that will mechanically translate some natural languages into others. Babelfish offers machine translation between English and a handful of common, European languages: French, German, Italian, Portuguese and Spanish.

Machine translation has a long, mixed history. The bottom line is the translations aren't perfect, and some of them are downright silly. What impresses us after a little use is how often Babelfish's translations are good enough.

Here's what Babelfish did with Ana's message:

Dear Dr. Haemer!

Cordial thanks for your invitation on Thursday, which I assume thanking. As you suggest, I will study the works of art at your walls. Then we can converse also further about such topics such as religion, literature and philosophy. I bring salad. Please you send directions to to me your house.

Cordially, Ana

Imperfect, but completely intelligible. It would be a pity to miss such wonderful email because of our linguistic limitations or because we demand perfect translations.

A joint venture of Systran and AltaVista, Babelfish is named after Douglas Adams' Babel fish from *Hitchhiker's Guide to the Galaxy*. It's mostly used to make sense of Web pages that would otherwise be gibberish, but it's a general-purpose tool.

Babelfish: Not Just for Browsers Anymore

Unfortunately, but not surprisingly, the AltaVista interface is tied to a browser, which limits you to typing at it. If you're interested in both programming and human languages, as we are, there are a lot of fun things you can imagine trying with a programmatic interface to a tool like this. However, writing Web clients from scratch can require a lot of ad hoc, trial-and-error work (see "A Simple Web Script," April 1999, Page 44, `http://sw.expert.com/C9/SE.C9.APR.99.pdf`).

Luckily, there is now a Perl module on the Comprehensive Perl Archive Network, or CPAN (`http://www.perl.com/CPAN/`), to help. `WWW::Babelfish` is a module specifically designed to let you write Web clients for the Babelfish server. It took us only a few minutes to produce a working, general-purpose

translation script. A few more iterations brought us to the script shown in Listing 1.

We'll mostly let the code speak for itself. The documentation that comes with Babelfish is very clear, and this column has so much code that we're cramped for space. The third line points the script at our own, local version of `WWW::Babelfish`. We had to add the line

```
$ua->proxy(['http', 'ftp'] => $ENV{http_proxy});
```

to let us get to the Web through proxy servers.

We Play Telephone

So, let's try it out.

In the game of "telephone," a sentence is whispered from person to person around a circle. When it completes a circuit, the original phrase is contrasted with what it has turned into.

Imagine a game of telephone at the European Commission headquarters in Brussels, where each player has a different native language and most of the transmission noise is translation error. We can simulate this by setting up a pipeline of translation programs. Because Babelfish only provides translations to and from English, every other speaker will have to be an Anglophone. (Alternatively, imagine that all the whispering is done in English, but that each speaker must translate the phrase that comes in his right ear, first from English into his native language and then back to English, before passing it on to the person on his left.)

Here's an example:

```
#!/bin/sh
# Continental telephone
# $Id: teleEurope,v 1.1 1999/08/09 16:26:36 jsh Exp $
whisper()   {
   ana -o $1  | ana -i $1 | tee /dev/stderr
}

echo my hovercraft is full of eels |
   whisper English |
   whisper French |
   whisper Portuguese |
   whisper Italian |
   whisper German |
   whisper Spanish
```

And here's its output:

```
my hovercraft is full of eels

my hovercraft is full with eels

mine hovercraft is full with conger-eels

Hovercraft of the mine is full with the gronghi

Air cushion vehicle of the pit is full with gronghi
```

Listing 1. A Simple Babelfish Client

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

use strict;
use lib ".";        # hack, cough
use WWW::Babelfish;
use Getopt::Std;
my $options = "[-i input_language | -o output_language] [filename ...]";
my $usage = "usage: $0 $options";

sub get_langs   {
   use vars qw($opt_o $opt_i);
   getopts "i:o:" or die $usage;
   die $usage if ($opt_o && $opt_i);
   my ($in, $out) = ($opt_i || "English", $opt_o || "English");
}

my ($in, $out) = get_langs;
my $obj = new WWW::Babelfish( 'agent' => 'Mozilla/8.0' );
die "Babelfish server unavailable\n" unless defined $obj;

my @languages = $obj->languages;
die "source language $in must be in @languages\n"
   unless grep /$in/, @languages;
die "destination language $out must be in @languages\n"
   unless grep /$out/, @languages;

$/ = undef;
my $translation = $obj->translate(source=>$in, destination=>$out, text=><>);

die "Could not translate: " . $obj->error unless defined $translation;
print "$translation\n";

=head1 NAME

ana - Simple Babelfish client, for notes from Ana

=head1 SYNOPSIS

ana [-i input_language | -o output_language] [files]
```

Continued on Page 40

```
=head1 DESCRIPTION
=over 2

B<ana> uses babelfish to translate from one language to another.
Default language for each is English.

=back

=head1 OPTIONS AND ARGUMENTS

=over 8

=item I<-i>

input language

=item I<-o>

output language

=item I<filename ...>

files to translate (default: stdin)

=back

=head1 AUTHOR

Jeffrey S. Haemer <jsh@usenix.org>

=head1 SEE ALSO

   perl(1) WWW::Babelfish(3)

=cut
```

```
The vehicle of pneumatic shock absorber of the
hollow is full with gronghi
```

("My hovercraft is full of eels" is used in the `WWW::Babelfish` documentation, and is taken from Monty Python's "Hungarian Phrasebook" sketch.)

But why stop there? Looking for Babelfish-related news articles on DejaNews (`http://www.dejanews.com`), we found the following wonderful post from David Chess at IBM Research:

```
> Subject: Babelfish invariance
> From: chess@us.ibm.com (David M. Chess)
> Date: 1999/05/27
> Newsgroups: alt.hackers
> The first thing everyone does with a translator
> like Babelfish (http://babelfish.altavista.digital.
> com/) is to translate something from one's native
> tongue into some other language, and then back
> again, to see what happens. It's only a slight
> stretch to *continue* this process until you get
> to a fixed point of the transform (the resulting
> string is the same as the last one you put in),
> or a cycle (the resulting string is the same as
> the one you put in N steps back). A string in
> language A which, when translated into language
> B by Babelfish and the result translated back
> into A, yields A again, is said to be "Babelfish
> invariant".
> [...]
```

Further on in the posting, David says he handcrafted a client to play with this idea. Lazily, we tried our hands at the same thing with `WWW::Babelfish`:

```
#!/usr/local/bin/perl -w
#$ID: telephone,v 1.3 1999/09/01 20:13:52 jeff Exp jeff

use strict;
use lib ".";        # hack, cough
use WWW::Babelfish;
use Getopt::Std;
my ($obj, $in, $phrase);
my $optionsa  = "[-c] [-v]";
my $optionsb1 = "[-s language_spoken ";
my $optionsb2 = "| -t language_of_thought]";
my $optionsb  = $optionsb1 . $optionsb2;
my $optionsc1 = "[-n cycles]";
my $optionsc2 = "[filename | -e expression]";
my $optionsc  = $optionsc1 . $optionsc2;
my $usage = "usage: $0 $optionsa $optionsb $optionsc";
use vars qw($opt_s $opt_t $opt_n $opt_v $opt_e $opt_c);

sub parse_args   {
   getopts "s:t:n:e:vc" or die $usage;
   die $usage if ($opt_s && $opt_t);
   my ($speak, $think) = ($opt_s ||
       "English", $opt_t || "English");
   $speak = ucfirst lc $speak;
   $think = ucfirst lc $think;
   my $n = $opt_n || 10;
   die unless $n =~ /^\d+$/;

   ($speak, $think, $n);
```

```
}

sub xform   {
   my ($s, $d, $in) = @_;
   warn "in = $in\n" if ($opt_v);
   my $out = $obj->translate(source=>$s,
      destination=>$d, text=>$in);
   warn "out = $out\n" if ($opt_v);
   die "Could not translate: $s" .
      $obj->error unless defined $out;
   chomp $out;
   $out;
}

my ($speak, $think, $n) = parse_args;
$obj = new WWW::Babelfish( 'agent' => 'Mozilla/8.0' );
die "Babelfish server unavailable\n"
   unless defined $obj;

my @languages = $obj->languages;
die "Spoken language ($speak) must be in:
   @languages.\n"
   unless grep /$speak/, @languages;
die "Language of thought ($think) must be in:
   @languages.\n"
   unless grep /$think/, @languages;

if ($opt_e)   {
   $phrase = $opt_e;
   die $usage if @ARGV;
}   else   {
   local $/ = undef;
   $phrase = <>;
}
$in = $phrase;

foreach my $t (1..$n)   {
   my $out = xform $speak, $think, $in;
   $out = xform $think, $speak, $out;
   if (lc $in  eq lc $out)   {
        chomp $in;
        print "$t\t" if $opt_c;
        print "$in\n";
        exit;
   }
   $in = $out;
}

die qq("$phrase"\n\thas become\n"$in"\n);

=head1 NAME

telephone - simulates the game of "telephone"

=head1 SYNOPSIS

telephone [-c] [-nI<n>] [-v] [files | -e expression]
[-t thought language | -s spoken langauge]
```

```
=head1 DESCRIPTION

=over 2

B<telephone> simulates the game of telephone. (In the
game of telephone, participants sit in a big circle.
One person whispers a phrase to the person next to
him. That person then whispers what he thought he
heard to the person on the other side, and this
continues around the circle until it gets back to
the originator. The point of the game is to see how
much the phrase changes in transit.

In this program, each simulated participant "thinks"
in one language (say, German) and "whispers" in a
second (say, English). The changes are generated by
one cycle of translating from English to German and
back again. Translation is performed by babelfish.

This process continues through a series of
English->German->English cycles until the phrase
has either become "babelfish invariant" (stable)
or gone around the circle.

=back

=head1 OPTIONS AND ARGUMENTS

=over 8

=item I<-v>

verbose

=item I<-t>

language of thought

=item I<-s>

language of speech

=item I<-n>n

number of participants (default: 10)

=item I<-c>

count iterations until stability

=item I<-e>

word or expression to translate

=item I<filename ...>

files to translate (default: stdin)

=back

=head1 AUTHOR

Jeffrey S. Haemer <jsh@usenix.org> and
Jeffrey Copeland <copeland@alumni.caltech.edu>
from a suggestion in alt.hackers
by David M. Chess <chess@us.ibm.com>

=head1 SEE ALSO

   perl(1) WWW::Babelfish(3)

=cut
```

David also says that French is rumored to be the best-supported language. To test this, we wrote a little shell script that plays telephone in several languages:

```
#!/bin/sh
# $Id: multi-tel,v 1.1 1999/08/09 16:26:36 jsh Exp $
# comparison of languages for "telephone"

for i in English French German Italian Portuguese Spanish
do
   echo == $i
   telephone -c -t $i -e "$*"
done
```

and another to exercise it:

```
#!/bin/sh
#! $Id: mtest,v 1.1 1999/08/09 16:26:36 jsh Exp $
# demo of multi-tel

multi-tel My hovercraft is full of eels.
echo
multi-tel Out of sight, out of mind.
echo
multi-tel CITRAN blows dead aardvarks.
```

Here's what we found when we ran it:

```
== English
1       My hovercraft is full of eels.
== French
2       My hovercraft is full with eels.
== German
5       My air cushion, machine pulls up,
        is full from the Aalen.
== Italian
2       My Hovercraft is full of the eels.
== Portuguese
3       Hovercraft of the mine is full of
        conger-eels.
== Spanish
1       My hovercraft is full of eels.
== English
1       Out of sight, out of mind.
== French
3       Out of the sight, spirit.
== German
4       Understand over the sight from out.
== Italian
2       From sight, the mind.
```

```
== Portuguese
3       Except of the sight, it is of the mind.
== Spanish
2       Outside Vista, the mind.

== English
1       CITRAN blows dead aardvarks.
== French
2       CITRAN blows the dead aardvarks.
== German
"CITRAN blows dead aardvarks."
has become
"CITRAN burns continuous aardvarks one of the dead
ones of one."
== Italian
"CITRAN blows dead aardvarks."
has become
"CITRAN jumps the aardvarks has put put out of order
put put put put put put put."
== Portuguese
2       Inoperative CITRAN establish aardvarks.
== Spanish
"CITRAN blows dead aardvarks."
has become
"Aardvarks died to the blowing of CITRAN."
```

We like reading these out loud in thick, stage accents.

The numbers at the beginning of each line are the number of steps to Babelfish invariance for that language. If no stable phrase has been found after 10 steps, the beginning and ending phrases are printed, as with the German, Italian and Spanish translations of the third phrase.

It looks to us like the Spanish translations may be better than the French; however, the German translations are certainly the worst. Because we began this column by showing how useful the German translations are, the Spanish translations must be very good indeed.

We'll leave you with a few questions.

Reader Quiz 1: *Obviously, different input words can produce different translations, but does Babelfish take punctuation into account, or just pass it through, unchanged?*

Also noteworthy is the final phrase's failure to stabilize in several languages. In his posting, David notices that some strings fail to stabilize because the translation goes into an infinite regression. Try this:

```
telephone -v -t french -e pizza
```

Reader Quiz 2: *Can anyone offer a word or phrase that puts telephone into an infinite loop by alternating between two (or more) translations?*

Oh, and the two new other phrases? "Out of sight, out of mind" has a venerable history in machine translation. It is said that an early attempt to translate this phrase to Russian and back returned "Invisible idiot."

Reader Quiz 3: *Can anyone out there provide a real citation for this oft-recited, possibly apocryphal story?*

Reader Quiz 4: *Can anyone tell us what* CITRAN *was, why it blew dead aardvarks, and who originally pointed this out?*

Soon after we finished writing this article, National Public Radio (NPR) ran an item about the Consortium for Speech Translation Advanced Research, or C-STAR, based at Carnegie-Mellon University in Pittsburgh, PA. C-STAR has developed a prototype machine translation system that, by operating in restricted domains–C-STAR's example is a travel agency–can do nearly simultaneous translation from *voice input.* If you have the RealNetworks Inc. RealAudio plug-in for your browser, you can listen to it from the Web page for the July 22nd edition of "All Things Considered," at `http://www.npr.org`.

Summary

In this column, we tried to tie together three topics that we're interested in: programming for the fun of it, the Web and internationalization.

But what about the art on Haemer's walls? If you want to come see it, send him email in English, French, German, Italian, Portuguese or Spanish. Plan to bring salad.

Until next time, happy trails. ➸

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

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

Note: The software from this and past Work columns is available at `http://alumni.caltech.edu/~copeland/work` *or alternately at* `ftp://ftp.expert.com/pub/Work`.

by Jim Frost

PETE WHYTE

Part of a Complete Breakfast

This month's topic is *serialization*, a process by which a data structure is written out to and restored from a file or network connection. It's called serialization because each element in the data structure must be written out one at a time, or serially. Serialization is used extensively by the Remote Method Invocation (RMI) classes (see "Across the Great Divide," August 1999, Page 44, `http://sw.expert.com/CA/SE.C10.AUG.99.pdf`) and is terrifically convenient whenever you want to save a Java data structure for later restoration (a process commonly called *persistence*).

In most languages, serialization is moderately difficult. First, the programmer must take every class and write a special output routine, which breaks the class up into its composite elements and writes each member out in some recognizable format. Then, the programmer must write a special input routine to reassemble them. This is tedious for even the simplest classes and becomes very difficult as the complexity and number of classes increases.

Java makes this task easy by providing many basic serialization capabilities as part of the language. Specifically, the `java.io.ObjectOutputStream` and `java.io.ObjectInputStream` objects have the `writeObject()` and `readObject()` methods, respectively, which decompose and reassemble Java objects. Listing 1 illustrates a simple class that attempts to serialize itself.

Our example is not complete, however. If you try to run it, it will fail with a `java.io.NotSerializableException`. This happens because the class is not marked as being serializable, a necessity to ensure you don't accidentally serialize a class that should not be serialized. An example might be `java.io.FileOutputStream`, instances of which have an open file descriptor that must be recreated with every instance. To mark the class as serializable, simply have it implement the `java.io.Serializable` interface (which has no methods):

```
public class MyClass
   implements Serializable { ...
}
```

In the case of simple Java classes that have only primitive types or serializable objects, this is all that is necessary; and if you make the change to our example in Listing 1, you'll see that it works. During serialization, `writeObject()` walks through each data member in the class and attempts to serialize it. These data members may be primitive types (for example, `int` or `float`) or other serializable objects. Interobject references are saved and restored, so it is possible to save entire self-referential data structures with a single `writeObject()` method call. To make this even easier, many of the basic data structures of Java, such as `java.util.Hashtable`, are already serializable.

There may be cases where a particular member in the class need not be

saved because it is easily reproduced, or cannot be saved because it represents some temporary state (for example, `FileOutputStream`). Java allows you to mark such class members using the transient keyword:

```
private transient Hashtable dataCache;
```

If `writeObject()` encounters such a transient member it simply ignores it, and after the object is reassembled with `readObject()` the member's value will be zero (for primitive types) or null (for object references). It's the responsibility of the object to reconstruct the value as necessary. Listing 2 (Page 46) implements a simple serializable version of the `java.io.FileOutputStream` object that will reopen `FileOutputStream` after deserialization.

Our simple example has at least one potential bug, however: any data that should be flushed before serializing the object may be lost. Similarly, it would be more convenient to restore `FileOutputStream` immediately when deserializing the object rather than waiting until it is used. Luckily, Java provides an easy way to manage pre- and post-conditions.

When `ObjectOutputStream.writeObject()` is called, it looks for a `private void writeObject(ObjectOutputStream)` method. If it exists, this method will be called rather than the standard Java object serialization method. The method may perform all of its own serialization tasks (for example, write out each important data member individually) or it may choose to perform additional tasks and use the `ObjectOutputStream.defaultWriteObject()` method to do the dirty work. Similarly, `ObjectInputStream.readObject()` looks for `private void readObject(ObjectInputStream)`, and there is also a `ObjectInputStream.defaultReadObject()`. Listing 3 (Page 47) illustrates a much more robust version of `SerializedFileOutputStream` that takes advantage of these facilities.

Notice that in Listing 3 the `readObject()` method throws not only the normal `IOException` but also a `ClassNotFoundException`. This is necessary because it is possible for a Java Virtual Machine (JVM) to serialize a class that is not available to the JVM that attempts to deserialize it. If this happens the deserialization will fail.

Versions and Compatibility

In addition to the contents of the object, a serialized Java object also contains the class name and some version information to ensure compatibility of the data with the class. The version information is, by default, a hash of all the methods and nontransient members of the class. This ensures that dif-

Listing 1. An Almost-Serializable Java Class

```
import java.io.*;

public class MyClass
{
   private static final String FILENAME = "MyClass1.ser";
   private String s = "A String";

   public static void main(String[] args)
   {
      MyClass object = new MyClass();
      ObjectOutputStream out = null;

      // create the object output stream to use for serializing the class
      try {
          out = new ObjectOutputStream(new FileOutputStream("MyClass1.ser"));
      }
      catch (IOException e) {
          System.err.println("Couldn't open " + FILENAME + ": " + e.toString());
          System.exit(1);
      }


      try {
          // try to write the class to the output stream
          try {
              out.writeObject(object);
          }
          catch (IOException e) {
              System.err.println("Unable to serialize object: " + e.toString());
          }
      }
      finally {
          try {
              out.close();
          }
          catch (IOException e) {}
      }
   }
}
```

Listing 2. A Simple Version of a Serializable FileOutputStream

```
public class SimpleSerializableFileOutputStream extends OutputStream implements Serializable
{
   /** The name of the file we're writing to. */
   private String fileName;

   /** The output stream we're writing to. This may be null after de-serializing the object. */
   private transient FileOutputStream out;

   public SimpleSerializableFileOutputStream(String fileName)
      throws IOException
   {
      this.fileName = fileName;
      out = new FileOutputStream(fileName);
   }

   public void close() throws IOException
   {
      if (out != null)
          out.close();
   }

   public void flush() throws IOException
   {
      if (out != null)
          out.flush();
   }

   /** An output method that restores the FileOutputStream if necessary. */
   public void write(int value) throws IOException
   {
      // restore the file output stream if it's not already
      // available.
      if (out == null)
          out = new FileOutputStream(fileName, true); // append
      out.write(value);
   }
}
```

ferent implementations of a class are close enough to be compatible. An attempt to deserialize an object using an incompatible version of a class will generate an `InvalidClassException`.

It may be that an application would like more flexibility, for instance, to handle a wide variety of variations for a single class (typical if there have been many previous versions of the class). In this case, it may be preferable for the class to implement the `Externalizable` interface rather than the `Serializable` interface. If a class implements this interface, then the Java serialization code simply writes out the name of the class and calls the `writeExternal(ObjectOutput)` method. This method is responsible for all necessary data output and there is no convenient `defaultWriteExternal()` method. Similarly, the class must implement `readExternal(ObjectInput)`. Note that `Externalizable` classes are very flexible but they are rather inconvenient to write, and are rarely used.

Fortunately, it is possible to create classes that are explicitly compatible so long as certain rules (outlined in the Object Serialization Specification, see `http://java.sun.com/products/jdk/1.1/docs/guide/serialization/spec/version.doc.html`) are followed, thus saving the work of creating an `Externalizable` instance of the class simply because of a minor change. When Java is serializing a `Serializable` class, it looks for the following class member:

```
static final long serialVersionUID;
```

If it finds it, this number is used as the version number. If not, a value is calculated as described previously. If you're creating a new class version that you know you'd like to be compatible with others in the future, you should specify your own `serialVersionUID` value (for example, `serialVersionUID = 1`). You can then maintain that value until the class changes enough to become truly incompatible.

Often, when you implement a serializable class, it finds its way into production and you must change it in such a way as to violate the default version calculation. You can avoid this by using the `serialver` utility provided with the Java Development Kit (JDK). This utility takes a class name and spits out the version number calculated for that class. You may then add this version information to your new class and, so far as the Java serialization code is concerned, those classes are compatible until proven otherwise.

One last interesting interface is `java.io.ObjectInputValidation`. This interface contains only one method,

Listing 3. A Better Version of a Serializable FileOutputStream

```
public class SerializableFileOutputStream extends OutputStream implements Serializable
{
   /** The name of the file we're writing to. */
   private String fileName;

   /** The output stream we're writing to. This may be null after de-serializing the object. */
   private transient FileOutputStream out;

   public SerializableFileOutputStream(String fileName) throws IOException
   {
      this.fileName = fileName;
      out = new FileOutputStream(fileName);
   }

   public void close() throws IOException
   { out.close(); }

   public void flush() throws IOException
   { out.flush(); }

   public void write(int value) throws IOException
   { out.write(value); }

   /** A custom object reader method that reopens the FileOutputStream after de-serialization. */
   private void readObject(ObjectInputStream objectIn)
      throws IOException, ClassNotFoundException
   {
      objectIn.defaultReadObject();
      out = new FileOutputStream(fileName, true); // append
   }

   /** A custom object writer that flushes the FileOutputStream prior to serialization. */
   private void writeObject(ObjectOutputStream objectOut)
      throws IOException
   {
      out.flush();
      objectOut.defaultWriteObject();
   }
}
```

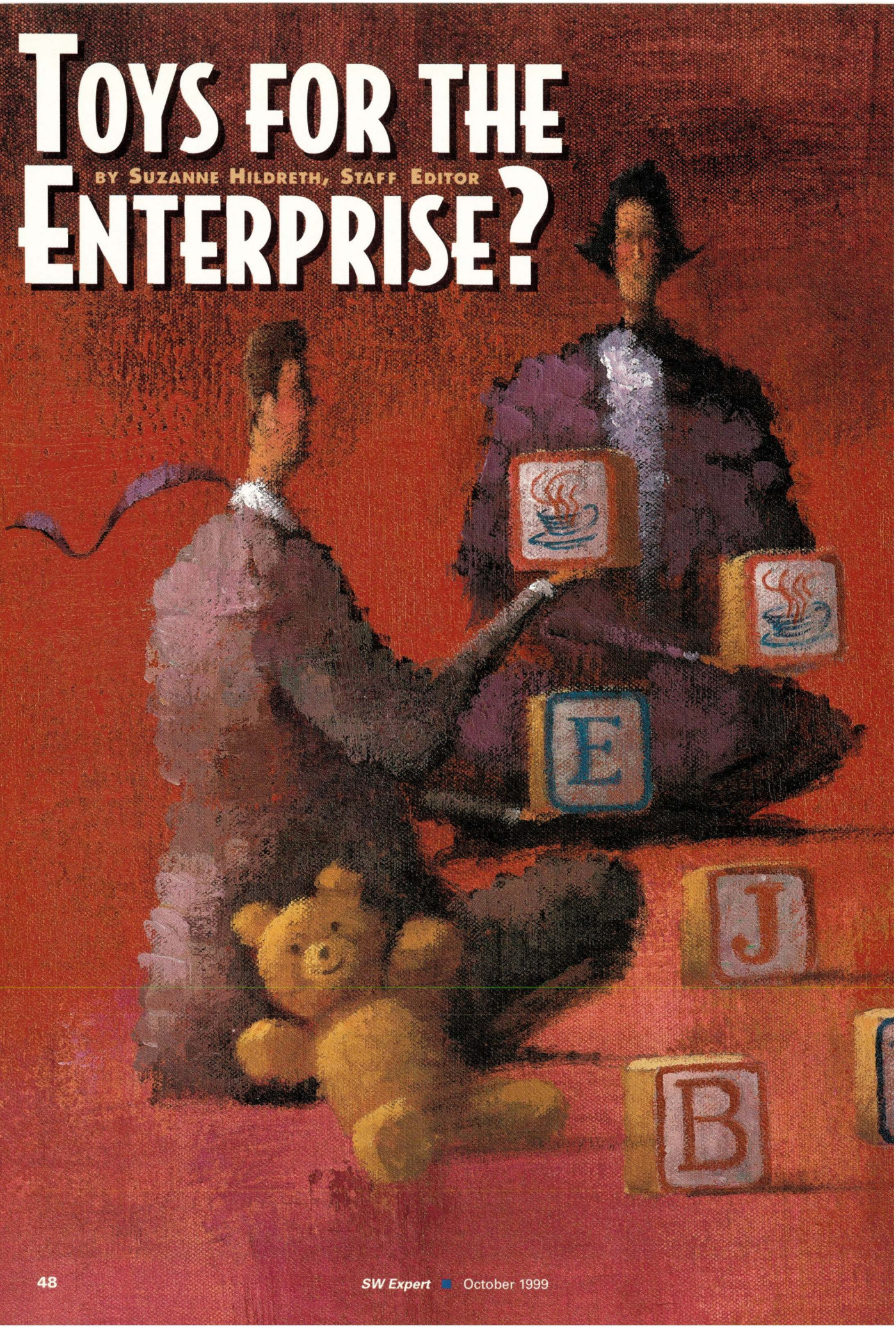
`validateObject()`. This method is called after deserializing a class and is used to ensure that the deserialized class is valid. It is also useful for implementing code segments that will run after an object has been deserialized. An object that is normally found through a registry, for instance, might add code to register itself in the `validateObject()` method.

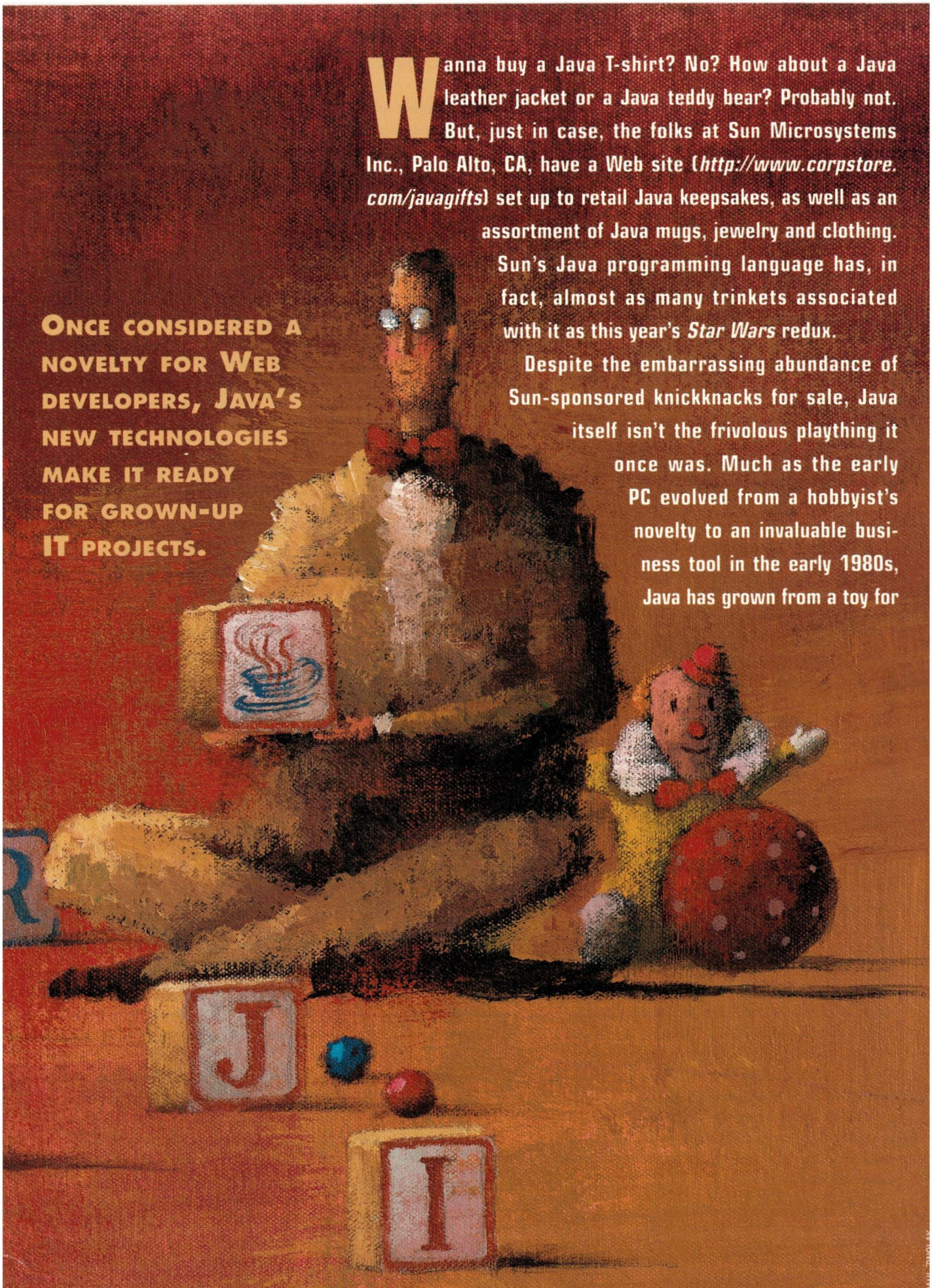
In this brief survey we've touched on all of the common, and a few of the not-so-common, classes and techniques used in Java object serialization. All of the examples in this article can be downloaded from `ftp://ftp.expert.com/pub/JavaClass/10.1999/serialization.tar` and include test harnesses that were removed for brevity's sake. The test harnesses further illustrate the use of `ObjectOutputStream.writeObject()` and `ObjectInputStream.readObject()`, so it's a good idea to take a look. In addition, it may be helpful to read the Java Object Serialization document mentioned above, as it provides the definitive description of the facility. ➸

***Jim Frost** is a software engineer specializing in Java technologies and strong opinions. He may be reached by email at `jimf@frostbytes.com`.*

TOYS FOR THE ENTERPRISE?

BY SUZANNE HILDRETH, STAFF EDITOR





ONCE CONSIDERED A NOVELTY FOR WEB DEVELOPERS, JAVA'S NEW TECHNOLOGIES MAKE IT READY FOR GROWN-UP IT PROJECTS.

Wanna buy a Java T-shirt? No? How about a Java leather jacket or a Java teddy bear? Probably not. But, just in case, the folks at Sun Microsystems Inc., Palo Alto, CA, have a Web site (*http://www.corpstore.com/javagifts*) set up to retail Java keepsakes, as well as an assortment of Java mugs, jewelry and clothing. Sun's Java programming language has, in fact, almost as many trinkets associated with it as this year's *Star Wars* redux.

Despite the embarrassing abundance of Sun-sponsored knickknacks for sale, Java itself isn't the frivolous plaything it once was. Much as the early PC evolved from a hobbyist's novelty to an invaluable business tool in the early 1980s, Java has grown from a toy for

livening up Web sites to a full-function language performing in high-level, distributed, enterprise applications.

To be sure, the migration to enterprise Java isn't happening overnight and not in every industry, but it is happening. A June survey of 50 Fortune 1,000 companies conducted by Forrester Research Inc., Cambridge, MA, found that 52% of the companies considered Java as having a "critical" or "important" impact on their overall software development strategy for the coming year. In some industries that percentage is even higher. For instance, Curtis Palm, president of E.H. SofSolutions, a Gretna, NE-based custom software development firm specializing in the transportation industry, says Java has emerged as the dominant programming language for transportation companies. "About two years ago, C++ was 95% of the code being written. Now we're seeing Java accounting for 60% to 70%," says Palm. "Java has become the main language of choice."

One oft-cited reason for Java's enterprise appeal is its cross-platform capabilities.

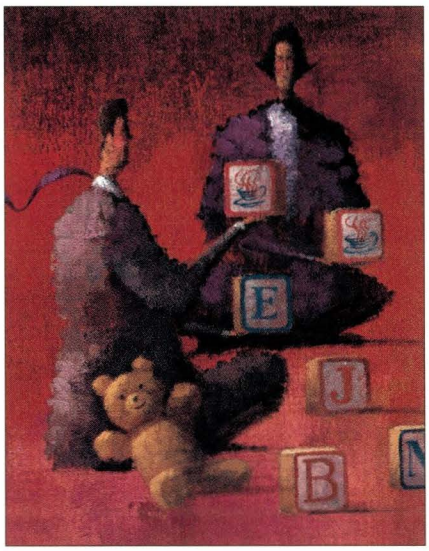
Ditto in the financial services sector, says Jeremy Sevareid, senior consultant for Random Walk Computing Inc., a New York, NY-based consulting and software development firm specializing in the financial services industry. "In financial companies, we see almost no new C++ development; all the new stuff going forward is in Java," says Sevareid. "At first, Java was just some enormously hyped thing that, when people actually tried it, was kind of disappointing. But now people are building and deploying real heavy-duty production apps. And if you're not doing it in Java, it's up to you to explain why."

One oft-cited reason for Java's enterprise appeal is its cross-platform capabilities–not just in terms of the client, but for the server as well. This is what makes Java popular in the financial industry, where it is common for companies to have a mix of Solaris and Windows NT servers, Sevareid says. "In our market, we do a lot of deployment on both Solaris and NT, and for that reason, Microsoft [Windows software] won't do," he says. Writing the applications in Java allows companies to more easily accommodate both environments.

Scaling for Cross Platform

The same is true in the transportation industry, where any number of different platforms might coexist within a single company. "You have companies that have 300 servers and a wide variety of platforms, from HP-UX and AIX, to NT to mainframes," says E.H. SofSolutions' Palm. "That takes a lot of different types of talent to write to all those environments and keep all of it running. A move to Java allows companies to use one pool of programmers to develop and maintain all of the programs," he says.

Java's object-oriented nature is also appealing to programmers working in distributed environments because it allows them to upgrade and maintain applications without having to do massive system overhauls. Vic Vaivads, engineering manager in the Burnaby, British Columbia office of Applied Digital Access Inc., a maker of network monitoring software for the telecommunications industry, says that Java's modularity allows his programmers to make alterations to Applied Digital's Java-based network testing product, Test OS, without having to do a major recompilation every time. "It's very eas to update a couple of classes without having to retest and recompile the entire system," Vaivads says.



Steve Willcox, chief technical architect with Java consulting firm Avitek Inc., Boulder, CO, says it's both the modular object-oriented architecture, coupled with the increasing number of components and tools available to developers, that make Java so appealing for rapid application development in many corporate enterprises.

"Java is an excellent language and platform for implementing distributed applications," Willcox says. "It makes it very easy–easier than C++ and other languages–to deploy distributed applications. But it's not just the language, but all the supporting products and class libraries that have evolved along with the Java language that have made it easy."

Java Building Blocks

If you go rummaging through the Java technology toy box, you'll discover that a number of handy mechanisms for creating distributed applications are built into the Java platform.

For example, Java has Remote Meth od Invocation (RMI), a remote procedure call that enables a Java program running on one computer to access the objects and methods of another Java program running on a different computer on the network. A new addition to the Java platform, RMI over IIOP, enhances the ability for both Java and non-Java applications to communicate over a network via The Object Management Group's Internet Inter-ORB Protocol (IIOP) for Common Object Request Broker Architecture (CORBA)

During the past year or so, the Java platform has also acquired an assortment of APIs useful for constructing enterprise applications. The list include Java Database Connectivity (JDBC) 2.0, the Java version of Structured Query Language (SQL) for access to relational databases; Java Naming and Directory Interface (JNDI), for accessing and updating Lightweight Director Access Protocol (LDAP)-compliant directories; and JavaServer Pages (JSP),

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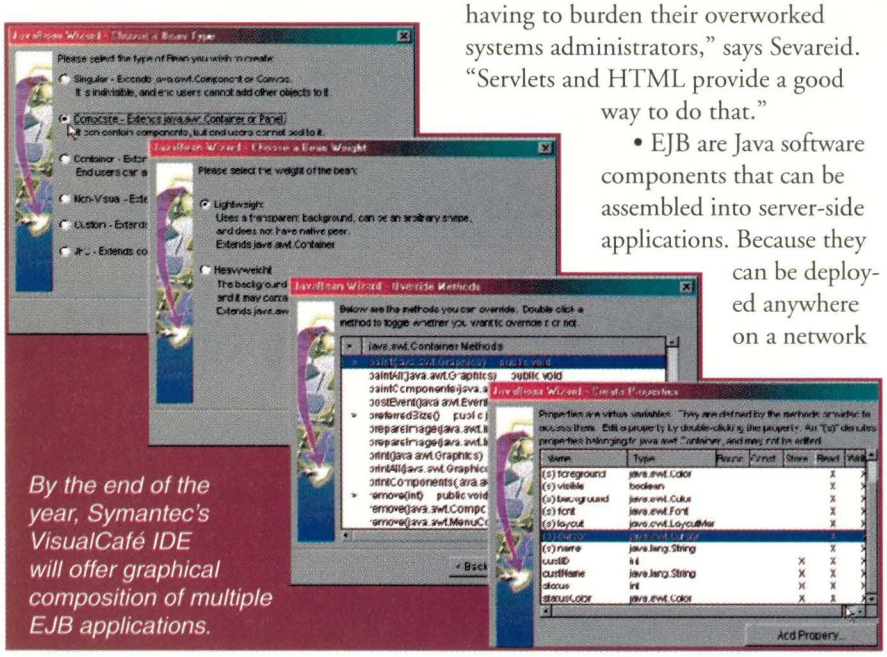
which makes it possible to develop dynamic Web pages containing Java code. All three are part of Sun's Java 2, Enterprise Edition, introduced in June. The Enterprise Edition is a superset of the Java 2 Platform–aka Java Development Kit (JDK) 1.2, unveiled in December–which lays out a set of APIs and services that Sun believes are required for enterprise-level Java applications. To bear a Java 2, Enterprise Edition logo, a software product must support all of the mandated APIs and technologies.

Of all the Java technologies included in the Enterprise Edition, two in particular are likely to prove extremely useful to enterprise developers: servlets and Enterprise JavaBeans (EJB).



By the end of the year, Symantec's VisualCafé IDE will offer graphical composition of multiple EJB applications.

• Servlets–server-side applets that are often used to extend the functionality of a Web server by communicating with back-end data and server applications–have proven to be especially helpful at Reliance National Insurance. Reliance, a New York, NY-based insurance company, uses servlets to handle inquiries from outside insurance agents and brokers. The servlets are designed to process specific requests–such as an insurance quote or determining the rating of a potential customer–and communicate between client-side and back-end applications and data. Because they can be replicated as needed, the servlets can easily handle an influx of requests. "We can scale up the number of [servlet] components we need based on our load," explains Fred Kauber, director of e-commerce and Internet solutions for Reliance.

Because servlets can perform a variety of sophisticated tasks and deliver the results right to the client's screen, they allow developers to provide fairly complex functionality to the client without having to provide any client software–either applets or full-fledged Java client applications.

Random Walk has been doing heavy servlet development for the past year and a half. "The client side of a client/server application can be a pain. A lot of people want something they can deploy [to multiple clients] without having to burden their overworked systems administrators," says Sevareid. "Servlets and HTML provide a good way to do that."

• EJB are Java software components that can be assembled into server-side applications. Because they can be deployed anywhere on a network and reused in other applications, they offer developers a way to create chunks of business logic that can be assembled into applications and accessed by Java clients across a network. EJB require containers–either built from scratch or purchased–to serve as the runtime environment for one or more EJB and to handle transactions between the EJB and the EJB server. EJB and their containers help shield programmers from having to handle the low-level functions for transactions and data access. "Building a network-savvy process with multithreaded applications is hard. EJB promise to take away some of the burden of thinking about those issues from the programmer," Sevareid says.

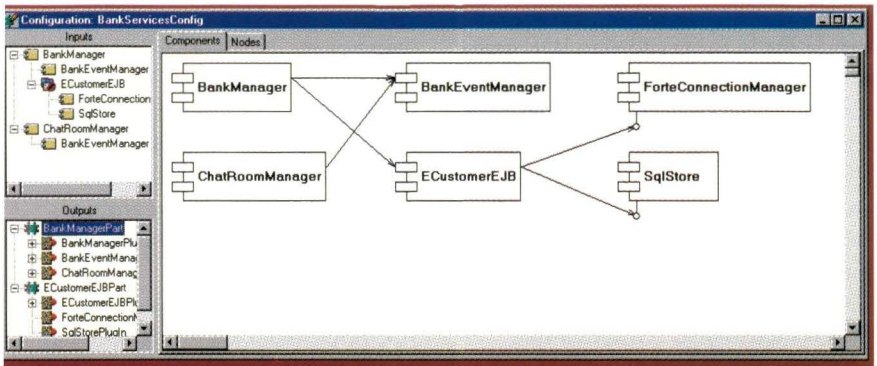
Down the road, developers will not only be able to purchase EJB containers to handle back-end services, but will be able to purchase individual EJB as well. Theoretically, then, a programmer could select an assortment of EJB from third-party vendors and assemble the components into a unique application. That's the theory, anyway. For now, however, there aren't any commercial EJB on the market, so developers have to take a do-it-yourself approach to EJB application deployment.

"There are zero on the market now, but I think there will be thousands available eventually, both in horizontal and vertical markets," says Charles Stack, chief executive officer of Flashline.com Inc., Cleveland, OH. Flashline sells Java components via the Web. Stack estimates he'll have "dozens" available at his site by the end of the year, and more in early 2000. To encourage commercial development, Flashline has established a "Beans by Design" section on its site where customers can post their EJB needs and designers can bid to do the custom development on them. Currently, says Stack, there are some 300 developers on his Beans by Design email list.

Java IDEs Grow Up

As important as EJB, servlets and other core components of the Java platform are for distributed application development, it's third-party development tools and integrated development environments (IDEs) that have the biggest impact on how quickly and easily a programmer can design, debug and deploy a distributed application.

Fortunately, the number of tools available to Java programmers has grown tremendously in the past couple of years. The survey featured in this issue catalogs 19 Java IDEs alone (see "JDE/IDE Survey," Page 56). But not all Java programming products offer the full range of features and functions that enterprise developers need to get their applications up and running quickly. Many such products, after all, started out as PC applications aimed at Web developers wanting to create applets. Adding the features and functions



SynerJ Assembler from Forté Software supports dynamic binding for application components such as EJB, which allows developers to visually assemble applications without manually coding them.

necessary to support the development of full-fledged distributed Java applications takes time.

"Two years ago, there were hardly any tools on the market, and you had to do everything yourself," says Avitek's Willcox. "We wrote our own servers and our own development tools. We're doing less and less of that now, but there still needs to be more tools on the market."

John Rymer, president of Java consulting firm Upstream Consulting, Emeryville, CA, says that's the message he heard from a number of programmers at this year's JavaOne trade show held in San Francisco in June. "A lot of people were saying, 'It's getting to be too complicated. We need tools too fast and we can't afford to keep building our own,'" Rymer says.

In his view, the real measuring stick of an IDE shouldn't be whether it supports all of the new Java APIs and services, although that is a fundamental requirement of any development tool, but whether it offers more sophisticated functions such as deployment and debugging. "To get real broad acceptance of Java, we need to reach out to people who don't have the same level of skills as some of these sophisticated development shops," Rymer says. "And that means there needs to be deployment services, testing services, profilers and simulators, as well as a visual interface to them."

Bill Roth, product line manager for the Java 2 Platform, Enterprise Edition at Sun, says Java development tools are essentially following a three-phase evolutionary path. "The first stage was to simply be able to build components. The second phase is the ability to do distributed debugging, and there are already some pretty good tools on the market for that. And the third phase is the ability to build a system of beans that does something useful. I call that 'aggregation'–the ability to wire a checking account bean to a general ledger bean in a graphical way."

Few IDEs today offer the sort of visual "aggregation" of multiple Java components that Roth envisions, but visual aids are beginning to appear. Cupertino, CA-based Symantec Corp.'s VisualCafé, for example, currently only supports visual composition of individual EJB, but Carlos Chang, product manager for VisualCafé, says the next release–due out before the end of the year–will also offer graphical composition of multiple EJB applications.

One tool that claims to do this is SynerJ Assembler from Forté Software Inc., Oakland, CA (recently acquired by Sun). Forté says SynerJ Assembler supports dynamic binding for application components, including JavaBeans, EJB, servlets and CORBA components, which allows developers to visually assemble whole applications or parts of applications without having to resort to manual coding. "This makes for easy assembly and maintenance," says SynerJ product manager John Biundo. "When things change, you can bring up the graphical tool, make the visual changes and run the application."

Another company, Bluestone Software Inc., Mount Laurel, NJ, has an EJB Builder feature in its Sapphire/Web application server that supposedly lets programmers visually create EJB applications via a drag-and-drop interface. For developers who want to add the capability to their existing IDE, InLine Software, Leesburg, VA, makes InLine Standard, a complementary IDE tool that enables developers to generate individual EJB and then package those EJB and associated files into a deployable application.

Another evolving feature of IDEs is enterprise-level debugging. When Reliance National Insurance started work on a customer management application nine months ago, its programmers discovered that the then-current version of Symantec's VisualCafé Professional Edition lacked the ability to debug distributed code. "We wanted to be able to simultaneously debug multiple Java applications, potentially running in different Java VMs [Virtual Machines] on different machines," says Reliance's Kauber. "But Café was oriented more toward debugging things that are running on a single workstation, not in a distributed environment."

Fortunately, support for distributed debugging is being added to IDE products. For example, Symantec's VisualCafé for Java Enterprise Suite now has a feature called Single View that presents all distributed components on a network, even those on different operating systems, in a single interface for debugging. And, as of March, VisualCafé has included the ability to debug Java components distributed across multiple platforms and on multiple application tiers, says Symantec's Chang. Sun's NetDynamics Studio, a development product that is part of the NetDynamics Application Server platform, also supports distributed debugging across multiple tiers. With NetDynamics Studio, a developer can debug an application as it runs from a Java applet to a server-side application to an EJB, Sun says.

A new entrant to the IDE market, Forté Software's SynerJ Developer, includes a distributed debugging feature that enables developers to test how components located on different servers perform together. "You bring up the interface and tell it to run this component on this machine and that component on that machine and fire them all up together," says Forté's Biundo. "You can trace the thread of execution as one component calls another." The product also allows developers to test two or more components in simultaneous operation. So developers working on different parts of a system can see how their code performs together at any time without waiting for a formal test-and-analysis phase.

After an application is debugged, the IDE should aid the deployment to the network. Deploying a distributed application residing on multiple servers or running on hundreds of unique clients over the Internet is inherently more complicated and time-consuming than deploying a single client/server application. Just generating and moving all the files needed can be quite time-consuming.

"The classic problem you have with a lot of [traditional] tools is that you have to physically move files out to your server systems and make sure you put them in the right places. Then, when you go to upgrade every 10 or 12 weeks, you're constantly having to redeploy new versions of the application," Biundo says. That method works fine, he says, for centralized client/server applications, but becomes extremely time-consuming for distributed applications that reside across a network.

Because of this, Symantec's Chang believes deployment tools will become must-have features for future versions of IDEs targeted at enterprise customers. "When you have all these Web servers and application servers, you're gong to need to target each one slightly differently. We're working on something to let a developer set their environment and, then to run it, they just hit the 'deploy' button and it will automatically handle it," he says. "You still have to know where the files are, where the servers are and set those things up in your configuration. But you don't have to keep doing it over and over again. Right now, anyone using an editor or straight JDK has to constantly FTP their files over to the servers."

Already, IDEs and application

Companies Mentioned in this Article

BEA Systems Inc.
2315 N. First St.
San Jose, CA 95131
http://www.beasys.com
Circle 150

Bluestone Software Inc.
1000 Briggs Road
Mount Laurel, NJ 08054
http://www.bluestone.com
Circle 151

Flashline.com Inc.
1300 E. 9th St., Ste. 1310
Cleveland, OH 44114
http://www.flashline.com
Circle 152

Forté Software Inc.
1800 Harrison St., 24th Floor
Oakland, CA 94612
http://www.forte.com
Circle 153

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

InLine Software
751 Miller Road
Leesburg, VA 20175
http://www.inline-software.com
Circle 154

Inprise Corp.
100 Enterprise Way
Scotts Valley, CA 95066
http://www.inprise.com
Circle 155

Luna Information Systems
1300 Clay St., Ste. 500
Oakland, CA 94612
http://www.luna.com
Circle 156

Novera Software Inc.
25 Corporate Drive
Burlington, MA 01803
http://www.novera.com
Circle 157

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500 Oracle Pkwy.
Redwood Shores, CA 94065
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Circle 158

Sun Microsystems Inc.
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Circle 159

Sybase Inc.
6475 Christie Ave.
Emeryville, CA 94608
http://www.sybase.com
Circle 160

Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
http://www.symantec.com
Circle 161

ervers are including wizards and other ypes of deployment assistance in their ›roducts. Oakland, CA-based Luna nformation Systems' Luna Server, for nstance, claims to provide dynamic napping of EJB objects to relational latabases and other data sources at leployment time. That can be very ıseful if you happen to have numerous ›ack-end databases and legacy systems :hat need to be tied into a Java applica-:ion, Random Walk's Sevareid says.

Scotts Valley, CA-based Inprise Corp.'s JBuilder IDE has a Deployment Wizard that automates the process of ›ackaging Java applications and their ıssociated files for deployment. Blue-stone Software's Sapphire/Web applica-:ion server has a Deployment Manager :hat guides developers through the pro-:ess of setting application parameters such as database connectivity, user con-nectivity options, security options and configuration options. Similarly, Red-wood Shores, CA-based Oracle Corp.'s JDeveloper includes a wizard to guide programmers through the deployment of EJB to the Oracle 8i database appli-cation server.

Broader use of EJB will also help to make deployment easier. That's because EJB containers within application ser-vers handle much of the work of deploy-ing and managing EJB applications. Containers take charge of tasks such as the reading, writing and deletion of objects and their data from permanent storage, the finding of EJB on the net-work and the prevention of sharing conflicts. "Because of EJB, a lot more things are handled for you by these EJB containers, like transactions. It makes it easier to deploy these applications," Avitek's Willcox says.

New Kid on the Block

What's the next new technology trend on the horizon for enterprise Java? Most likely, it's the arrival of eXtensible Markup Language (XML). XML, a specification from industry consortium The Open Group, has received almost as much hype as Java itself, and is gain-ing a broad range of support as a stan-dard for exchanging documents and data between disparate applications. So it is, perhaps, only natural for Java, the cross-platform programming language, to hook up with XML, the cross-applica-tion document markup language.

Java application server vendors are quickly adding XML support. For exam-ple, IBM Corp., Armonk, NY, has in-cluded an XML parser in its WebSphere application server. Novera Software Inc., Burlington, MA, has also included one in its Novera 4.5 application server, as has BEA Systems Inc., San Jose, CA, in its WebLogic Server, and Sybase Inc., Emeryville, CA, in its Enterprise Appli-cation Server.

"We think XML is going to become very dominant in the industry and will become the way one application talks to another application," says Bob Bickel, senior vice president of products at Blue-stone Software, which likewise supports XML in its Sapphire/Web product.

Sun is currently working on an XML standard extension to the Java 2 Platform and, according to its own liter-ature, considers it "fundamental" to the Java 2 Platform, Enterprise Edition. Sun says XML will play two key roles in the Java 2 Platform: It will serve as both the standard method for storing deploy-ment information for components and as the standard method to exchange data between components.

By the end of the year, Sun plans to release the final specification for its XML extension, which will include an API, a parser to interpret XML docu-ment data into Java and a Document Object Model (DOM) to enable XML data to be presented as objects, which can be manipulated by a Java application. XML already plays a role in the latest EJB specification 1.1, unveiled in June. In it, Sun replaced its JavaBeans-based format for EJB Deployment Descrip-tors–deployment information included with all EJB–with an XML-based one. The idea, according to Sun, is that XML is simply better suited for exchanging content between applications.

Now, if Sun can just come up with a logo for its new XML extension, it might have whole new line of T-shirts, watches, mugs and stuffed animals to peddle on its retail Web site. ⊷

JDE/IDE Survey

compiled by MAUREEN MCKEON
(based on information supplied by the vendors)

Key
— = Information not supplied
N/A = Not applicable
EJS = Enterprise Java Server
IDE = Integrated Development Environment
JDE = Java Development Environment
JDK = Java Development Kit
JFC = Java Foundation Classes
JIT = Just-In-Time (compiler)
JVM = Java Virtual Machine
MRJ = Mac OS Runtime for Java
RAD = Rapid application development
XML = eXtensible Markup Language

Company	Apple	Chami	Forté	IBM
Product	WebObjects 4.0.1	WebIDE 1.5	SynerJ 1.4	VisualAge for Java Enterprise Edition 2.0
Memory/disk space required (MB)	64/500	N/A (Online tool)	32/200	80/400
Development environments supported	Mac OS X Server, Windows NT	Any with JVM	Windows NT	AIX, OS/2 Warp, Windows 95/98/NT
Debugger	Yes	No	Yes	Yes
Remote debugger	No	No	Yes	Yes
Trace points	Yes	No	Yes	Yes
Conditional breakpoints	Yes	No	Yes	Yes
Programming/IDE tools	Yes	Yes	Yes	Yes
Action points	Yes	No	No	Yes
Display change variable	Yes	No	Yes	Yes
JIT compiler	No	No	Yes	No
Visual/RAD tools	Yes	No	Yes	Yes
Editor	Yes	Yes	Yes	Yes
Additional Java class libraries	Yes	No	Yes	Yes
Java native method support	Yes	No	Yes	Yes
100% Pure Java support	No	Yes	Yes	Yes
JDK 1.1/1.2 support	Yes/No	Yes/No	No/Yes	Yes/No
Auto creation of source documentation	No	No	No	No
JDK switching	Yes	No	No	No
JFC/Swing	Yes	No	Yes	Yes
Java database compliance	No	No	Yes	Yes
JavaDoc output	No	No	Yes	Yes
IDE extension APIs	Yes	No	Yes	Yes
Sun's JDK required	No	No	Yes	No
Interface	Application GUI, browser applets, command-line	Online through browser	Application GUI, browser applets, command-line	Application GUI
Applet viewer used	Any supporting Swing	N/A	Any supporting Swing	EJS, Java servlet engine (included)
JavaBeans development/JavaBeans library	Yes/Yes	N/A	Yes/No	Yes/Yes
Suited for team development	Yes	No	Yes	Yes
Built-in version control	No	No	Yes	Yes
Is this product a configuration management tool?	No	No	Yes	Yes
Ability to integrate outside configuration management tools	No	No	Yes	Yes
Is this product a testing tool?	No	No	Yes	Yes
Ability to integrate with computer-aided test tools	Yes	No	Yes	No
Ability for users to add their own objects to palette	Yes	No	Yes	Yes
Online documentation/printed manuals	Yes/Yes	Yes/No	Yes/Yes	Yes/Yes
Time to configure	Less than 30 minutes	N/A	10 minutes	Less than 1 hour
Free trial version available	No	Yes, *http://www.chami.com/webide*	Yes, contact vendor	Yes, *http://www.software.ibm.com/vadd*
Upgrade available for download	Yes (patches)	Yes	Yes	Yes
24x7 support	Yes	No	Yes	Yes
Telephone support	Yes, toll-free	No	Yes, toll-free	Yes, toll-free
Email support	Yes	Yes	Yes	Yes
Technical support and pricing ($)	Multiple levels	Free	Free 30-day install	Multiple levels
List price ($)	Contact vendor	Freeware	6,000 per application server, 199 per developer	2,999 (enterprise site license available)

JDE/IDE Survey

Company	Instantiations	Metrowerks	Microsoft	Modelworks	NetBeans
Product	**Jove Super Optimizing Deployment Environment**	**CodeWarrior for Java Release 5**	**Visual J++ 6.0**	**JPad Pro 3.7**	**NetBeans Developer Enterprise Edition**
Memory/disk space required (MB)	128/100	32/80	48/110	64/15	128/12
Development environments supported	Windows 95/98/NT on Intel	Solaris, Mac OS, Windows 95/98/NT	Windows 95/98/NT	Windows 95/98/ NT/2000	Any with JVM
Debugger	No	Yes	Yes	Yes	Yes
Remote debugger	No	Yes	Yes	No	Yes
Trace points	No	No	Yes	No	Yes
Conditional breakpoints	No	Yes	Yes	Yes	Yes
Programming/IDE tools	No	Yes	Yes	Yes	Yes
Action points	No	No	Yes	No	No
Display change variable	No	Yes	Yes	No	No
JIT compiler	No	Yes	Yes	No	Yes
Visual/RAD tools	No	Yes	Yes	No	Yes
Editor	No	Yes	Yes	Yes	Yes
Additional Java class libraries	No	Yes	Yes	No	No
Java native method support	Yes	Yes	Yes	Yes	No
100% Pure Java support	No	Yes	Yes	Yes	Yes
JDK 1.1/1.2 support	No/Yes	Yes/Yes	Yes/No	Yes/Yes	No/Yes
Auto creation of source documentation	No	Yes	No	No	Yes
JDK switching	No	Yes	No	Yes	No
JFC/Swing	No	Yes	No	Yes	Yes
Java database compliance	No	Yes	Yes	Yes	Yes
JavaDoc output	No	Yes	No	Yes	Yes
IDE extension APIs	No	Yes	Yes	Yes	Yes
Sun's JDK required	No	No	No	Yes	Yes
Interface	Application GUI, command-line	Application GUI, browser applets, command-line, importing/exporting XML	Application GUI, browser applets, command-line	Application GUI, browser applet	Application GUI
Applet viewer used	Internet Explorer, Netscape	Apple MRJ viewer, Sun appletviewer.exe	Any, Internet Explorer by default	Any browser	Any browser
JavaBeans development/ JavaBeans library	N/A	Yes/Yes	Yes/No	N/A	Yes/No
Suited for team development	Yes	Yes	Yes	Yes	Yes
Built-in version control	No	No	Yes	No	No
Is this product a configuration management tool?	No	No	No	No	No
Ability to integrate outside configuration management tools	No	Yes	Yes	Yes	Yes
Is this product a testing tool?	No	No	No	No	No
Ability to integrate with computer-aided test tools	No	Yes	Yes	Yes	No
Ability for users to add their own objects to palette	No	Yes	Yes	Yes	Yes
Online documentation/ printed manuals	Yes/No	Yes/Yes	Yes/printed manuals through Microsoft Press	Yes/No	Yes/Yes
Time to configure	Less than 1 hour	Less than 1 hour	1 hour	Less than 30 minutes	Less than 15 minutes
Free trial version available	Yes, *http://www.instantiations.com/jove*	Yes, *http://www.metrowerks.com/contact/eval/desktop*	Yes, *http://msdn.microsoft.com/downloads/tools/visualj/default.asp*	Yes, *http://www.modelworks.com/downloads.html*	Yes, *http://www.netbeans.com/register.html*
Upgrade available for download	Yes, quarterly	Yes	No	Yes	Yes
24x7 support	No	No	Yes	No	No
Telephone support	Yes, toll-free	Yes	Yes	No	Yes, toll-free
Email support	Yes	Yes	Yes	Yes	Yes
Technical support and pricing ($)	20% of list price	Free 30-day install, then 79-1,999	Multiple levels	Free	Multiple levels
List price ($)	4,495+	99	549 (volume licensing available)	59	1,450

JDE/IDE Survey

Company	Objectsoft	Oracle	Progress	Rogue Wave	SilverStream
Product	**BrewMaster 2.0**	**JDeveloper Suite 2.0**	**Apptivity 3.1**	**StudioJ 1.2**	**SilverStream Application Server 2.5.2**
Memory/disk space required (MB)	125/14	96/225	48/120	Depends on components	64/50
Development environments supported	Any with JVM, Windows 95/98/NT	Any with JVM	Win32	Java 1.1/1.2	Windows NT
Debugger	No	Yes	Yes	No	Yes
Remote debugger	No	No	Yes	No	No
Trace points	No	Yes	Yes	No	No
Conditional breakpoints	No	Yes	Yes	Yes	No
Programming/IDE tools	Yes	Yes	Yes	Yes	Yes
Action points	No	Yes	No	No	No
Display change variable	No	Yes	Yes	No	No
JIT compiler	No	Yes	No	No	Yes
Visual/RAD tools	Yes	Yes	Yes	No	Yes
Editor	Yes	Yes	Yes	No	Yes
Additional Java class libraries	No	Yes	Yes	Yes	Yes
Java native method support	No	Yes	No	No	Yes
100% Pure Java support	Yes	Yes	Yes	Yes	Yes
JDK 1.1/1.2 support	Yes/Yes	Yes/Yes	Yes/No	Yes/Yes	Yes/No
Auto creation of source documentation	Yes	Yes	No	No	No
JDK switching	Yes	Yes	Yes	No	No
JFC/Swing	Yes	Yes	No	Yes	Yes
Java database compliance	No	Yes	Yes	Yes	Yes
JavaDoc output	No	No	No	No	No
IDE extension APIs	No	Yes	No	Yes	Yes
Sun's JDK required	No	No	No	No	No
Interface	Application GUI, browser applets, command-line	Application GUI, browser applets	Application GUI, browser applets	Command-line, JavaBeans	Application GUI, browser applets
Applet viewer used	—	Supports applet plug-ins	Netscape, Internet Explorer	N/A	Any JDK 1.1 JVM supplied with browser
JavaBeans development/ JavaBeans library	N/A	Yes/Yes	No/Yes	Yes/Yes	Yes/Yes
Suited for team development	Yes	Yes	Yes	Yes	Yes
Built-in version control	No	No	No	No	Yes
Is this product a configuration management tool?	No	No	No	No	No
Ability to integrate outside configuration management tools	No	Yes	No	No	Yes
Is this product a testing tool?	No	No	No	No	No
Ability to integrate with computer-aided test tools	No	Yes	No	No	No
Ability for users to add their own objects to palette	No	Yes	Yes	No	Yes
Online documentation/ printed manuals	Yes/No	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Time to configure	Less than 1 hour	Seconds	Less than 1 hour	Less than 1 hour	Less than 2 hours
Free trial version available	Yes, *http://www.objsoft.com*	Yes, *http://technet.oracle.com*	Yes, *http://apptivity.progress.com*	Yes, contact sales representative	No
Upgrade available for download	Yes	No	Yes	Yes	Yes
24x7 support	No	Yes	Yes	Yes	Yes
Telephone support	Contract only	Yes, toll-free	Yes, toll-free	Yes	Yes, toll-free
Email support	Contract only	Yes	Yes	Yes	Yes
Technical support and pricing ($)	Multiple levels	Multiple levels	Multiple levels	Free	Multiple levels
List price ($)	49.99	2,995	995 per seat (IDE), 10,000 per server	1,995	2,500 per 5-pack (floating licenses available)

JDE/IDE Survey

Company	Sybase	Symantec	TakeFive	Tek-Tools	WingSoft
Product	**PowerJ 3.0**	**VisualCafé 3**	**SNiFF+J 3.1**	**Kawa 3.22**	**WingEditor 1.61**
Memory/disk space required (MB)	64/230	128/165	20/50	32/10	32/4
Development environments supported	Windows 95/98/NT	Windows 95/98/NT	Most UNIX, Linux, Windows 95/98/NT	Windows 95/98/NT	Any with JVM
Debugger	Yes	Yes	Yes	Yes	Yes
Remote debugger	Yes	Yes	Yes	Yes	Yes
Trace points	No	Yes	Yes	No	Yes
Conditional breakpoints	Yes	Yes	Yes	No	No
Programming/IDE tools	Yes	Yes	Yes	Yes	Yes
Action points	No	Yes	Yes	No	Yes
Display change variable	Yes	Yes	Yes	No	No
JIT compiler	No	Yes	No	No	No
Visual/RAD tools	Yes	Yes	Yes	Yes	No
Editor	Yes	Yes	Yes	Yes	No
Additional Java class libraries	Yes	Yes	No	No	Yes
Java native method support	Yes	Yes	Yes	Yes	No
100% Pure Java support	Yes	Yes	Yes	No	Yes
JDK 1.1/1.2 support	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Auto creation of source documentation	Yes	Yes	Yes	No	No
JDK switching	Yes	Yes	Yes	Yes	No
JFC/Swing	Yes	Yes	Yes	Yes	Yes
Java database compliance	Yes	Yes	No	Yes	No
JavaDoc output	No	Yes	No	Yes	No
IDE extension APIs	Yes	Yes	Yes	No	No
Sun's JDK required	No	Yes	Yes	Yes	Yes
Interface	Application GUI, command-line	Application GUI, browser applets, command-line	Application GUI, command-line	Application GUI, browser applets	Application GUI, command-line
Applet viewer used	N/A	Netscape, Internet Explorer	N/A	Navigator, Internet Explorer	N/A
JavaBeans development/ JavaBeans library	Yes/Yes	Yes/Yes	Yes/No	Yes/No	No/No
Suited for team development	Yes	Yes	Yes	Yes	Yes
Built-in version control	Yes	Yes	Yes	No	No
Is this product a configuration management tool?	No	No	No	No	No
Ability to integrate outside configuration management tools	Yes	Yes	Yes	Yes	No
Is this product a testing tool?	No	No	No	No	No
Ability to integrate with computer-aided test tools	No	Yes	Yes	No	No
Ability for users to add their own objects to palette	Yes	Yes	Yes	No	Yes
Online documentation/ printed manuals	Yes/Yes	Yes/Yes	Yes/Yes	Yes/No	Yes/No
Time to configure	Less than 1 hour	10 minutes	Less than 1 hour	Less than 1 hour	5 minutes
Free trial version available	Yes, *http://e-shop.sybase.com/buynow.htm*	Yes, *http://www.visualcafe.com*	Yes, *http://www.takefive.co.at/download*	Yes, *http://tek-tools.com/kawa*	Yes, *http://www.wingsoft.com/wingeditor.shtml*
Upgrade available for download	Yes	Yes	Yes	Yes	Yes
24x7 support	Yes	Yes	No	No	No
Telephone support	Yes, toll-free	Yes	Yes, toll-free	Yes	Yes
Email support	Yes	Yes	Yes	Yes	Yes
Technical support and pricing ($)	Multiple levels	Multiple levels	Multiple levels	Multiple levels	Multiple levels
List price ($)	595	99+	Contact vendor	59	29.95

Companies Mentioned in this Survey

Apple Computer Inc.
1 Infinite Loop
Cupertino, CA 95014
http://www.apple.com
Circle 200

Chami.com
P.O. Box 4174
Fort Walton Beach, FL 32549
http://www.chami.com
Circle 201

Forte´ Software Inc.
1800 Harrison St.
Oakland, CA 94612
http://www.forte.com
Circle 202

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

Instantiations Inc.
7618 S.W. Mohawk
Tualatin, OR 97062
http://www.instantiations.com
Circle 203

Metrowerks Inc.
9801 Metric Blvd.
Austin, TX 78758
http://www.metrowerks.com
Circle 204

Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
http://www.microsoft.com
Circle 205

Modelworks Software
4882 Old Brook Circle S.
Colorado Springs, CO 80917
http://www.modelworks.com
Circle 206

NetBeans Inc.
Pod Hajkem1
180 00 Prague 8
Czech Republic
http://www.netbeans.com
Circle 207

Objectsoft Inc.
350 W. Erie St., Ste. 200
Chicago, IL 60610
http://www.objsoft.com
Circle 208

Oracle Corp.
500 Oracle Pkwy.
Redwood Shores, CA 94065
http://www.oracle.com
Circle 209

Progress Software Corp.
14 Oak Park
Bedford, MA 01730
http://www.progress.com
Circle 210

Rogue Wave Software Inc.
5500 Flatiron Pkwy.
Boulder, CO 80301
http://www.roguewave.com
Circle 211

SilverStream Software Inc.
1 Burlington Woods
Burlington, MA 01803
http://www.silverstream.com
Circle 212

Sybase Inc.
6475 Christie Ave.
Emeryville, CA 94608
http://www.sybase.com
Circle 213

Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
http://www.symantec.com
Circle 214

TakeFive Software Inc.
20813 Stevens Creek Blvd., Ste. 200
Cupertino, CA 95014
http://www.takefive.com
Circle 215

Tek-Tools Inc.
4300 Alpha Road, Ste. 101
Dallas, TX 75244
http://www.tek-tools.com
Circle 216

WingSoft Corp.
P.O. Box 7554
Fremont, CA 94537
http://www.wingsoft.com
Circle 217

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Affordable Ultra Workstation with SunPCi and Elite3D

by **IAN WESTMACOTT, Technical Editor**

With a 440-MHz processor, new graphics options and a slick PC integration product, Sun's Ultra 10 is hard to beat.

Faster and cheaper. These are the highlights of Sun Microsystems Inc.'s latest Ultra workstation releases; and now they can be optionally equipped with a PC motherboard. With a 440-MHz UltraSPARC processor and recent price reductions, the Ultra 10 Model 440 is a very attractive workstation. Add in new graphics options and a slick PC integration product, and the Ultra 10 is hard to beat.

Sun sent us its Ultra 10 workstation with a 440-MHz UltraSPARC-IIi processor, 2-MB cache, 256-MB RAM and the Elite3D m6 graphics adapter (previously unsupported on the Ultra 10). Equipped with a 21-inch color monitor, the SunPCi card and Solaris 7, this is an amazing machine at just under $9,000. And with base configurations starting around $4,000, the Ultra 10 line offers a great price/performance ratio for an entry-level graphics workstation.

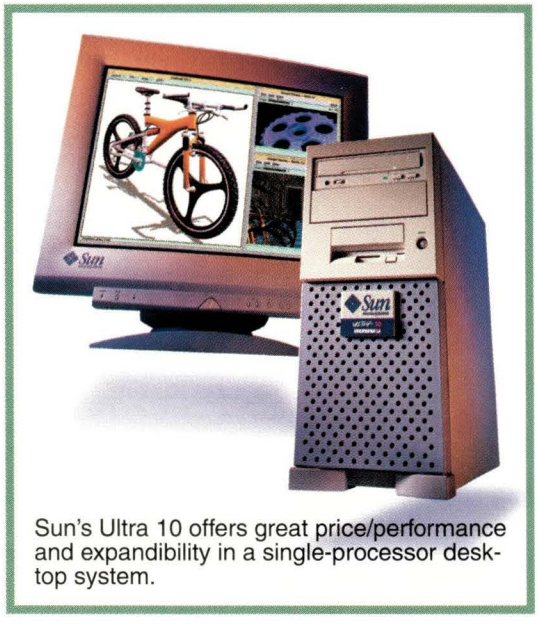
Ultra 10 Model 440

We ran a range of benchmarks to test the Ultra 10, SunPCi and Elite3D. We first ran the SPEC CPU95 benchmarks in single-user mode using a configuration file supplied by Sun and Sun's C and f77 5.0 alpha compilers. The system achieved a SPECfp95 result of 20.7 and a SPECint95 result of 18.3. Sun has published results of 22.7 and 18.1, respectively.

Next, we ran the MDBNCH molecular dynamics benchmark written by Furio Ercolessi, a FORTRAN 77 application that performs a number of molecular dynamics calculations with short-range potentials. This type of application accesses memory in very irregular ways, and the benchmark results may be used as an indicator of performance for similar applications.

The Ultra 10 achieved a result of 7.35 seconds using the f77 5.0 alpha compiler. For comparison, a 200-MHz Ultra 2 running Solaris 2.6 and Sun's f77 4.2 alpha compiler achieved a result of 14.6 seconds. Other results can be found at `http://www.sissa.it/furio/Mdbnch/results.txt`.

With these results, the Ultra 10 Model 440 offers very good performance for its price. One factor that helps keep the price down is Sun's choice of EIDE disks in the Ultra 10. The problem with EIDE is that, unlike SCSI, commands are single-threaded and rely on the CPU to transfer data. Sun argues that in a single-user (desktop) configuration there is little contention for the disk and channel, and the performance of EIDE is adequate. We would argue that even in a single-user configuration, sufficient multitasking does make the effects of the EIDE interface noticeable–but we can't argue with the price.



Sun's Ultra 10 offers great price/performance and expandibility in a single-processor desktop system.

SunPCi

The new SunPCi coprocessor card is a full-length PCI card that contains a 300-MHz Active Micro Devices Inc. (AMD) processor, 64 to 256 MB of RAM, SoundBlaster-compatible audio, serial/parallel/USB

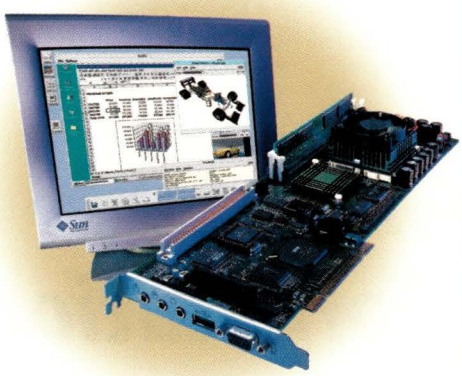
ports and a VESA super VGA display driver. All are industry standard PC components. SunPCi shares the host workstation's hard disk, floppy drive, CD-ROM drive, network interface, keyboard and mouse. Why? So you can run all your DOS and Windows (NT and 95) applications natively on your Solaris desktop, of course.

Installation of SunPCi is simple. Just drop the card in an empty slot (you will need a second slot for the serial/parallel ports) and install the Solaris software. Then you can run the Windows setup program off the CD (purchased separately) as you would with any PC.

This is not remote access to a PC, nor is it PC software emulation. With SunPCi you can open an X Window on your technical workstation which *is* a 300-MHz PC running DOS or Windows locally with its own processor and memory. Or, you can attach an external monitor to SunPCi and run DOS or Windows alongside your workstation. And this is not some customized version of Windows where you have to be concerned about licensing arrangements, source code access or support. SunPCi uses off-the-shelf Microsoft Corp. Windows. All you need are the SunPCi BIOS (Award Modular BIOS) and hardware drivers for shared devices.

SunPCi is booted via a Solaris process, which provides several interesting configuration and administration options. SunPCi does not contain any storage. PC hard drives are emulated via UFS files on the host's storage system. You can create multiple PC boot disks, for example, and specify which to use on the command line when booting SunPCi. Although you can create boot disks with multiboot options (Windows NT and 95, for example), the ability to specify the boot disk on the command line allows SunPCi users to share and copy PC hard disks. In addition, administrators can create standard boot configurations that can be centrally administered.

Although SunPCi shares the Ethernet adapter with the host system, it has its own IP address. On the network, SunPCi appears as a separate PC node and is logically independent from the host system. The two systems may interact with one another and independently with other network nodes. For example, you can browse and use network resources with Network Neighborhood. You can also set up SunPCi to boot using Dynamic Host Configuration Protocol (DHCP).



Run Microsoft Windows natively on your workstation with SunPCi.

To test the SunPCi card we used ZD Inc.'s WinBench 99 Version 1.1. The test configuration consisted of a single 300-MHz AMD K6 processor with 512-KB L2 cache and 127-MB RAM, running Windows NT 4.0 (Service Pack 4). The SunPCi achieved a CPUmark99 score of 15 and a FPU-WinMark score of 972. It also achieved a Business Disk WinMark 99 score of 4,940 and a High-End Disk WinMark 99 score of 6,350. While these numbers are not stellar, they are certainly more than adequate for office productivity applications. And they beat the performance of emulation solutions (such as Insignia Solutions' SoftWindows95) by leaps and bounds.

These tests were conducted with the host system in a quiescent state, however. Because SunPCi shares some devices with the workstation, most notably the hard disk and network adapter, SunPCi performance can be affected by load on the host system. For example, running a disk-intensive application on the workstation can slow down Windows on the SunPCi considerably, because both the workstation and SunPCi are contending for the shared hard disk. While running `catman` (an application that creates preformatted versions of online manual pages) on the workstation, our Windows NT session became almost unusable.

SunPCi has two video options. The card features an onboard SVGA controller that may be used with either a second monitor or a switched-input monitor shared with the host. SunPCi also includes an X Window application that displays on any X-capable device (not just the host's display). It also provides text cut-and-paste functionality with other X applications. Users can specify whether SunPCi uses the external controller or an X Window via the command line when the card is booted.

But the X Window's GUI has some limitations. For example, DirectDraw and DirectX (part of Windows) are not supported, so applications that depend on these will suffer in performance. In addition, the display drivers do not support any three-dimensional functionality the host's display may provide. For most office productivity applications, graphics performance is reasonable and cut-and-paste functionality is a plus. But for graphics-intensive applications, you will want to use the SVGA controller (it supports DirectDraw) and a monitor.

In our tests we ran into

ViewPerf OpenGL Results

	Geometric Mean	
Viewset	Elite3D m3	Elite3D m6
ProCDRS-02	14.18 (14.26)	19.77 (19.77)
DX-05	28.90 (28.12)	30.67 (30.95)
Light-03	1.25	1.27

We were able to match Sun's published ViewPerf results, given in parentheses. Sun has not published results for the Light-03 viewset. These results were obtained using software texture mapping for ProCDRS because the data sets are too large to avoid swapping with hardware texture mapping in 256 MB. Sun recommends 512 MB for hardware texture mapping with data sets of this size.–iw

rouble with the Windows NT 4.0 dis-
lay driver, which Sun says will be fixed in
he next release (released in September, but
navailable for our review). The NT dis-
lay driver for the X application had color
napping problems with a number of app-
ications, most notably Internet Explorer.
Most images with large bit depth did not
lisplay correctly. The same problems were
ot apparent when using the external
VGA controller. We also had no trouble
vith the Windows 95 display driver (either
or external controller). It can support
,280-by-1,024 True Color (24-bit) con-
igurations with good performance.

Elite3D

The Elite3D family of graphics systems,
comprising the m3 and m6, is Sun's prem-
er solution for 3D graphics, replacing
he Creator series. Like Creator, Elite3D
nakes use of Sun's 3D RAM, the SPARC
Visual Instruction Set (VIS) and Ultra Port
Architecture (UPA) to boost drawing and
rendering performance. The m3 includes
hree onboard graphics floating-point
nits, while the m6 includes six units.
Both are available on the Ultra 10, 30 and
50, while the m6 is also available on Ultra
2 and Enterprise systems. Sun touts the
m3 as having twice the 3D performance of
Creator3D, and m6 as having four to five
imes the 3D performance of Creator3D.

We ran several ViewPerf 6.1.1 Open-
GL benchmarks (see "ViewPerf OpenGL
Results"), using Sun's OpenGL 1.1.2.
ViewPerf is a portable OpenGL bench-
mark tool originally developed by IBM
Corp. and written in C. The OpenGL
Performance Characterization group has
endorsed ViewPerf for OpenGL bench-
marks. We ran tests on both the m3 and
m6 graphics adapters.

The ProCDRS-02 viewset models the
performance of Parametric Technology
Corp.'s CDRS industrial design software
and includes both wireframe and shaded
model tests. DX-05 measures the perfor-
mance of IBM's Visualization Data Ex-
plorer, a general-purpose software package
for scientific data visualization and analy-
sis. The DX tests visualize a set of particle
traces through a vector flow field. Light-03
models the performance of the Lightscape
Visualization System from Discreet Logic,
computer graphics technology that com-
bines proprietary radiosity algorithms with
a physically-based lighting interface.
Other ViewPerf results can be found at
`http://www.spec.org/gpc/opc.data/summary.html`.

Although both IBM (43P-260 with
PowerGXT3000P graphics) and Hewlett-
Packard Co. (J5000 with Visualize fx6
graphics and C3000 with Visualize fx3)
offer workstations with better ViewPerf
results, no other UNIX workstation
offers a better price/performance ratio
than the Sun Ultra 10 Model 440 with
Elite3D graphics, according to ProCDRS
results published in July (see `http://www.spec.org/gpc/opc.data/procdrs-priceperf.html`). All
three systems with higher results list for
more than $20,000 (the J5000 lists for
more than $30,000) in tested configu-
rations, whereas the Ultra 10 lists for
less than $10,000.

Summary

Sun's Ultra 10 offers great performance
and expandability in a single-processor
desktop system. Starting at $4,295, this
workstation is not only affordable, but
eliminates much of the pricing disparity
between UNIX- and NT-based technical
workstations. And when fully configured,
such as the system we reviewed, it offers
just about anything you could ask for in
a desktop system: excellent compute per-
formance in the 440-MHz UltraSPARC
processor, first-rate UNIX environment
in Solaris 7 with more than 12,000 off-
the-shelf applications, excellent graphics
performance in the Elite3D and a 300-
MHz PC in the SunPCi capable of run-
ning Windows and all the Windows soft-
ware out there. All for less than $10,000.

SunPCi is a great solution for anyone
who needs both a Solaris technical work-
station and a Windows PC for office pro-
ductivity applications, and may be the
best solution to the combined UNIX and
Windows desktop that we have seen. For
$495, you get a 300-MHz PC that is in
some ways more versatile than a more
expensive stand-alone system that would
take up twice the desk space. Although
you won't get brilliant graphics perfor-
mance, and compute performance is
mediocre, the office suites run well and
PC LAN integration is seamless. User and
administrator will be happy with SunPCi.
And did we mention it costs $495? ⊸

Ultra 10 Model 440 and SunPCi Card

Company
Sun Microsystems Inc.
901 San Antonio Road
Palo Alto, CA 94303

Phone
(650) 960-1300
(800) 555-9SUN

Fax
(650)969-9131

WWW
http://www.sun.com

Ultra 10
http://www.sun.com/desktop/products/Ultra10

Base Configuration
- 333-MHz UltraSPARC-IIi processor
- 2-MB cache
- 128-MB RAM
- 9-GB hard drive (7,200 RPM)
- 24-bit onboard graphics
- Solaris 7 preinstalled

Price
$4,295

Test Configuration
- 440-MHz UltraSPARC-IIi processor
- 2-MB cache
- 256-MB RAM
- 9-GB hard drive (7,200 RPM)
- Elite3D m6 graphics
- Solaris 7 preinstalled
- 21-inch color monitor

Price
$8,995

Best Feature
Price/performance ratio

Worst Feature
EIDE disk interface

SunPCi Card
http://www.sun.com/desktop/products/sunpci

Price
$495 (with 64-MB RAM)

Best Feature
Cheaply solves the combined UNIX/Windows desktop

Worst Feature
X display driver

Elite3D
http://www.sun.com/desktop/products/Graphics/elite3d.html

Price
$1,995 (m3), $2,995 (m6)

Best Feature
Price/performance ratio

Worst Feature
Sun's premier graphics option falls short of other vendors' offerings

Circle 165

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.

Evaluation Software for Pro/Engineer

Parametric Technology is now shipping ModelCheck, a software productivity tool that checks the quality of three-dimensional designs created with the company's Pro/Engineer mechanical design automation product.

ModelCheck is said to be the equivalent of the spell checker in word-processing documents for 3D CAD modeling software. It evaluates parts, drawings and assemblies, and recommends Pro/Engineer modeling techniques. As an integrated application, ModelCheck runs transparently within the Pro/Engineer environment, Parametric says. It uses a configurable list of company design standards and best modeling practices, and immediately flags modeling violations.

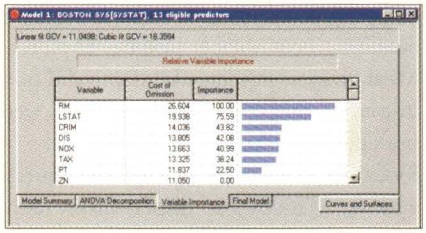
Key features include enforcing predefined design standards; establishing modeling best practices and quality control; enhancing communication and the sharing of information between suppliers and partners; and providing a standards-based training tool. ModelCheck can be used as a key process tool as part of a total managed information infrastructure. This ensures that when data are shared they are of a high quality and conform to industry standards, the company says.

Pro/Engineer runs on various platforms, including Solaris, HP-UX, AIX, IRIX and Windows NT. ModelCheck is available as an option to Pro/Engineer for $1,995.

Parametric Technology Corp.
128 Technology Drive
Waltham, MA 02453
http://www.ptc.com
Circle 101

High-Speed Predictive Modeling Tool

Salford Systems has introduced MARS 1.0, a high-speed, flexible regression tool for data mining and predictive modeling. Based on Multivariate Adaptive Regression Splines, or MARS (developed in the early 1980s), MARS 1.0 is designed for predictive modeling problems involving continuous outcomes, such as how much a customer will spend on a catalog order, how many minutes a customer will spend on their cell phone or how electricity production will change as generator inputs change. MARS can also predict yes/no binary responses such as whether a customer will default on a loan or refinance a mortgage.



MARS automates all aspects of model development and deployment, including separating relevant from irrelevant predictors, determining interactions between predictors, handling missing values with surrogate variable techniques and conducting self-validation tests to ensure the model holds up to new data, Salford says.

MARS reportedly enables analysts to search a large number of candidate models and quickly identify the "optimal" solution. Predictive models can be deployed directly from within the software or exported as ready-to-run C source code. MARS' data translation engines can convert data from more

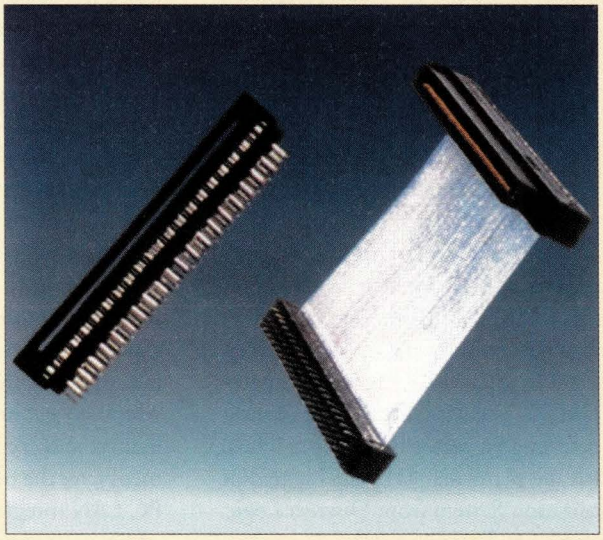
Slim-Line Transition Board Connector

Circuit Assembly has announced its Micro Transition Slim-Line (MTSL) Series connector, a board-mount insulation displacement slim-line transition connector designed for cable-mounted internal 68-pin SCSI 3 or 80-pin SCA-2 type applications. It can also be used on SCSI 3 terminators.

The MTSL Series was developed in response to demand for a high-quality, low-cost transition board connector, the company says. Its design–which features a two-piece grooved cover and retainer–is said to ensure fast, accurate and reliable termination to cable.

The MTSL Series is available as individual connectors in 68- and 80-pin positions, or as custom cable assemblies. Pricing starts at $1.07 per unit for a 68-pin standard configuration.

Circuit Assembly Corp.
18 Thomas St.
Irvine, CA 92618
http://www.circuitassembly.com
Circle 100



ıan 80 file formats, including popular .DBMSs and statistical analysis packges such as Statistical Analysis System SAS) and Statistical Package for the ocial Sciences (SPSS), Salford says.

MARS is supported in various lient/server operating environments. upported operating systems include ıost flavors of UNIX, Windows 95/98/ NT and IBM MVS and CMS. The ɔftware requires a minimum of 10 MB f disk space and 64 MB of RAM. 'ricing for MARS 1.0 starts at $2,495 ɔr a desktop version; site licenses range rom $5,000 to $25,000, with volume iscounts available.

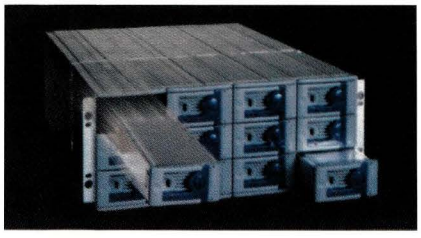
Salford Systems
8880 Rio San Diego Drive
Ste. 1045
San Diego, CA 92108
http://www.salford-systems.com
Circle 102

High-Performance Enterprise RAID System

Unison has unveiled its RAID I/O Fibre RAID storage system, which is aid to provide more than 3 TB of storge when configured with up to 60 0-GB hot-pluggable drives.

RAID I/O Fibre features an industry tandard 19-inch rack-mount design with tower option); dual 550W power upply and fans; hot-pluggable I/O nodules (containing Loop Resiliency Circuits for the drives), optional RAID controllers and host-attachment hub ards; hot-pluggable disk drive carriers; nd a SCA-2 direct docking drive ttachment.

The system's transfer and transaction ates are optimized for the best possible peed, Unison says. With large block izes, RAID I/O Fibre can reportedly chieve sustained transfer rates of up to 00 MB/s via a single RAID controller vith dual-host loop. An additional conroller can be added for a completely ault-tolerant system, the company says.



The chassis can be configured as a Just a Bunch Of Disks (JBOD), one RAID/ one hub, one RAID/two hubs or two RAIDs/two hubs system. The hub and I/O modules have two high-speed serial data connectors for each logical connection. In addition, using the company's Global Array Manager (GAM) software, the RAID I/O Fibre system can be completely configured, monitored and managed from anywhere in the world, Unison says.

Pricing for the RAID I/O Fibre storage system starts at $19,700.

Unison Information Systems Ltd.
21 Walsh Way
Framingham, MA 01701
http://www.unisoninfo.com
Circle 103

C++ GUI for UNIX/NT

Version 2 of Qt, the multiplatform C++ GUI framework from Troll Tech, is now available. This latest version adds support for application internationalization and formatted document display.

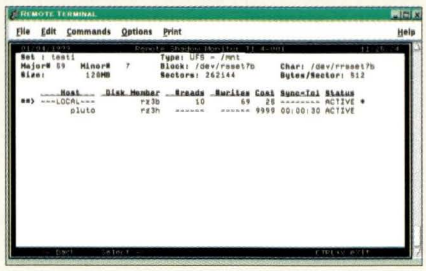
The Qt library allows developers to create GUIs for UNIX/X11 and Windows platforms, the company says. Qt is said to provide an object-oriented, cross-platform alternative to the Motif/Xt and Microsoft Foundation Classes (MFC) libraries, and offers C++ developers the portability benefits of Java. Version 2.0 introduces more than 40 classes to the Qt API.

Qt is supported on Solaris, HP-UX, True64 UNIX, AIX, IRIX, Linux and Windows 95/98/NT. Contact vendor for pricing.

Troll Tech AS
Waldemar Thranes gate 98B
N-0175 Oslo
Norway
http://www.troll.no
Circle 104

Remote Disaster Recovery Software

RemoteShadow recovery software from Advanced Systems Concepts now supports Solaris. RemoteShadow is designed to transparently and continuously protect business information by keeping an updated copy of it at a remote location. It includes both local and remote saving capabilities for parti-



tions or volumes in the event of a disk drive, controller, system or data center failure, the company says. A Network Restart feature is said to save time restarting a network after a failure by sending information into a queue when a connection is lost. The information continues to build in the queue until the connection is established, saving hours of downloading time.

RemoteShadow runs on Solaris, Tru64 UNIX and Open VMS. Licenses are priced starting at $7,500.

Advanced Systems Concepts Inc.
33-41 Newark St.
Hoboken, NJ 07030
http://www.advsyscon.com
Circle 105

Free Security Software

Aurora Enterprise Solutions, developer of the Java-based information security system Soteria, has announced that for a limited time (until December 31, 1999) it's offering application developers free end-user licenses for Soteria Version 2.0. In addition, the price of future upgrades of the product will be significantly reduced for developers who take advantage of this free offer, Aurora says.

Soteria 2.0 provides a complete set of security services for authentication, authorization, auditing, access control and secure communications across the enterprise, regardless of size and heterogeneous nature. It includes a full set of Solaris and Windows NT components, a software development kit, a full set of GUI administrative tools, online documentation and sample applications.

To register for a free license, go to `http://www.aurorasim.com/products/soteria20.html`.

Aurora Enterprise Solutions
12310 Pinecrest Road, Ste. 200
Reston, VA 20191
http://www.aurorasim.com.
Circle 106

Economical ERP Rental Plan

Industrial Application Software (IAS) has announced a new rental program designed for small to mid-size manufacturing and distribution companies that want to take advantage of an integrated enterprise resource planning (ERP) system without having to shell out the usual up-front costs.

Under the new program, rental fees for IAS ERP software start as low as $34 per user, per month, which includes user support, maintenance fees and system updates. IAS says its unique rental option offers companies a faster and easier way to start putting an ERP system in place, allowing them to maintain their competitive advantage.

The IAS ERP system is designed around three main modules: Logistics, Production Planning and Finance. Users have the option of implementing all three modules at the same time or gradually. IAS ERP software uses Troia, a simple object-oriented language developed specifically for the IAS ERP program. With the available Troia source code, users can reportedly modify and edit screens, dialog boxes and reports as their needs change. This helps reduce overall costs and allows users to quickly adopt the system to their ever-changing environments, the company says.

IAS ERP runs on UNIX (including Solaris, HP-UX, AIX and Linux), NetWare, AS/400 and Windows NT, and supports major RDBMSs such as Sybase, Oracle and Informix. IAS ERP software meets ISO 9000 requirements for data management and offers multicurrency and multilanguage capabilities. Contact company for rental fees and conditions.

Industrial Application Software LLC
7900 Westpark Drive, Ste. A-50
McLean, VA 22102
http://www.iascon.com
Circle 107

Upgrades, Enhancements, Additions...

■ Dataram has released a 2-GB memory option for Sun Microsystems Inc.'s 3000, 3500, 4000, 4500, 5000, 5500, 6000 and 6500 Enterprise-class servers. According to Dataram, the DRS702/2GB memory option doubles the maximum memory in Enterprise 6500 to 60 GB. The new memory option is manufactured exclusively by Dataram and is priced at $9,775. **Dataram Corp.**, P.O. Box 7528, Princeton, NJ 08543, *http://www.dataram.com*. **Circle 108**

■ ParaSoft, a leading provider of software error detection tools, has announced that the latest version of Insure++, Version 5.1, adds support for 64-bit development on Solaris and AIX. Insure++, ParaSoft's runtime error detection tool for C/C++, was the first development tool to support 64-bit development on HP-UX and IRIX, and now extends this support to AIX and Solaris environments, the company says. Insure++ 5.1 is available for Solaris (2.x), AIX (4.x), HP-UX (10/11), IRIX (6.x), Linux and Windows NT. It costs $2,995. **ParaSoft Corp.**, 2031 S. Myrtle Ave., Monrovia, CA 91016, *http://www.parasoft.com*. **Circle 109**

■ Veritas NetBackup from Veritas Software includes enhanced storage area network (SAN) support, nondisruptive database support, automated disaster recovery and the next generation of Veritas NetBackup Java and Windows NT interfaces. NetBackup now offers a Shared Storage Option, which is said to be a heterogeneous SAN-ready storage solution that works on both UNIX and Windows NT. It dynamically shares individual tape drives, either stand-alone or in a tape library. It also offers broad support of databases, including SQL Server 7 and DB2, and new point-and-click interfaces. Version 3.2 of NetBackup supports a range of platforms, including Solaris, AIX, Tru64 UNIX, HP-UX, IRIX and Windows NT. Pricing starts at $3,995 for Windows NT and $8,500 for UNIX. The Shared Storage Option costs $995 per shared tape drive. **Veritas Software Corp.**, 1600 Plymouth St., Mountain View, CA 94043, *http://www.veritas.com*. **Circle 110**

■ Sun Microsystems' Easy Access Server 3.0 for the Solaris 7 operating system now offers a higher level of Windows NT network support. The new version combines a complete set of Windows NT network services, administration tools and global enterprise security services into a comprehensive solution for network computing. Version 3.0 includes Solaris PC NetLink 1.1, the latest version of Sun's Windows NT network services for Solaris, new graphical tools, such as a new Print Manager for setting up and managing network printers, and Sun's Enterprise Authentication Mechanism software for user authentication using the Kerberos V5 protocol. It also includes Solaris WBEM Services, Sun's implementation of the Distributed Management Task Force's Web-Based Enterprise Management (WBEM) initiative. Solaris WBEM Services comprises a set of tools and services that are said to make it easier for software developers to create applications based on the Common Information Model (CIM) schema and eXtensible Markup Language (XML) and HTTP communications standards. Solaris Easy Access Server 3.0 costs $595 per server. **Sun Microsystems Inc.**, 901 San Antonio Road, Palo Alto, CA 94303, *http://www.sun.com*. **Circle 111**

■ Tandberg Data has lowered the prices on its SLR32 and SLR50 tape drives. The SLR32 drive delivers a native capacity of 16 GB and data throughput of 5.4 GB/hour. While, the SLR50 provides native capacity of 25 GB at speeds of 7.2 GB/hour. Capacity and performance are doubled with hardware data compression enabled. The SLR32 is priced starting at $1,359 and the SLR50 is priced at $1,923. **Tandberg Data Inc.**, 2685-A Park Center Drive, Simi Valley, CA 93065, *http://www.tandberg.com*. **Circle 112**

■ Lancast has enhanced its NetBeacon management software for media converters with the addition of Solaris 2.6 support. Previously, NetBeacon was only available on machines running Windows 95/98/NT. In addition to the new platform support, NetBeacon-Windows can now be launched from the Hewlett-Packard Co. HP OpenView Network Node Manager main menu bar and the HP OpenView Network Node Manager map, which provides graphical views of the network. NetBeacon features more than 40 functional, operational and environmental statistics on the media converter chassis, and all of its intelligent modules can be easily monitored and controlled, the company says. All manual commands and configuration changes can be performed remotely throughout the enterprise via in-band and out-of-band communications. In addition, customizable threshold and alarm conditions allow automatic notification by email or pager. NetBeacon-Windows and NetBeacon-UNIX cost $399 and $999, respectively. **Lancast Inc.**, 12 Murphy Drive, Nashua, NH 03062, *http://www.lancast.com*. **Circle 113**

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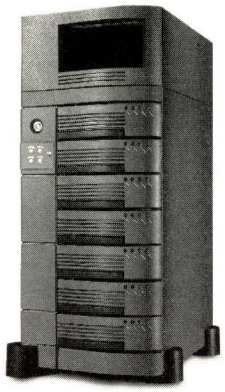

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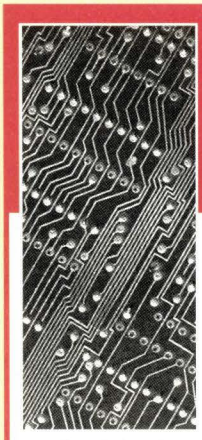

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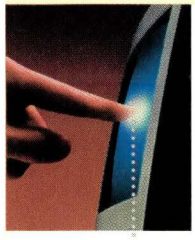

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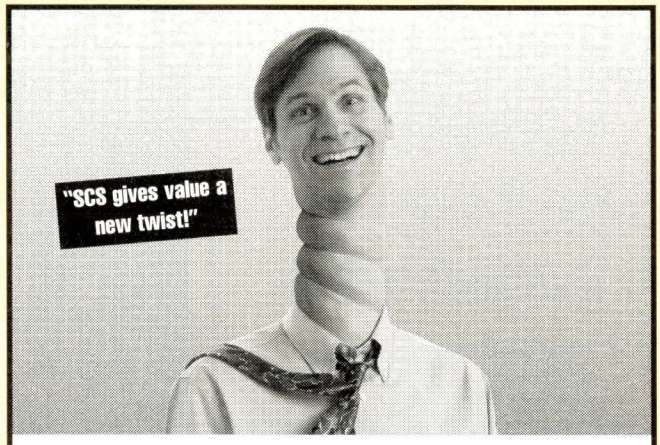

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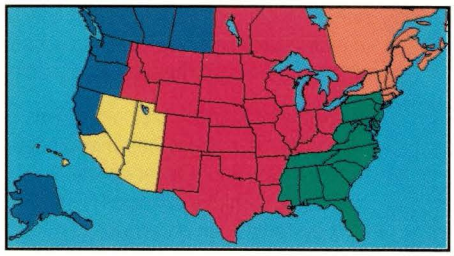

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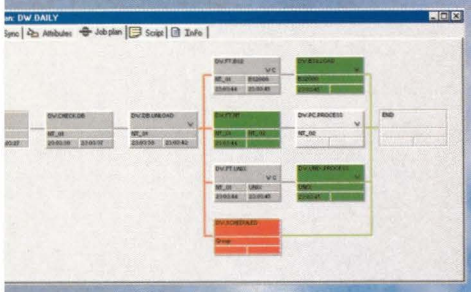

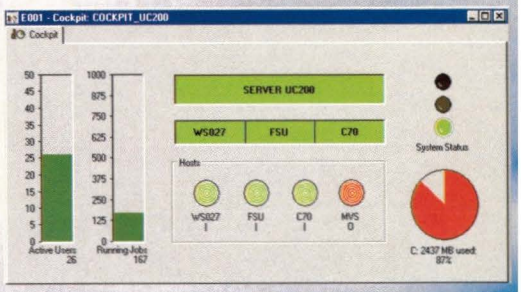

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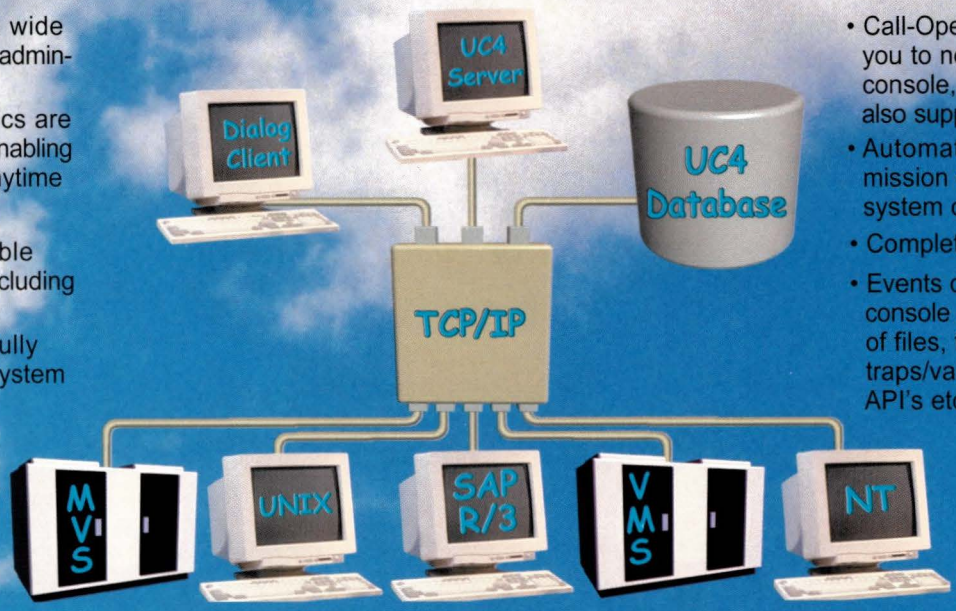

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