

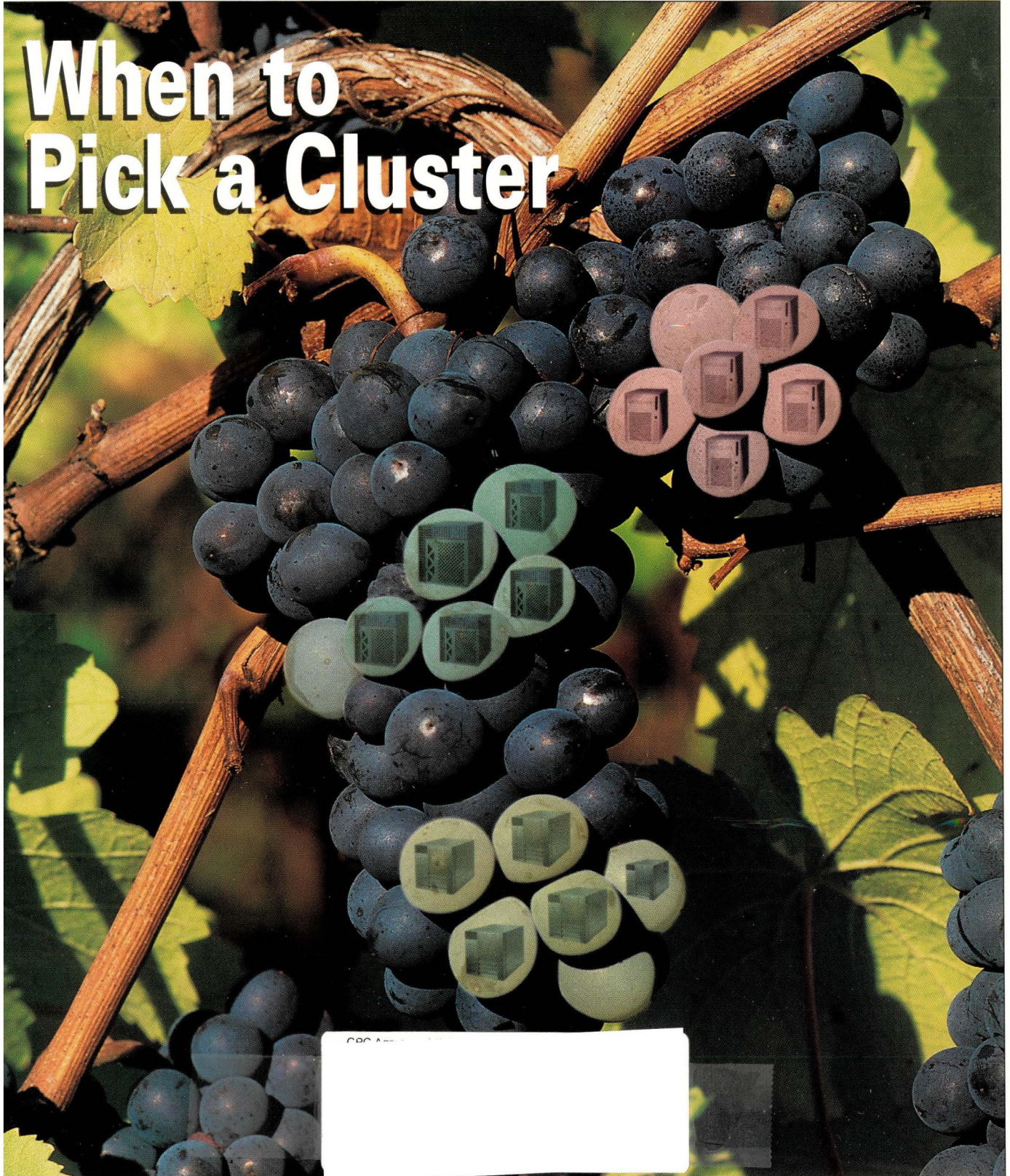
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When to Pick a Cluster

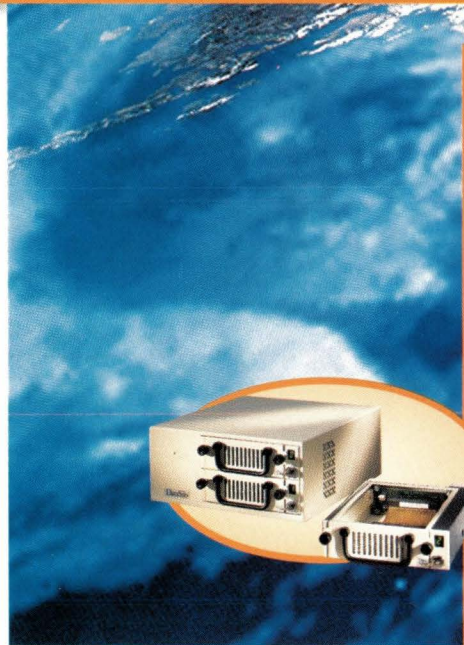


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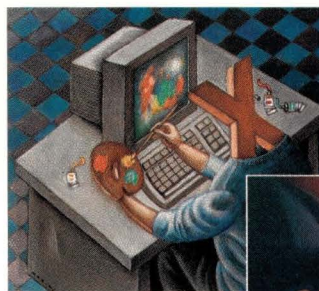
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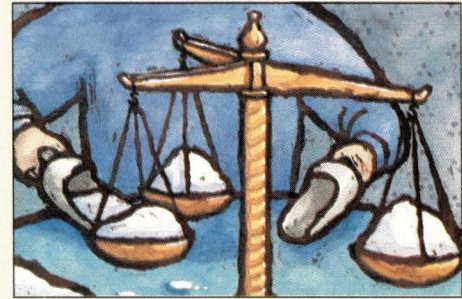
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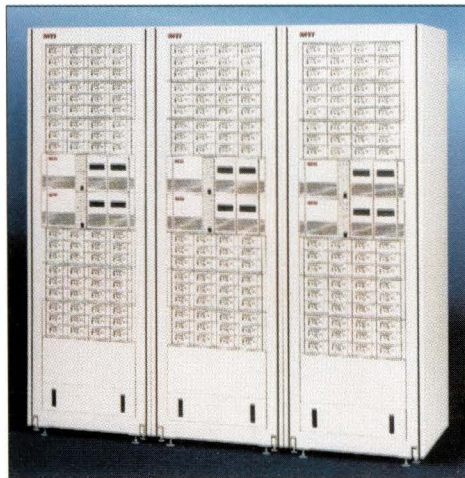
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Illustrations by ERIN TERRY



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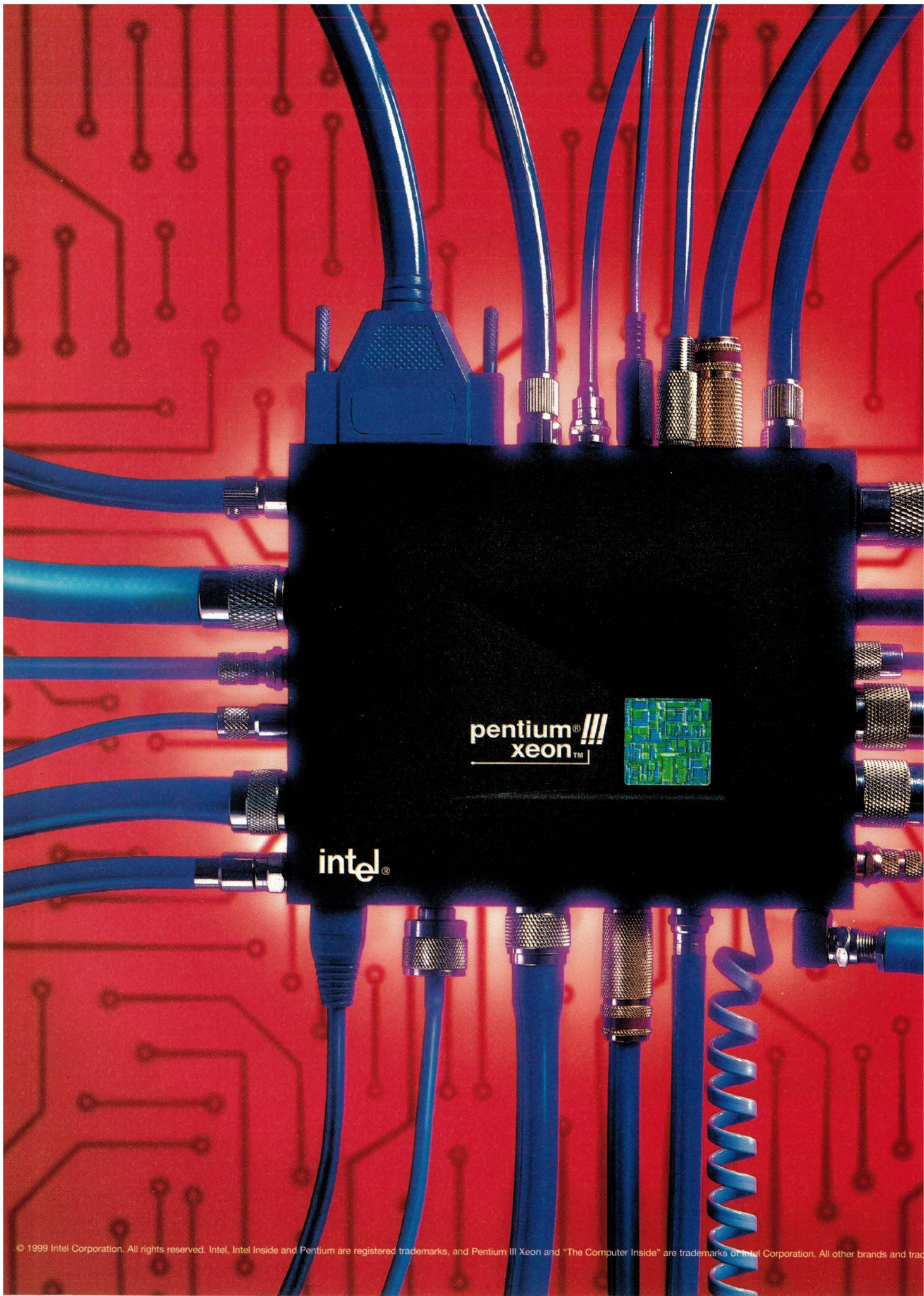
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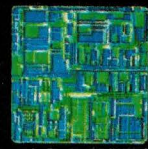
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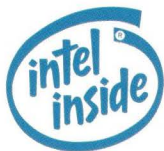
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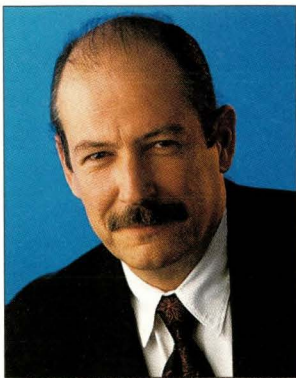
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Is it Time for Clusters?

For most of us, it may be premature to start thinking about this year's harvest but that's only if you're talking about grapes, not clustered computer systems.

According to Neville Nandkeshwar, product line manager for Solaris clusters at Sun Microsystems Inc., only 5% to 10% of server sales include clustering features. If you want to know why, check out Paul Korzeniowski's cover story, "When to Pick a Cluster," Page 62. It explores why some customers are willing to pay the sometimes high premium—30% to 50%, in some cases—for clustering. Paul suggests it could have something to do with the fact "market research firms have pegged the average cost of downtime for an enterprise resource planning (ERP) application at \$10,000 to \$15,000 per minute." That's a lot of potential sour grapes. More and more IT shops will turn to clusters to avoid this problem. Strategic Research, a Santa Barbara, CA-based market research firm, predicts the number of UNIX servers with clustering features sold worldwide will grow from 25,989 in 1998 to 91,212 in 2003. According to Strategic, this will be roughly 26% of all new server shipments. And the usual claim from Microsoft Corp. about OS futures—better clustering features with Windows 2000 when it arrives in late 1999—make it clear that clustering is on the rise.

While we're on the subject of NT and UNIX, let's take a look at a recent report from International Data Corp. (IDC), the Framingham, MA-based research outfit. According to the report, "Strategies for Windows NT in the Enterprise," Microsoft marketing efforts have resulted in a cloudy picture of what is actually happening with IT practices around the world. "Media reports often leave the impression that Windows NT is being adopted by organizations of all sizes for every conceivable mission and that organizations are abandoning their investments in other operating environments," says Dan Kusnetzky, program director for IDC's operating environments and serverware research programs. IDC finds that NT is most often used for jobs like file/print, messaging and communications, rather than as a major enterprise server running mission-critical applications. Contrary to reports that suggest that NT is becoming a de facto standard, this report confirms my suspicion that a good way to place your job in jeopardy is to install a mission-critical application on an NT server—clustering or no.

Email me at dpryor@cpg.com if you think that's a cheap shot.

Doug Pryor

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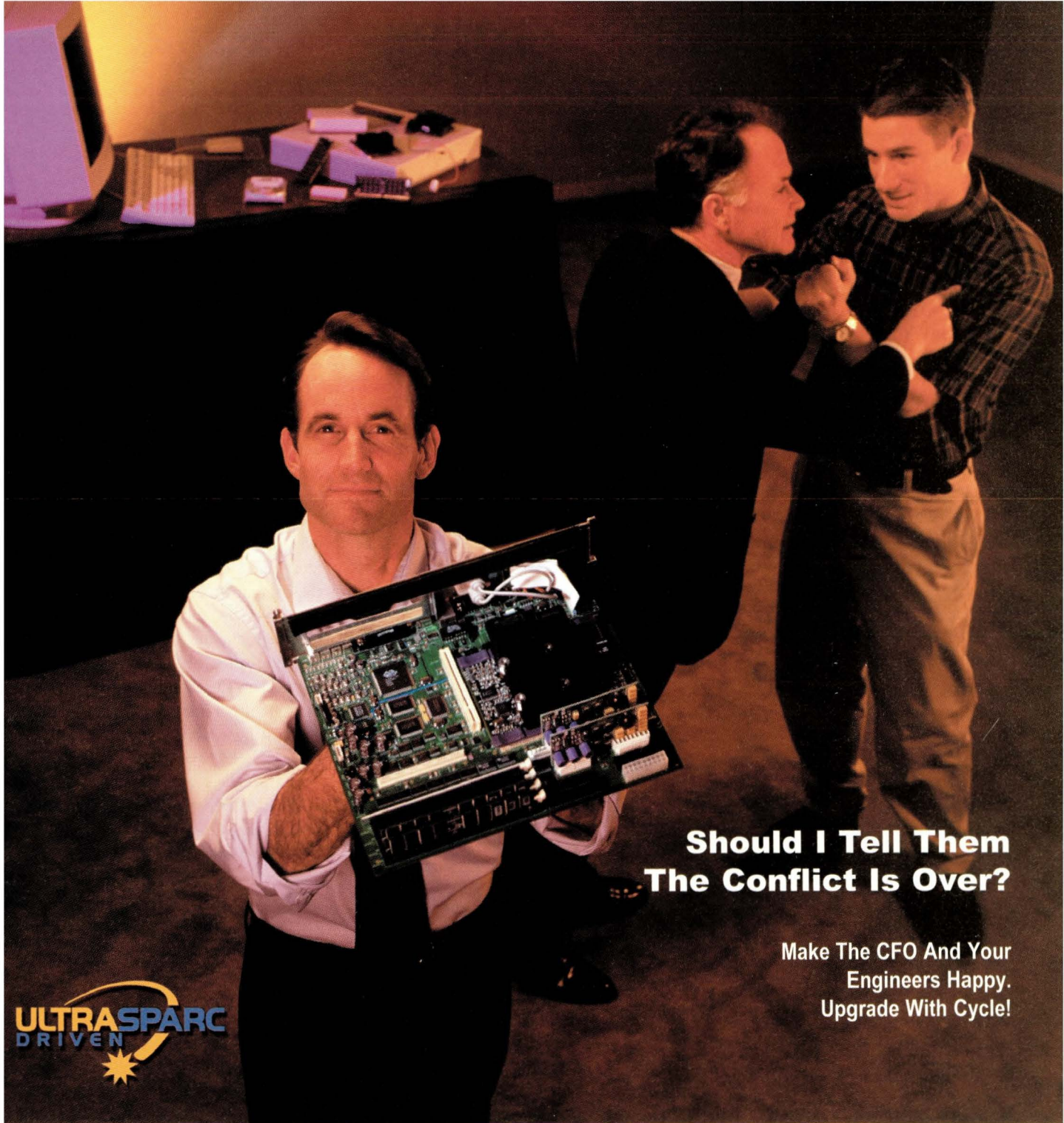
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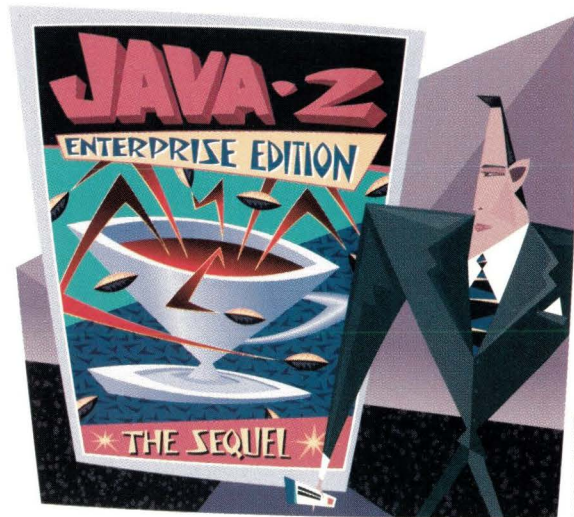
Mainframe Java?

Just when you thought you were getting the hang of Sun Microsystems Inc.'s Java Development Kit (JDK) 1.1, along came JDK 1.2—or Java 2, as Sun now calls it. Well, now it's time to get ready for Java 2 Platform, Enterprise Edition, aimed specifically at server-side Java application development. In March, Sun announced it would begin releasing early versions of the new specification to its development partners in April and May.

"We will now have a complete, credible computing platform across an entire range of needs—for devices, for desktops and general-purpose computing—and now an enterprise edition that extends all the way up to the enterprise server and mainframe class support. So the whole computing world is covered by Java," says Bill Roth, product line manager for Java 2 Platform, Enterprise Edition.

The new spec will build on the existing Java specification—to be renamed Java 2, Standard Edition—and will add support for server-specific standards not currently mandated by Java 2. According to Roth, some of the standards likely to be mandated for software vendors wanting to comply with the new spec include Sun's Enterprise JavaBeans (EJB) component architecture for writing server-side business logic objects; Java Database Connectivity (JDBC) for database connectivity; Java Naming and Directory Interface (JNDI) for accessing multiple naming and network directory services; Java Server Pages for accessing server-side Java components via Web pages; servlets for writing small server-side programs to run on Web servers; and the eXtensible Markup Language (XML).

"In doing this, we're providing a platform for server-centric enterprise class computing," says Roth. "Previously, we had a set of vertical technologies. For example, JNDI just handles naming and directories, EJB just handles distributed objects and JMS [Java Message Service] just handles message-oriented middleware. Each was independent. So we're tying them together



to make them a credible platform for enterprise computing."

Roth says Sun hasn't yet finalized a list of standards to be required in the enterprise specification, but says it's unlikely any new standards will be specifically created for it. A finished product is not expected until the end of the year.—*sjh*

IBM Spotlights OEM Biz

In March, IBM Corp. announced separate but major OEM agreements with two of its competitors. The larger of the two deals involves a seven-year, \$16 billion agreement, which gives Dell Computer Corp. access to various

IBM component technologies. Similarly, EMC Corp. agreed to a five-year, \$3 billion deal to purchase advanced IBM disk drives for its enterprise storage systems.

In both instances, IBM is leveraging technology it has already developed. To do this, the company is focusing on its sales to OEMs. According to IBM, revenue from OEM sales has grown 40% compounded since 1993, and generated \$6.6 billion in revenue for 1998. Moreover, James Vanderslice, senior vice president and group executive at IBM, says the company has identified three growth areas: services, software and OEM technologies. The deals with Dell and EMC are examples of how IBM plans to expand its OEM business and recoup some of the investments it has made in developing technology. "IBM invests more in R&D than any company in the IT industry," Vanderslice says.

As for Dell and EMC, they will be able to take leading-edge components and incorporate them into their own products. At the same time, they will be able to leverage the brand recognition of a strong competitor. In particular, industry analysts say, this could provide Dell with some of the cachet of the IBM brand name.

"By promoting the fact that they are using IBM components, they get access to the IBM brand. That allows them to move into larger enterprises that accept the IBM brand over and above the Dell brand," says Rob Enderle, analyst at research firm Giga Information Group, Cambridge, MA. "They are able to leverage that relationship to make it appear that they are more enterprise-ready."

In some cases, companies try not to promote the fact they are using a competitor's components. In the past, IBM has quietly sold technology to competitors such as Hewlett-Packard Co. and Compaq Computer Corp.

"IBM has been able to demonstrate over the years that they don't use the [OEM] relationship against the other

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Help! My name is Data.



In a major OEM announcement, EMC has agreed to a five-year, \$3 billion deal to purchase advanced IBM disk drives for its Symmetrix storage systems.

company and, as a result, these firms have grown to trust them to provide current and unbiased technology," Giga Information's Enderle says.

Dell will purchase IBM's high-capacity disk drives, network adapter cards, flat-panel displays, SRAM and custom chips. In addition, the deal is expected to include IBM's copper and silicon-on-insulator semiconductor technology. EMC in turn will buy IBM disk drives for incorporation into its Symmetrix Enterprise Storage Systems, which are designed for AS/400, UNIX, Windows NT and mainframe systems.

Both deals call for patent cross-licen-

ses with IBM for the development of future technologies and products.

"Both Dell and EMC are sending the signal that they have adopted the strategy of using the best that is available, and if that has to come from a competitor, then so be it," says Jerry Sheridan, analyst at Dataquest Inc., San Diego, CA. "Certainly, their clients will have a lot more confidence in their

servers and workstations from Dell and storage products from EMC, based upon the fact that they do have outstanding components installed in them." —*ptc*

CA Goes Platinum

With the unanimous approval of both companies' board of directors, Computer Associates International Inc. will acquire rival Platinum Technology International Inc. in a deal valued at \$3.5 billion. Once antitrust issues are reviewed by the U.S. government and the deal—which was announced in March—can be completed (perhaps

within the next two months), Computer Associates will have significantly broadened its product offerings.

Computer Associates' President and Chief Operating Officer, Sanjay Kumar, says Platinum's technologies will round out his company's wares. "In the database tools business, the data warehousing business, the application life cycle management business and the Internet business, Platinum brings an incredible wealth of technology with literally no overlap to CA products," he says. "The technology that Platinum has can really evolve into something much broader when combined with [our] products."

One product Computer Associates will be able to add to its arsenal is the rules-based development environment called Aion, which is used for the creation of middle-tier and Web applications. Computer Associates will also benefit from Platinum's March acquisition of New York, NY-based Memco Software Ltd. and its security and single sign-on capabilities.

Other technologies Platinum brings to the table relate to online analytical processing (OLAP), database connectivity and application management. Computer Associates believes this will broaden

Syncing the Desktops

Sun Microsystems Inc. wants its customers to get "in sync" with mobile computing. So in February, the company announced it will license Santa Clara, CA-based 3Com Corp.'s HotSync technology for synchronizing data between Sun's desktop computers and 3Com's PalmPilot and Palm III handheld computers.

Under the agreement, Sun will create a Java version of the HotSync technology that will enable Sun customers to synchronize data in personal information applications such as calendars and address books between their PalmPilot and Sun systems. It will also allow Sun users to synchronize their workstations with Microsoft Corp. Windows-based PCs by using the PalmPilot as a conduit between the two.

While she has no estimates on the number of Sun customers who currently use PalmPilots, Barbara Key, product line manager, says Sun expects strong interest.

"There are a lot of Sun workstation customers who have Pilots and are eager to use synchronization software to get their desktops and PalmPilots in sync. Every meeting I go to, I see PalmPilots. In our market space, at least, PalmPilots seem to be the ones that most people are using," Key says.

Jill House, analyst with International Data Corp., Framingham, MA, agrees that 3Com's Palm Computing is a good

partner for Sun. "3Com has the dominant market share for personal companions," says House. According to IDC, 77% of the personal companion handhelds on the market in 1998 ran Palm OS and 15% ran Windows CE.

Currently, PalmPilots can be synchronized with Windows-based PCs and Macintosh systems using HotSync. There's also a freeware product available based on HotSync, called PilotManager (<http://www.moshpit.org/pilotmgr>), which allows PalmPilot users to synchronize their handheld computer's data with Linux, Solaris and IRIX machines. PilotManager is based on Perl rather than on Java, and is not supported by Sun.

The advantage of the Java product, says Sun's Key, is three-fold. "It's being integrated with the desktop, so you will have it available as part of the Solaris that you see on your workstation. It will be written in Java, so it will be available on more environments, such as on our JavaStation [network computing] systems. And Sun is putting its weight behind it in terms of quality and availability," Key says.

However, HotSync won't be out until later this year—probably third or fourth quarter—according to Key. So for users who need to get "in sync" now, PilotManager is the best option. —*sjh*

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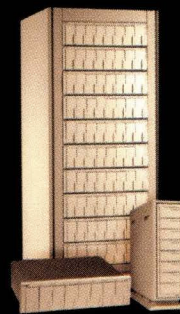
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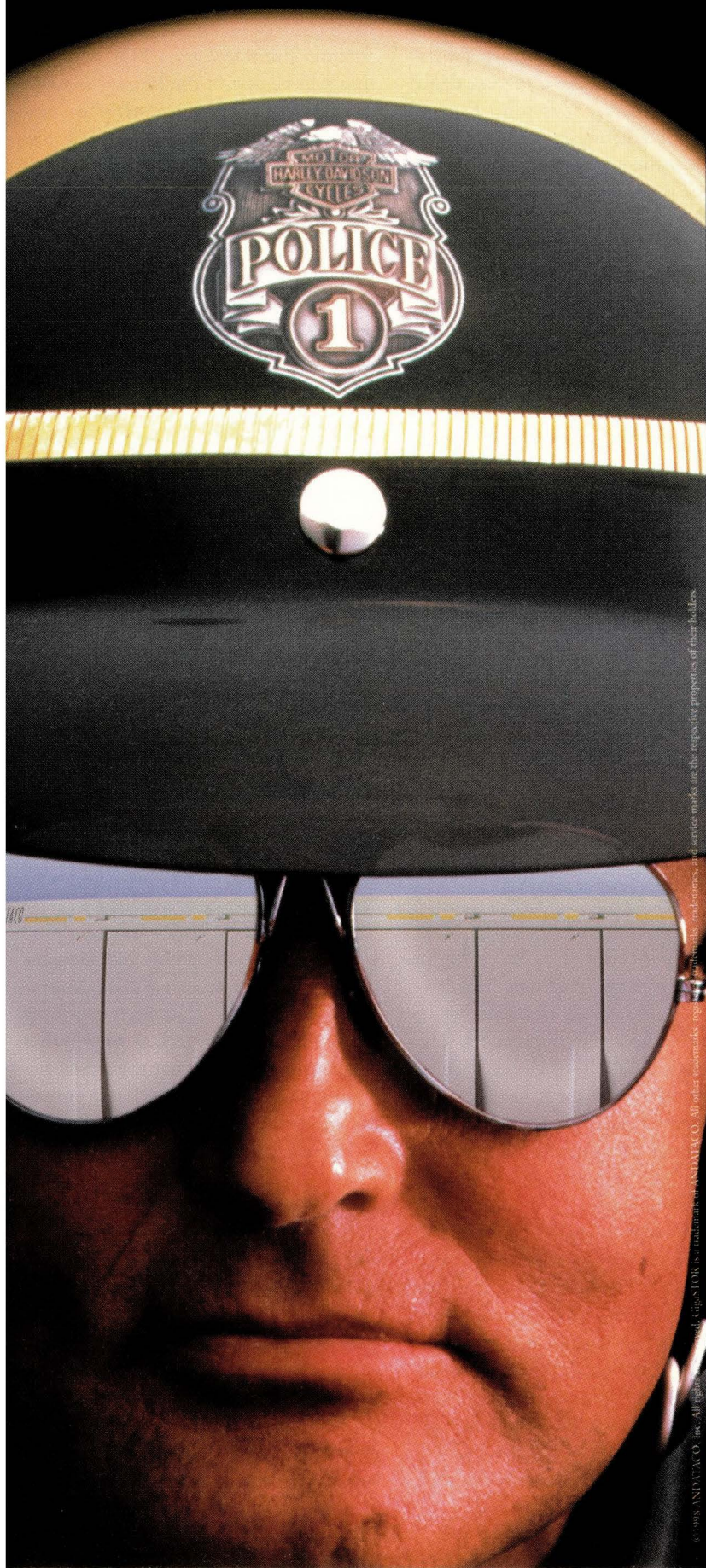
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its product portfolio. "This transaction will complement what CA already has in technology and services," Kumar says.

In areas where there is overlap, Computer Associates may benefit from being able to offer Platinum's point solutions in addition to its own products such as the integrated Unicenter TNG systems management framework. Both companies have been competing in this area, particularly with regard to system performance,



security, job scheduling, help desk and file transfer and software distribution.

"With some of Platinum's system and network management tools, CA gets some leading point products that they don't have," says Patrick Dryden, analyst at Giga Information Group, Cambridge, MA. "Platinum has a great job scheduler in Autosys. CA can't offer that as a stand-alone product."

Dryden adds that mergers are a growing trend in the systems management market. Currently, there are four market leaders—Computer Associates, Tivoli Systems Inc. (an IBM Corp. subsidiary), BMC Software Inc. and Hewlett-Packard Co.—and to compete, each is trying to offer more products and services relating to management. "Everyone is assembling an arsenal of tools. The big get bigger. The goal is to provide everything to the customer," Dryden says.

This trend is further demonstrated by BMC's merger with Boole & Babbage Inc., San Jose, CA, which was finalized in March. BMC also announced its acquisition of New Dimension Software Inc., Irvine, CA, in March, and last year, Tivoli acquired Software Artistry Inc., Indianapolis, IN, in order to obtain the

company's help desk systems.

But competitors say that by acquiring Platinum, Computer Associates may have bitten off more than it can chew. "If you look at the combining of these two companies, it's like a mating dance of two dinosaurs," says John Savage, director of marketing strategy at Tivoli. "You've got these two very large companies with these very extensive product lines. Making sense of that is going to be a challenge that they are going to have to invest a lot of energy into."

In addition to products, Computer Associates will inherit approximately 1,000 of Platinum's integration staffers, providing a significantly larger service business.

"They are all trying to build their services organization, and that's a key thing that CA gains here," says Dryden. "They want to supply the service and the pieces, whether you want a whole

soup-to-nuts set of tools already integrated, or you want to buy one good tool at a time. Eventually, they will all work together."—*ptc*

HP Retools for the Internet

It's a rare computer company that hasn't yet proclaimed itself to be an "Internet company." And now, Hewlett-Packard Co. has finally decided that it, too, needs to be in the Internet biz. The 60-year-old, Palo Alto, CA-based computer and electronics giant has launched a campaign of corporate restructuring and national advertising designed to reposition itself as a leading provider of Internet technologies.

In early March, HP announced it would spin off its \$7.6 billion test and measurement division into a separate company. That will leave the surviving, \$40 billion HP organization free to concentrate on identifying Internet market opportunities for its computer products divisions—the LaserJet Solutions Group, Inkjet Products Group, Enterprise Computing Solutions Organization and

Personal Systems Group.

HP also unveiled plans to reshuffle its various Internet business products under a new umbrella division, the Internet Business Unit (IBU). This new unit will be part of the Enterprise Computing Solutions Organization and will comprise five subdivisions: E-Services (responsible for developing software infrastructure products), Internet Security, E-Commerce, E-Business Solutions and Verifone Inc., a HP subsidiary that makes e-commerce payment systems such as smart cards and point-of-sale terminals.

The creation of the IBU, coupled with a \$150 million ad campaign launched in late March, is aimed at making potential customers more aware of HP as a provider of e-commerce and networking products, as well as setting the stage for future product and partnership announcements, says Joe Beyers, general manager of the IBU. "People often don't think of HP as a major Internet company, but the fact is that we are a very major Internet company.... We just really haven't done a good job of communicating either our position or our strategy. That's all going to change."

Jack Staff, analyst with Redwood City, CA-based Zona Research Inc., believes the reorganization will help clear up some past customer confusion over which HP divisions were handling what type of Internet-related products.

"In HP, you've had someone doing e-commerce in one group and someone doing e-commerce in another group," Staff says. "I think it has been confusing to some HP customers as to whether they're dealing with a company that has a full-range solution or that's just providing a component. Now I think that will be less of a problem."

Too Late in the Game?

With the company's new focus, HP will face some stiff competition from major players such as IBM Corp. and Sun Microsystems Inc. Both IBM and Sun are aggressively targeting Internet markets, and whether HP can steal some of their thunder remains to be seen. Jonathan Eunice, analyst with Illuminata Inc., an IT consulting firm based in Nashua, NH, thinks HP may

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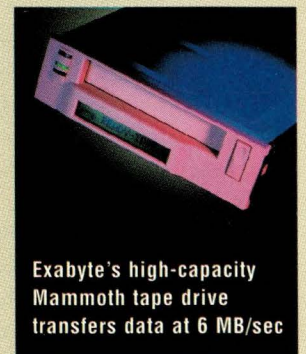
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have waited too long to hop onto the Internet bandwagon.

"In 1995 and 1996, HP was way behind the curve. HP is not a name you hear a lot in the ISP environment," says Eunice. In order to catch up, he says HP will need some strong new product announcements to get the market's attention. "Now that the train has left the station, they'll have to run ahead and get to the next station before it arrives."

Michelle Bailey, senior research analyst for International Data Corp., Framingham, MA, agrees that HP needs some bold moves in order to make up for lost time. "It's about building strong partnerships and alliances with ISVs and others in the Internet space, like Sun's deal with AOL [American Online Inc.]. HP needs to go out and do interesting things that will put themselves out in the media as being winners in the Internet space," Bailey says.

HP's Beyers claims his company will be able to leap ahead of existing competitors by taking advantage of the constantly shifting nature of Internet markets and technologies. "Whenever you have discontinuity in a marketplace, you have new entrants arrive that can achieve significant market position," he says. "So our goal is to ensure that we're the new entrant to achieve that market position."

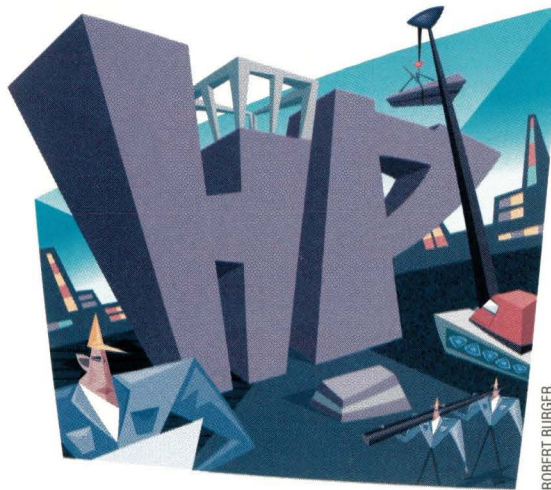
He points to two recent projects as examples of HP's new direction: a partnership with Atlanta, GA-based Security First Technologies Corp. to promote Internet banking applications, and a joint venture with Ariba Technologies Inc., Sunnyvale, CA, to provide the hardware, software and services for Ariba's business-to-business procurement portal.

Also, HP unveiled plans in April for a new technology, code-named Fremont, which will allow network services using different protocols to communicate with one another. With Fremont, the company says, a computer in Boston could send a print job to a branch office printer in Hong Kong running on a different network operating system.

"Fremont is a service definition struc-

ture that allows you to describe a service in a very simple way," says Greg Kleiman, marketing manager for open services operations, part of the E-Services division of the IBU. Kleiman says HP plans to enlist development partners to incorporate support for a wide range of other protocols and languages into Fremont.

In addition to Fremont and its other Internet partnerships, the launch of HP's major ad campaign in March is aimed at publicizing the company's vision of the Internet as a place where "e-services" are bought and sold. E-services is HP's new buzzword—similar to Sun's "dot.com" and IBM's "e-business" slogans—which HP has adopted to refer to a range of services that can be provided electroni-



ROBERT BURGER

cally, such as outsourced data storage and application hosting. That campaign, which started with multipage ads in major newspapers such as the *The Wall Street Journal* and *The New York Times*, will target international newspapers, magazines and television later this year. The extent of the ad campaign is "unprecedented" for HP, according to Beyers, who says, "This is a major play we're making here."

Are all these new initiatives an indication of a bolder, more marketing-savvy HP? Experts certainly hope so.

"HP is very much a quality-driven company and a consensus-driven company and a very stable environment. But the world is changing fast and boldness is one of the attributes I have not seen in the past," says Illuminata's Eunice. "HP has the goods, they just haven't had the

boldness or the energy they need. They need to have a willingness to come out with a product that absolutely may fail, but may also be a tremendous win."—*sjb*

IBM Aims to be OS Agnostic

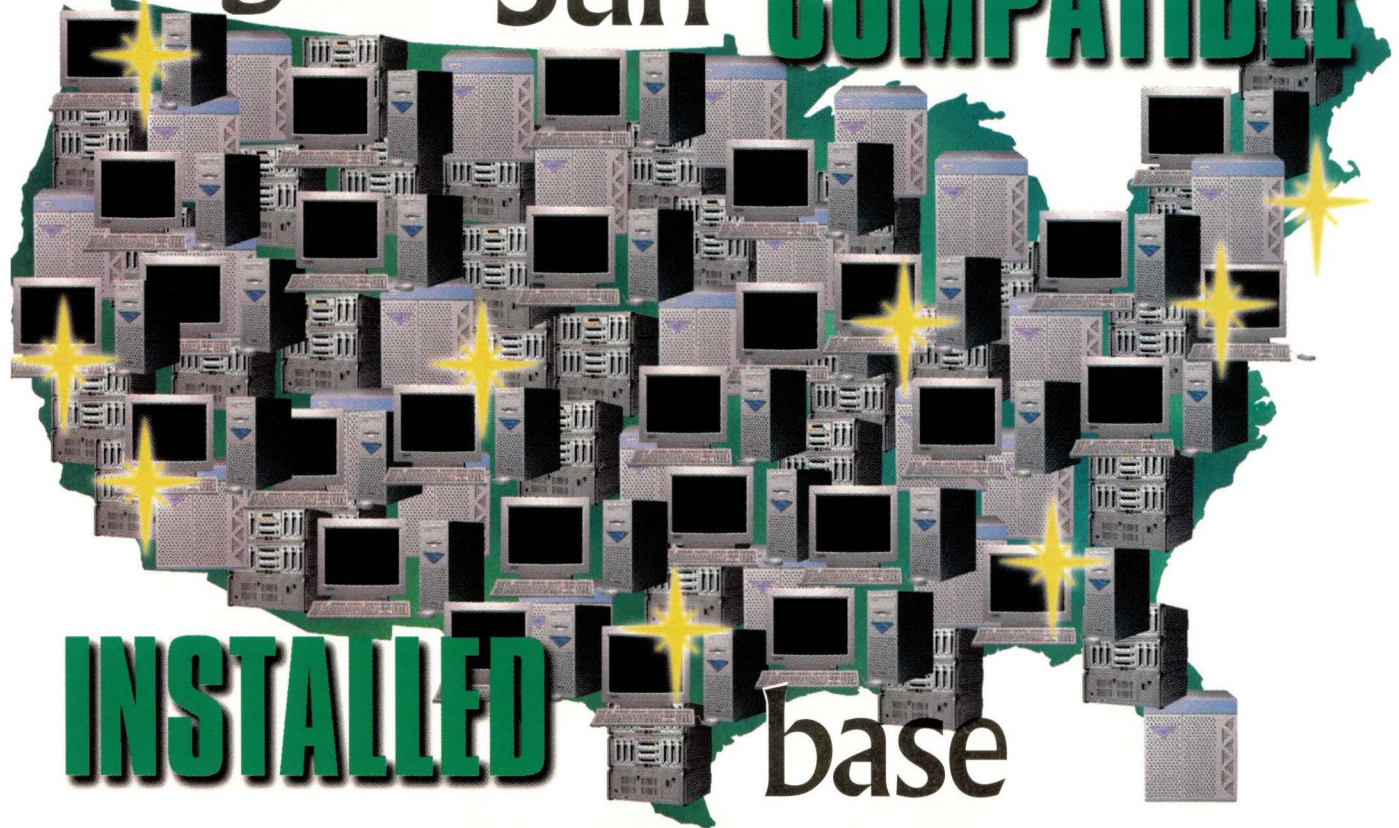
IBM Corp. has opened its arms to competitor Sun Microsystems Inc.'s Solaris operating system with the launch of IBM Suites for Solaris. Introduced in February, the new suites are bundled packages of IBM middleware, application server, database and workgroup software aimed at organizations that need an end-to-end electronic commerce solution. The three packages are IBM Suites for Solaris, IBM Business Integration Suite and IBM Enterprise Suites for Solaris—each designed for small, medium and large enterprises, respectively. IBM also announced Suites for AIX, its own UNIX operating system, and has been shipping Suites for NT since November.

"IBM is clearly trying to position its products so that they're more operating system agnostic," says John Enck, research director for the Gartner Group Inc., a market research firm based in Stamford, CT. "IBM is creating greater separation between its software products and its hardware platforms. So, just as IBM has been making products for NT, we're now seeing software products for other non-IBM operating systems." The choice of Solaris was a natural one, says Enck, given that Sun servers are common in Internet environments.

A "Suites for Linux" may be next. Dick Sullivan, vice president of integrated solutions marketing at IBM, says that in addition to Solaris and NT, customers have been requesting Linux support. IBM may announce a Linux version in the future, says Sullivan, although he can't say when that might be.

According to Joe Clabby, group vice president of Boston, MA-based research firm The Aberdeen Group, IBM benefits by having a multiplatform software package to offer customers, while Sun benefits by having a strong bundle of integrated applications. "IBM has acknowledged demand for Sun-based

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hardware and enriched that hardware with a whole suite of applications that Sun didn't have," Clabby says.

The software will be sold through Access Graphics, an international distributor based in Boulder, CO. According to Michael Minard, vice president of enterprise solutions at Access Graphics, both IBM and Sun have been eager to promote Suites for Solaris. "IBM had a specific initiative in mind for us, which was to create a channel for the Solaris versions of these products. And we also heard very strong interest from Sun for us to do this," says Minard, adding that many of his company's reseller customers have expressed a desire to sell the products. "Until we get this thing into [our] marketplace in May, I can't say for certain, but the initial response has been very positive."

IBM Suites for Solaris and AIX include Lotus Development Corp. Notes groupware and Domino R5 Application Server, IBM DB2 Universal Database,

IBM ADSTAR Distributed Storage Management software, IBM WebSphere Application Server and EnlightenDSM (Distributed Systems Manager) software for managing mixed UNIX and NT environments from Enlighten Software Solutions Inc. IBM Business Integration Suite includes everything in Suites plus IBM MQSeries messaging software, and IBM Enterprise Suites for Solaris includes both MQSeries and TXSeries middleware.

The inclusion of MQSeries is likely to be a key factor in the success of Suites, says Gartner Group's Enck. "MQSeries is probably the most popular piece of IBM server-based software being sold today. It's a very solid alternative to Microsoft's messaging software and it's very popular because it works well with heterogeneous environments," Enck says.

Support for multiple platforms may give Suites an edge over Microsoft Corp. BackOffice, which runs only on NT,

says IBM's Sullivan. He points to a survey conducted by IBM of Fortune 1,000 customers in North America, which showed that 90% of those surveyed use three or more platforms within their organization. "Heterogeneity is very real," Sullivan says.

One advantage of the product's multiplatform support is that it allows customers to manage the scalability problem often associated with Windows NT without having to rip out the NT infrastructure and invest in new applications and staff retraining. "If you've got an NT server and run out of room to support your user population, IBM can tell you to just move them to these [Solaris or AIX] boxes and you don't have to retrain people," says Aberdeen Group's Clabby. "The apps they were running on NT, now run on UNIX. That's a pretty potent message."

Whether existing NT customers will be convinced to migrate from Microsoft BackOffice to IBM Suites for Solaris

Microsoft Targets E-Commerce

Software giant Microsoft Corp. has unveiled its strategy for servicing the electronic commerce market. At the center of its approach is BizTalk, Microsoft's own definition of the World Wide Web Consortium's (W3C) eXtensible Markup Language (XML) Specification.

Microsoft says BizTalk will be a framework for integration and communication based on an open standard, and will be the successor to Windows Distributed InterNetwork Architecture (DNA). It will define schemas for specific corporate functions, such as purchasing and marketing, with an emphasis on facilitating e-commerce. "BizTalk is a way for applications to talk with one another, to share information [and] to interact," says Bob Herbold, executive vice president and chief operating officer at Microsoft.

The XML-based framework will manifest itself in Microsoft's strategy in several ways: first as DNA and then as part of its product offerings. The company plans to merge the framework into existing products, such as Windows, Office, Visual Studio and BackOffice Server. BizTalk will also be integrated with the upcoming Commerce Server, the promised predecessor to Site Server Commerce Edition, and Small Business Commerce Service.

To promote BizTalk, Microsoft has lined up German firm SAP AG to work toward creating a common XML semantic that will allow SAP's Business Framework and Business Application Programming Interface (BAPI) to communicate with Microsoft's Component Object Model (COM) and BizTalk. Other companies declaring their support of the BizTalk framework include MasterCard International Inc., Clarus Corp. and PeopleSoft Inc. MasterCard and Clarus plan to market integrated, Internet-based corporate purchasing systems based on BizTalk, while PeopleSoft

announced it will base its PeopleSoft Business Network on the Microsoft technology.

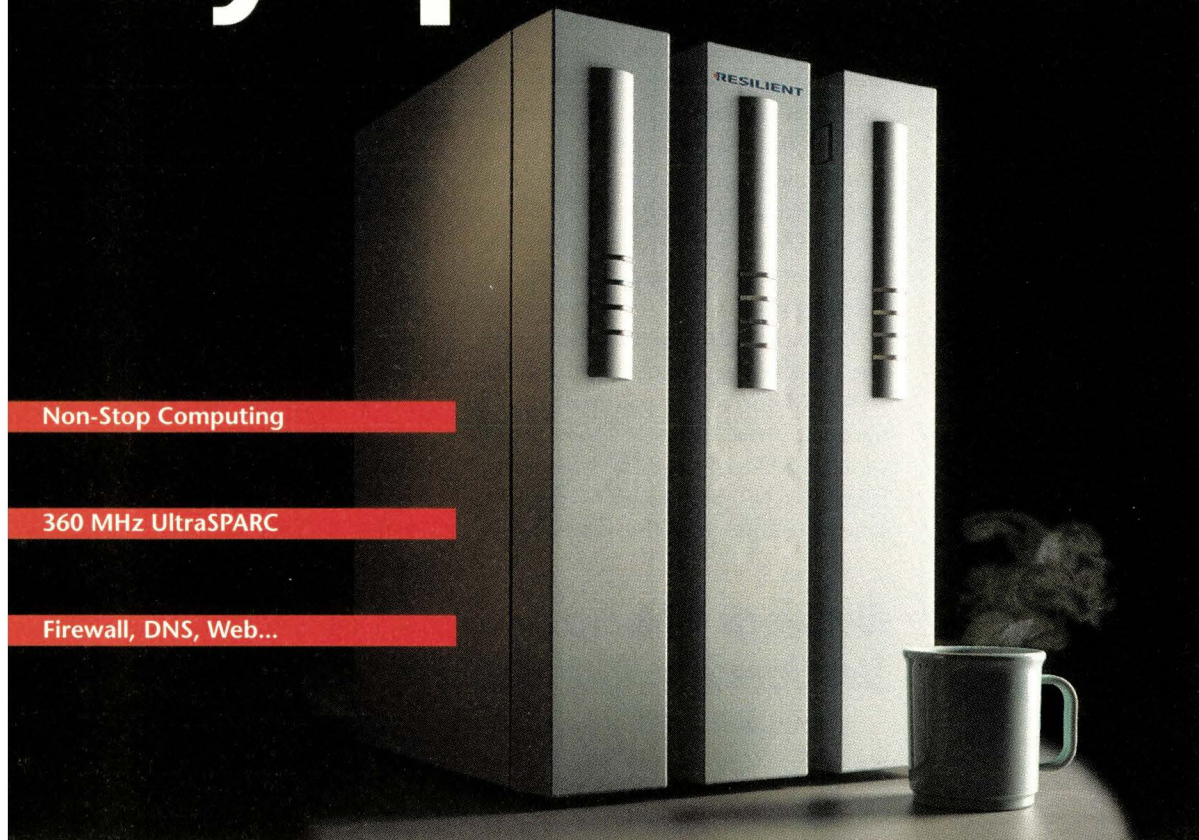
With Microsoft's plan to develop BizTalk, the lines are being drawn in a battle over XML as a data format description (DFD). Already, several companies are developing their own XML schemas, including Commerce XML (cXML) from Ariba Technologies Inc. and Common Business Library (CBL) from Commerce One Inc. Some industry watchers see this developing into a standards debate similar to the battles Microsoft and Netscape Communications Corp. engaged in over Cascading Style Sheets (CSS).

"Hopefully, Microsoft will take a more conciliatory approach to working with other vendors out there, given the hostile environments they have encountered in other battles," says Albert Pang, e-commerce software analyst at International Data Corp., a market research firm based in Framingham, MA. But he doesn't believe that will be the case. "A number of vendors have tried to maximize their leverage over some of these XML schemas, specifications and protocols. It will be a nasty battle."

Microsoft also plans to expand its portal strategy for MSN to include online shopping capabilities. This will include online design tools that will allow designers and small businesses to create commerce sites via their Web browsers.

The overall reaction to the strategy has ranged from confusion to praise, but one thing is clear, until actual products and services are made available, it's all talk. "There will not be any dramatic impact on the e-commerce software market in the near term," says Pang. "Microsoft is trying to play catch-up. I think they will eventually get it, but that's going to take a while."—*ptc*

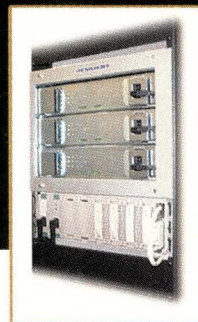
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solely for the cross-platform capabilities, however, remains uncertain. "The question is whether people will look at UNIX as an alternative to NT for back-office types of applications. Large organizations who are looking for more stability and reliability than NT currently has to offer will probably look favorably on IBM Suites for Solaris. But there just aren't enough applications written that use some of the components in it. For instance, there are more applications written using [Microsoft's] SQL Server than DB2. That may change over time, but today, the database world in Microsoft's land is mostly Oracle [Oracle Corp.'s Oracle 8 database server] and SQL Server," says Gartner Group's Enck.

Pricing for IBM Suites for Solaris was not available at press time, but Sullivan says IBM intends to maintain prices similar to those for its NT-based suites, which are \$2,239 for IBM Suites for Windows NT and \$16,249 for IBM Enterprise Suites for Windows NT.—*sjh*

Network Directory Vendors Eye Internet

Network directories may not have the allure of sexier products like application servers and e-commerce software, but they are, nonetheless, critical components of all major networks—even a network as vast as the Internet. And now two companies, Novell Inc. and Oracle Corp., have decided to go after the emerging Internet directory services market with Internet-sized products.

In February, Oracle announced its Oracle Internet Directory (OID), a directory services product aimed at large enterprises and Internet service providers (ISPs). Designed to handle up to half a billion entries, OID is available in two flavors: an Enterprise Edition for large corporations and a Hosting Edition for ISPs and telecommunications companies. Contact Oracle for more information and pricing on OID.

At the same time, Novell announced the latest edition of its own directory services product, Novell Directory Services (NDS) Version 8. This new edition is capable of storing up to half a

billion objects, such as individual user data and the names and locations of network resources. The previous version, 7.02, had a capacity of 2 million objects. "It's aimed at anybody who has a highly centralized environment, such as ISPs and large [telecom] carriers," says Michael Simpson, director of strategic market planning for Novell.

So far, there aren't many organizations, including ISPs, in need of a directory that scales to a half-billion or more objects. But Anthony Hopp, cofounder of EOS Inc.'s SpringNet, an ISP based in Springfield, IL, says he wouldn't be surprised to see such capacity needed by large ISPs down the road. The reason, says Hopp, is that Internet services have become more complex, customized and security oriented. Thus, they require more information about the users who can access them. This will increase the amount of data that needs to be stored in a directory. "As Internet services become more profile-oriented, you're going to start replicating all of the profiles for all of your Internet users. So you may see larger ISPs starting to need capacities approaching a half-billion," Hopp says.

ISPs will be the first but not the only customers to take advantage of the half-billion-object limit, predicts Rick Villars, director of network software research for International Data Corp. (IDC), a research firm based in Framingham, MA. "For large enterprises, if they're driven by e-commerce or by having to support more external users on their resources, half a billion is not an unattainable number. Where that kind of scale becomes interesting is with external activities, such as when you have 100,000 customers, which you expect to grow to one million, and you want to keep 20 or 30 attributes on each of them," Villars says.

In fact, the two announcements contained more indications of cooperation than competition. The two unveiled plans to work together to bring support for Oracle's 8i database to Novell's NDS v8 product, so it can use Oracle 8i as its data store (OID is already built onto the 8i database). Both the Oracle and Novell products support Lightweight Directory Access Protocol (LDAP),

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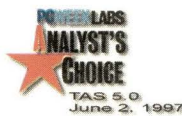
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security features such as Secure Sockets Layer (SSL) and digital certificates. The two companies will also collaborate on security integration to enable users to use a single sign-on for access to all Oracle and Novell enterprise solutions on a network, and jointly develop extensions to LDAP to address data replication, user authentication and other security issues.

Novell's Simpson says that, while

Novell doesn't have a specific timeline for adding Oracle 8i support, it expects to provide it sometime next year. "A customer might say, 'I want all the benefits of integration and management that NDS provides, but I also want to be able to do some of the Oracle-specific developments.' So this gives us the best of both worlds."

Novell's product also supports

Domain Name System (DNS) and Dynamic Host Configuration Protocol (DHCP), allowing customers to access information stored in DNS and DHCP server databases. NDS v8 will be available on NetWare 5 by the end of the second quarter and will be released on Windows NT and Solaris later this year. NetWare 5 customers can currently download a free beta version of NDS v8 from Novell's Web site.

Directory services, which identify all resources on a network—such as computers, peripherals and email addresses—and make them available to users and applications, already come bundled with various products from enterprise resource planning (ERP) applications to network routers. However, NDS and other products such as the Netscape Directory Server from Netscape Communications Corp. (now owned by America Online Inc.) and the Active Directory component of Microsoft Corp.'s upcoming Windows 2000 operating system are competing in the market for central, enterprise directories that coordinate information from other, subdirectories over a network. The Internet, being the largest network and most promising market, is a natural next step for these large-scale directory providers. "The directory is a good entry point into the Internet world of e-commerce and ISPs," IDC's Villars says.

Oracle, which has not been a player in the enterprise directory services market before, has recently been pitching itself as a provider of "Internet platform" products and is treating enterprise directory services as a component of that strategy—as well as a possible threat to its database business.

"It's hard to imagine a vendor more threatened by directories than Oracle," says Tim Sloane, analyst with Boston, MA-based research firm The Aberdeen Group. "A directory is really a function-specific database. And Oracle is the largest vendor of repository systems in the world. So where directories start to position themselves as repositories of corporate data, that threatens Oracle. The problem is that Oracle, to its bone, is a database company, and I don't see them fundamentally changing that with this announcement." —*sjh*

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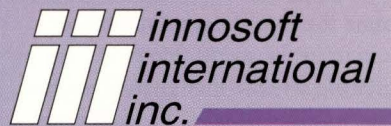
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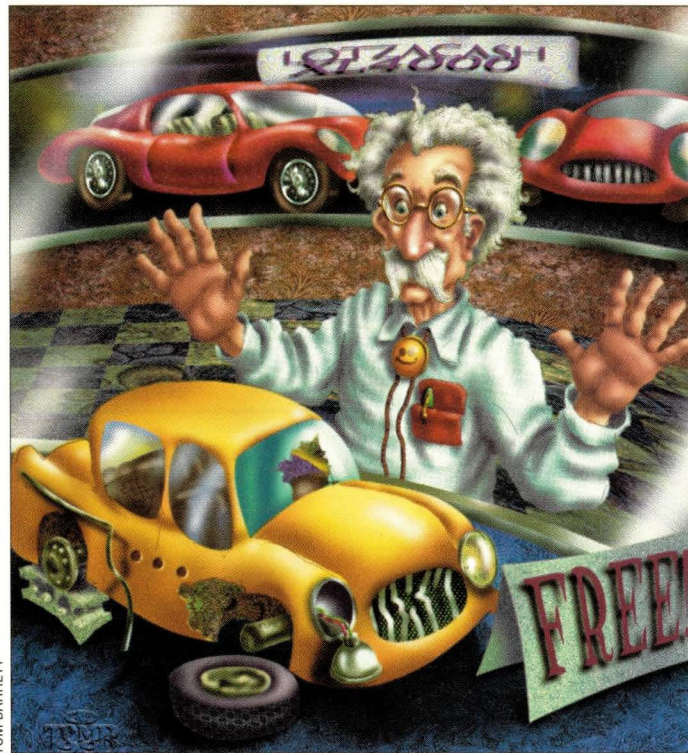
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Q: *I got this great bargain: Juno gave me a free mailbox! Only, one day last month, not a single message I sent was delivered. Juno never replied to my email asking what happened, either. Can you explain what's going on?*

A: Oh, I think we might make a blind stab at it. Way back in prehistory, which Mr. Protocol defines as the days before IMP #1 was powered up, there was a fellow in Los Angeles named Muntz, who sold cars, appliances, tape decks, cell phones, you name it. Unfortunately for him, Mr. Muntz was a man of some intelligence. Now, selling appliances is dull work, particularly after you've been doing it for 10 or 20 years, and the boredom eventually cost him his sanity. This was the best thing that ever happened to him, as "Mad Man Muntz" became the most famous appliance salesman in the world. He pioneered a marketing scheme that guaranteed him a large number of sales. He sold every-

thing below cost. "I make it up," he said, "on the volume!"

Mr. Muntz died not too long ago, apparently a rich man despite his unusual approach toward finances. One can only hope that his heirs and assigns have taken up business on the Internet, as it appears to be evolving into a financial model that puts Mr. Muntz's original business plan to shame.

The Internet, of course, started out as a strictly not-for-profit proposition. It is, perhaps, difficult to imagine what that Net was like for those of you who were not there. It was almost entirely text-based, for one thing, in the absence of the Web. The Web itself started out as a text-oriented service. Person-to-person communication was about all that went on there, aside from the giant FTP repositories, many of which are still around. Mailing lists, anonymous FTP and Usenet traffic made up the bulk of traffic on the Net.

And absolutely everything was free. The Net did not cost anything, at

least from the perspective of most users. The ARPANET cost around \$200,000 per year for each host connection, but it was extremely difficult to actually wind up paying for this. Connectivity to the ARPANET was limited to those who had certain types of federal research contracts. Those who had hosts on the ARPANET were on the hook to pay \$200,000 per year, but they were expected to turn around and write this into their Advanced Research Projects Agency (ARPA) research contracts as an expense. ARPA, therefore, wound up footing the bill for practically all of the host connections. (N.B.: ARPA/DARPA has changed its name so many times that Mr. Protocol has decided to call it by whatever name it had when the events being discussed took place. In the early days, it was mostly ARPA.)

International connectivity was practically nonexistent, of course, because it was a U.S. defense network. There was an ARPANET IMP or two in Ramstein, Germany, and that was about it.

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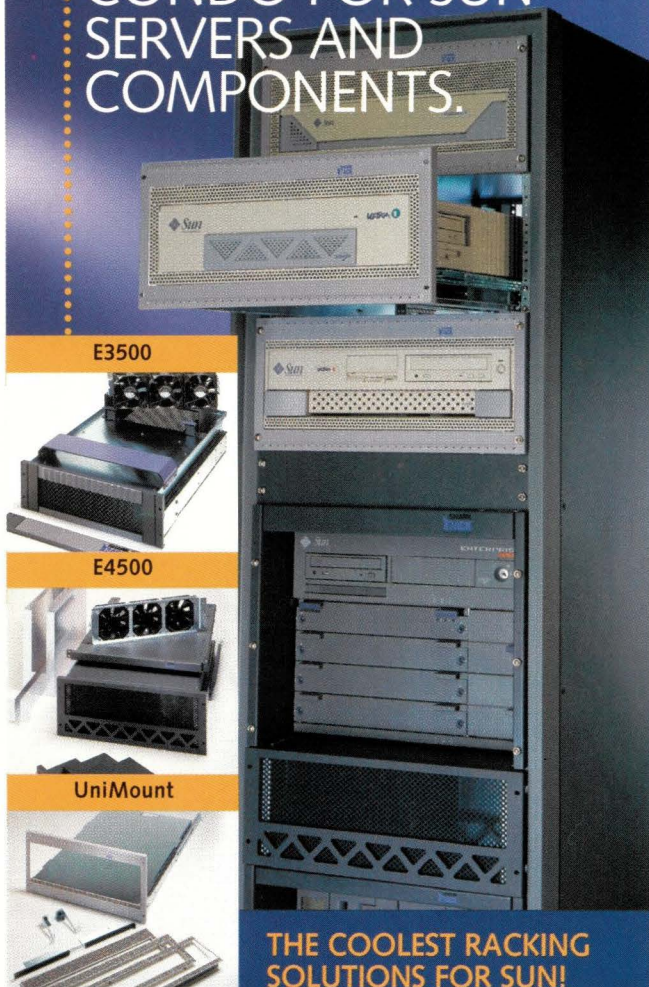
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(IMP #1 was built like a battleship and had a giant steel ring on the top, reputedly so it could be craned into a submarine. There is no hard evidence that an IMP ever went into a sub. Certainly, IMP #1 never did. It sat in Boelter Hall at UCLA for years and years and the most adventurous thing that ever happened to it was the time it was visited by the original Robbie the Robot. A companionable picture of the two machines in close consort graced the side of the IMP ever after, looking for all the world like one of those celebrity pictures in restaurants.)

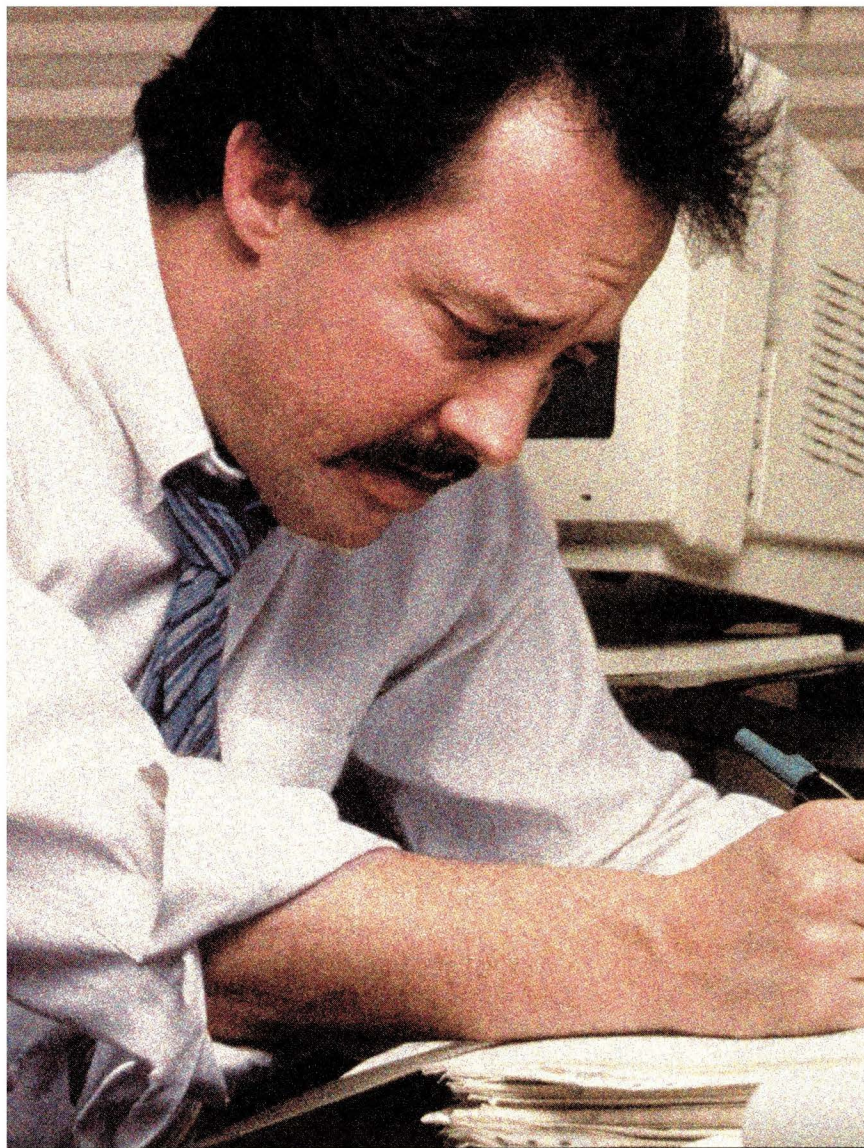
For better or for worse, anything that a) costs a huge amount of money, b) has members who aren't pinched by that cost and c) limits its membership to a specific cadre, strongly resembles a gentleman's club. Certainly, it shares most of the pluses and minuses. The network world was sharply divided into the "haves" and "have-nots," where the "haves" rarely heard from the "have-nots" except at professional meetings, because the "have-nots" couldn't share the network environment of the "haves," by definition. Finally, the National Science Foundation decided to fund a seed project to turn "have-nots" into "haves" on a pay-as-you-go basis, and the Computer Science Research Network (CSNET) was born.

CSNET, however, still had a distinctly academic air about it. Certainly, its commercial members did not garner the email addresses of everyone on the Net and spam them with commercial email. The closest thing CSNET had to a commercial publication was the online "CSNET Forum," a monthly publication of news and columns. And the closest thing CSNET had to Mad Man Muntz was YHOS, Mr. Protocol, in his first incarnation, where he said things in the rashness of his youth that today's editors and publishers wouldn't come close to printing.

(In fact, Mr. Protocol suffers from no censorship today, but suffered considerable censorship in those days. Each column would be greeted with roars of laughter from offices up and down the hall, and then Dick Edmiston, CSNET Director, would come into the office of Mr. Protocol's amanuensis, chuckling and wiping tears from his eyes with his necktie, and say, "That's brilliant. I'm afraid we can't send that out." What was so scandalous about those columns? Mr. Protocol is glad you asked. Heh.)

CSNET did not exactly open the floodgates, but it did establish grounds for opening them. It showed that the Internet would not come to an abrupt end if nets other than the ARPANET were allowed into the pool. A trickle of independent Internet service providers (ISPs) became an eventual flood, and some people started to make serious money.

They made it in the traditional way, though: flat-rate service agreements. The ARPANET had a flat-rate access policy, because ARPA wanted the ARPANET to be used and did not want people a) pinching bits, or b) trying to figure out how to put variable expenses into a fixed-price research contract. The fact that this created a political movement that adheres to the notion of fixed-price Internet access as a constitutional guarantee was never foreseen or intended. Whenever people thought about the "far" future at all, usage-sensitive pricing for Internet services seemed to make as much sense as anything because that's what the phone companies do, and every-



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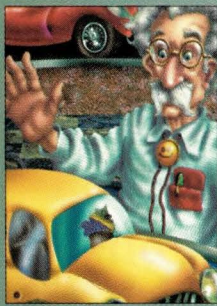
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one sort of figured the Internet would be like phone service, as much as it was like anything familiar. Be it here noted that many Internet founders have given up prognosticating what this cockamamie Net is going to do next.

It is very probable that, had the Internet been developed anywhere else in the world, it would have been priced by usage from its very earliest days. "All you can eat" is a peculiarly American marketing gimmick. Its staying power in today's Internet is a testimony to the ferocity of the American consumer in pursuit of a bargain.

Most of the national backbones are owned by companies that carried telecommunications traffic before the Internet became widespread and, hence, are quite happy to charge midline networks and smaller ISPs by the megabyte. Squeezed by consumer insistence on flat-rate pricing from below, and usage-sensitive pricing from above, front-line Internet providers have had to become creative.



'All you can eat' is a peculiarly American marketing gimmick. Its staying power in today's Internet is a testimony to the ferocity of the American consumer in pursuit of a bargain.

The first flat-rate fees were based on educated guesses. No one had a long track record in this business. Some early ISPs had previous incarnations as BBS operators. They knew how to run at least a few dial-in lines. None had experience with routing and connecting to the Internet backbone in a commercial environment, though many had previous experience in maintaining university systems. Most had to learn that university notions of uptime and commercial versions of uptime differ. Well, let's admit it, many ISPs have never learned that lesson. These deluded fools believe that sleep has priority over keeping the Domain Name System (DNS) server running. This is why larger, business-oriented providers have a leg up over smaller providers. Smaller providers have lower overheads, but larger companies can afford to hire people to nursemaid the routers and cover the phones all night, for truly pitiful amounts of money.

As the Internet began to ramp up, flat-rate pricing became one of the main competitive factors. Most individual customers had a relatively small number of providers to choose from, if the selection were to be held to those providers who had dial-up numbers that were a local call away.

Increasing competition led to price wars on flat-rate service, until it got to the point where no one could make a profit being a straight ISP anymore if competition were limited to price. At this point, the market fragmented and went in several different directions at the same time. This sort of behavior isn't possible except under conditions of extreme growth. Under

these conditions, anyone can succeed with any kind of business plan as long as a few elements are covered: you've got to attract customers and you've got to pay the bills. In most lines of work, both of these are difficult. In the Internet business both of these are currently very easy. The only difficulty is finding capitalization, mostly because all of the ready capital has already been invested.

Now we have several kinds of providers. Some emphasize service and availability ("no busy signals!"). Some still emphasize price and squeak by on margin. Recently, a third style of provider has arisen. They go Mad Man Muntz one better: they give their product away for free. And yes, they do expect to make it up in volume.

Now before we go any further, I need to make something clear. Mr. Protocol deals with the protocols these people run over the Internet to deliver their services. He does not deal with the business end of things. This is a good thing. Mr. Protocol knows everything there is to know about protocols, of course, but regarding business matters, he's as loony as a three-humped camel. But although Mr. P. is alone in many things, he is not alone in this.

The entrepreneurial spirit is not rare in humankind. The problem is most people who have it, apply it to lunatic enterprises. One might as well try selling socks to starfish as try what some of these people come up with. But what makes even Mr. Protocol laugh, economic ignoramus that he may be, is that most economic pundits write long, serious analyses of the secrets of business success on the Internet...and mean it.

The Internet is so new that it doesn't even itself have an economic model of operation. People just lay fiber and charge what the market will bear—literally. There is no government regulation to speak of, in the United States at least. Using this unregulated medium to make money is about as risk-free as the California Gold Rush of 1849—some make it, some don't and, for the most part, the law will keep you from killing one another but it sure won't help if you go bust. The nice difference here is that you're not limited by the physical rarity of gold; you get to make it up as you go along.

The people who got rich in the gold rush were, primarily, the ones who saw a need and filled it. Levi Strauss had a novel idea about making pants. Cabot Yerxa filled two steamer trunks with cigars and took them to the Alaskan gold fields, where he got rich from the proceeds. When Yerxa later came back south to found the town of Desert Hot Springs in California's Coachella Valley, he proved he was as loony as a bass on a bike. Those who visit his house in the desert will find that fine tradition continues today: The guide holds occasional conversations with the pilots of flying saucers. None of this stopped Yerxa from getting rich.

So the ones who provide free email, Web services and even Internet access do have a method in their madness. Advertising pays the bills on Juno, Hotmail, Webjump and the rest. It's a back-to-front business model. Don't charge the customers, charge the people who put up the ads. You're selling other people's businesses.

The epitome of this so far is the outfit that is giving away free PCs to people who are willing to allow the company to

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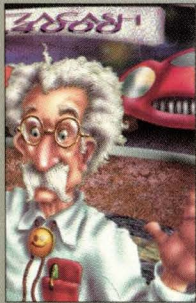
track their every move on the Internet while using the PC. At this writing, the number of requests for a free PC is best characterized as “Wahoo!” Either millions of people have no intention of ever visiting a porn site, or they just don’t care who knows about it. Or they figure they can get around the reporting requirements somehow, possibly by changing the name on the mailbox and covering the front step with bear grease to discourage visitors.

What’s interesting is that this is a model we’ve seen before. This is television.

It’s on TV!

Television started out with people broadcasting just about anything that would stand in front of a camera. Advertising came along shortly thereafter, and when it had settled into a sometimes uneasy, sometimes accommodating relationship with the programming department (i.e., the advertiser always wins), television had an economic structure that has lasted from that day to this.

Television could have been supported in any number of ways. British readers are already quite familiar with another model: Everyone who owns a TV pays a license fee, a publicly supported pseudo-corporation makes most of the product and commercial interests make the rest. It’s as if PBS and the networks swapped channels.



In a libertarian sort of way, this is freedom. You pay top dollar, you get premium service. You pay no dollar, you get most-of-the-time service, plus ads. You pay in-between, you get in-between.

Now providers are trying on the notion of advertiser-paid Internet services instead of user-paid, ad-free services. Their belief is that people will put up with all sorts of advertising if they get their email, their Web surfing, their Internet access, even their PC, for free. How well is this likely to work?

Mr. Protocol figures it comes down to a matter of service. When packets don’t flow, when email goes missing, Mr. P. is Johnny-on-the-spot. This is his bread and butter. One might predict that when advertisers are the ones funding the operation, advertisers are the ones who get the attention. While, technically, the ads are being fed to the users, the business view of this model is that users are being roped in off the street and fed wholesale to the advertisers. If a day’s worth of user email gets lost, well, the marginal cost is that a small percentage of users will drop off the service and go elsewhere—the bulk will remain. And, likewise, there’s no real reason to spend a lot of money on user support, because users who need a lot of support aren’t really worth the candle. “Free” makes up for a lot of bad word-of-mouth. You get what you pay for, after all.

And this observation is key. Look at other media. Television is free in the United States, except for “public television,” paid for by a combination of government and private grants and voluntary subscription. About half the television in the United Kingdom is paid for by the government via licensing fees while the other half is commercial, à la the U.S. model. Newspapers and magazines are universally paid for by a combination of user fees and advertising, but books are paid for entirely by the user. Movies in U.S. movie theaters are paid for by the user, except some advertising is creeping in. It has been in the United Kingdom for years, lots of it, and the only visible benefit is reserved seating, offset by higher ticket prices (someone’s making a boodle over there).

The Internet doesn’t have a solid model yet. Amazon.com is capitalized in the billions but, by many reports, has yet to show a profit. Who knows how Juno, Hotmail, Webjump and the rest are doing? Often, you don’t find out how a site is doing till it disappears.

Possibly, the Internet will become a stratified economy. People are already known, or stigmatized, by the company they keep. Many mailing lists refuse to accept subscribers with mailboxes on America Online, because AOL users are stigmatized as being incompetent “newbies” who are universally ignorant of the rules of decorum on mailing lists. People with Hotmail or Juno addresses are not regarded as heavy hitters, except for those who are using such accounts as spam deflectors. Tired of spam? Recycle your public email address every three months.

And so forth. Currently, one can pay a wide range of prices for nominally identical services. In a libertarian sort of way, this is freedom. You pay top dollar, you get premium service. You pay no dollar, you get most-of-the-time service, plus ads. You pay in-between, you get in-between.

Within a given economy, media have always flattened out. You don’t find many magazines with no advertising, and you don’t find many free magazines. You don’t pay for television in New York and watch it for free in Los Angeles. Yes, I know, never mind about cable. But you can either pay for email, or not; pay for Web hosting, or not; pay for access, or not. And you can pay a lot, or a little, your choice.

If this stratification remains, and it shows no signs of disappearing anytime soon, it may mean that the Internet is not a single medium. It is a space in which media are created. That’s worth thinking about. ➡

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@cpq.com.

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UNIX Basics

by Peter Collinson, Hillside Systems



xterm

In the wake of my article on rlogin ("The rlogin Program," *SunExpert*, December 1998, Page 22, <http://sw.expert.com/C2/SE.C2.DEC.98.pdf>), someone sent me an email suggesting I do an article on xterm. "Good idea," I thought. However, the original email from my correspondent has disappeared, so I cannot credit him publicly, sorry.

I use the Common Desktop Environment (CDE) on my Solaris system, but I still prefer to type into the machine using the xterm program. There are a couple of reasons for this. First, you can run xterm using different foreground and background colors, and you can also set the color of the text cursor to complement your choices. I use colors when I log into different machines so I can easily tell which window contains a connection to which machine. Second, I find the cut-and-paste model provided by xterm to be the "right way" to do things; it has minimum mouse interaction for maximum effect.

If you want to use xterm under CDE, then you'll have to work a little to find it. It lurks, seemingly unappreciated, in `/usr/openwin/bin`. Assuming your search paths are established to include this directory, you can type xterm into a terminal window and get an invocation of the program running. I've used the Create Action tool to make a clickable icon on my desktop that runs xterm for me. Spending a little time creating an action is worth it because you can then add the icon to the control panel's pop-up menus, saving time later.

The xterm program is a terminal emulator supporting the Digital Equipment Corp. (DEC) standard VT100, VT102, VT200 and VT300 programming models for terminals. It also supports Tektronix 4014 terminals that use storage screens to display vector graphics. I suppose there are numerous people out there who've never come across a storage tube terminal, so a little digression into history is in order.

In the early days of graphical output

from computers, several companies adapted the cathode ray tube technology that started in oscilloscopes. The oscilloscope uses X and Y inputs to position the cathode ray beam on the screen. The beam creates a small dot of light. By applying a time signal, the beam is moved over the screen, leaving a trail in the phosphor. The phosphor retains the image for a short period of time, but the brightness gradually decays. However, when the moving beam is coupled with the miracle of persistence of vision in humans, then the excited areas of the screen can be seen as a static image of equal brightness by the viewer.

A computer can use the same technology to move the beam and then generate a drawn image. We ended up with devices like the DEC GT40, which was a PDP-11-based graphics processor that endlessly executed a list of vector commands and generated an image on the screen. This device was undoubtedly used in early CAD/CAM applications, but is probably more noted for its

Moonlander program, which still persists in arcade games.

The GT40 needed a processor to continuously execute a sequence of commands because it used a short persistence phosphor for its display, so the image faded allowing animation and change of information. There are other phosphor technologies that can be used. The Storage Screen oscilloscope can capture a single event on the screen, storing the track of the beam in the phosphor for some appreciable time. The image either gradually decays or can be cleaned from the screen by flooding the screen with electrons.

Tektronix used this technology to create computer displays. The device could accept a nontime-critical sequence of vector commands from the computer and draw an image that was retained on the screen until it was cleared. The device was used in early UNIX systems and became a de facto standard output device for many early graphics programs. At the time `xterm` was created, it seemed natural to want to use this software, so the Tektronix emulator was born. Until recently, I used this emulator with the `plot` and `graph` programs to see a graphical representation of the electrical usage in my house. My scripts now generate PostScript.

Incidentally, an ex-colleague of mine, John Bovey of the University of Kent in England, wrote a lightweight X11 terminal emulator called `xvt` around 1992. It omits all the largely unused Tektronix code. This became popular on early Linux systems because it was fast and small. It has now moved into the hands of others and become `rxvt`.

Using `xterm`

The `xterm` program works in a similar way to `rlogin`. However, rather than interacting with a server on a remote machine, the program communicates information with the X server that controls your screen. The X server sends the characters that you type into the running `xterm` process as X events. The characters are in turn passed by `xterm` into an application. Output from the application is captured and sent back to the X server to be placed on the screen. The application is usually a shell running the commands that generate output destined for your screen. The shell and other programs need to be fooled into thinking that they are talking to a terminal. To achieve this transparency, the `xterm` program talks to the control end of a pseudo-terminal and the commands communicate with the “user” end of the pseudo-terminal, which provides the necessary terminal interface.

By default, `xterm` will start your favorite shell taken from your `SHELL` environment variable. It doesn't have to; you can start an arbitrary command. For example,

```
$ xterm -e vi
```

executes the `vi` command in a new window. The `-e` parameter should be the last element on the command line and this restriction allows you to supply program arguments:

```
$ xterm -e vi filename
```

The window will disappear when the `vi` command terminates.

So typing something like

```
$ xterm -e ls
```

will run the command in a new window, but it will stop quickly and you may not see it. Incidentally, the `-e` argument is supported by `dtterm`, the standard CDE terminal emulator.

Cut and Paste

I mentioned that one of the things I like about `xterm` is its easy-to-use cut-and-paste operations. The description that follows uses the default button settings. If you are left-handed, you may wish to change them. I generally feel that it's a bad idea to change default settings that are fundamental to the use of a program because you'll find it difficult to use other people's desktops. You must “take a view on this,” as lawyers say.

For cut and paste, you start by sweeping out an area with the left mouse button. Point at the start of the area you want to pick up, hold the left button down and move the mouse. The area you are about to pick up will be highlighted. It is loaded into the cut buffer and can be deposited in another window (or part of the same window) at the cursor position by pressing the middle button. If you've included the end of a line in the selection, you'll insert a new line when you press the middle button. The information is stored and can be inserted as many times as you like, until you reload the selection buffer.

If you double-click the left mouse button, you'll find that a “word” is highlighted; triple-clicking will pick up a whole line. The right mouse button is used to extend any selection that you have made. It can be used in sweep mode, or just pointing to a spot further down the screen and clicking with the right button will extend the selection. Another way to create a selection area from scratch is to click at the start point with the left mouse button and then at the end point with the right mouse button.

Incidentally, it's useful to know that you can perform cut and paste while holding down the Shift key. So if the application in the `xterm` window has used mouse buttons for its own editing application, and this doesn't work with the normal selection buffer mechanism, you can use Shift with the mouse keys to obtain “global” cut and paste. When working with my editor, I actually find it useful to have both an application-specific cut buffer and a window-wide one.

And, oh yes, if you use certain other operating systems, you will find you can cut and paste text in and out of certain parts of your screen and not others. This, to me, is deeply annoying. It's very unusual to find any application running under X that doesn't permit the pasting of text into a suitable place.

Scrolling

There are several values in the `xterm` program that can be set either from the command line or from X resources to change the default behavior of the program. I generally call `xterm` with

```
$ xterm -sb -sl 2000
```

The `-sb` flag adds a scrollbar to the screen permitting access

to the information that has scrolled off the screen. It's a history of what has happened, so you can scroll back up the screen to see what has happened before. The `-sl` option gives me a 2,000-line history that I can scroll into rather than the default 64 lines.

You can turn the scrollbar on and off via the `xterm` control menus. If you hold down the Control key and press the mouse buttons at the same time, you are presented with one of three menus, depending on which mouse button you have chosen. The middle button allows you to turn options on and off. Actually, I hate this kind of secret chorded keystroke, it's one of the "problems" with X.

When you have scrolled the screen looking back at the history, you will move the active last line out of sight at the bottom of the screen. By default, `xterm` will reposition the screen when it receives further data from the application. This can be annoying if you are using `tail -f` to watch a log file and have scrolled up to look at some previous activity. You can turn off this behavior by using the control menu, or by supplying an `-si` flag to the program on start-up. You can also make `xterm` automatically jump to the last line when you type something. This action is turned off by default. I find the default settings for scrolling are generally tolerable.

Putting Color on Your Screen

There are several parameters that are used to permit `xterm` to display in different colors. You can supply these from the command line, and I generally do this while I am testing for viable color combinations. For example, to set up an `xterm` with a dark blue background, white text and a yellow text cursor, you type

```
$ xterm -fg white -bg darkblue -cr yellow
```

You may also want to add the scrollbar options I mentioned earlier. The color names are taken from the `rgb.txt` file, which lives in `/usr/openwin/lib/X11` on my system, although there are symbolic links from elsewhere.

The colors can also be specified by X resource names that are somewhat more lengthy (I've wrapped the lines below for printing; when entering this text use one line, and remove the backslash characters):

```
$ xterm -xrm '*foreground: white' \  
-xrm '*background: darkblue' \  
-xrm '*cursorColor: yellow'
```

The `-xrm` option is standard with every X command and supplies a value to the X resource manager. Each X application consists of a hierarchy of named objects known as "widgets." Each widget has a set of resources that can be set internally in the program, but also from outside the program. The result is you can tailor your X application to your own needs once you understand the set of rules.

In the example above, I am using the star (*) operator in the same way I do when looking for files in the file system tree. It sets every widget with a named resource of `foreground`,

`background` or `cursorColor` to the argument value. The command may be somewhat too overpowering because it will set the menus to the color set and you may not want to do that. I usually want to be more specific and only change the colors in the `xterm` window. The `xterm` window is called `vt100`, and because I am invoking the command using `xterm`, the application will be called `xterm`. So to only set the colors in `xterm`, type

```
$ xterm -xrm 'xterm.vt100.foreground: white' \  
-xrm 'xterm.vt100.background: darkblue' \  
-xrm 'xterm.vt100.cursorColor: yellow'
```

If you try this, you'll find that the menus are now the default color. Before trying to change that, let's make it easier to use this setup. Incidentally, you can replace the `xterm.` string at the start of each name with a star if you want to save typing.

Now that we are happy with our settings, we can load them into our `.Xdefaults` file so that we don't have to type all this stuff every time we want to invoke the command. I expect you are relieved about that.

One of my aims was to provide different color settings for the different machines I use, so when we edit our `.Xdefaults` file, we want to add lines that are tagged with a specific name. My main machine is called `craggy`, so I have the following lines in my `.Xdefaults` file:

```
craggy.vt100.foreground: white  
craggy.vt100.background: darkblue  
craggy.vt100.cursorColor: yellow
```

If you are using CDE, there's a button called Reload Resources in the Application Manager under Desktop Tools. When you edit your `.Xdefaults` file, you'll need to run this application to ensure your X server is given the new settings. If you are not using CDE, then you will find a command to load the resource in your start-up sequence somewhere, and you'll need to type

```
$ xrdb -load .Xdefaults
```

Once that is done, you can type

```
$ xterm -name craggy
```

and now whenever we name the `xterm` as `craggy`, it will use the settings we have established for that named application. Note that most programs read information from the resources database only on start-up, so changing some settings will only affect new invocations of the program. Also, make sure the settings work before logging off, otherwise you may log in again and find that the system is unusable.

Changing the menu colors is a little more complicated and uses some X magic. In `xterm`, menus are "pop-ups" and don't really have obvious names in the hierarchy of widgets in the application. We want to say, "set these colors whenever you start up a menu." In X-speak, we need to affect the *class* of menu objects. We do this by using a capital letter when we set the

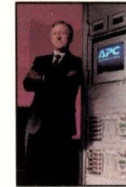
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resource. So to change the menu colors for `craggy`, we'll add some text to our `.Xdefaults` file:

```
craggy.SimpleMenu*foreground: darkblue
craggy.SimpleMenu*background: yellow
```

I'm not exactly sure what exists underneath `SimpleMenu`. I don't care either. I can use the star operator to fill in the missing bits for me.

Right, I can devise several color schemes for different invocations of `xterm` and so I am ready to take the next step of running `xterm` applications on different systems. I'll leave the full horrors of this for another time.

Looking into my `.Xdefaults` file reminds me that I have some other default settings for `xterm` programs. They apply to every invocation of `xterm` because the entries in the file start with a capital X.

The first line changes my keyboard's default behavior and adds a new translation for my keyboard:

```
XTerm*VT100.Translations: \
    #override Ctrl<Key>space: string(" ")
```

This ensures that my applications are sent a space when I type Control-Space. I did this eons ago and seem to recall that otherwise Control-Space generates nothing. I found that when using my editor it was convenient to generate a space so that my somewhat inaccurate typing would find the correct character.

The second entry changes the way a word on the line is constructed when you perform a double-click to select it:

```
XTerm*charClass: 33:48,37:48,45-47:48,64:48,126:48
```

This is a comma-separated list of values. Each value is separated by a colon. The number (or number range) before the colon is a value in the ASCII character set; the number after the colon is 48 in this case, putting the characters into the same group as the alphanumerics used in words. Easy? Well, no. Dreadful.

When you select a word by double-clicking, `xterm` scans on either side of the cursor to select the characters that comprise the word. When creating the selection, it scans outwards from the cursor position (in both directions) until it finds a character that isn't in the character set indicated by, in this case, 48 in the lookup table.

It's often convenient for a word to contain some nonalphanumeric characters, so you can select file path names in one double-click action. The setup line above was suggested from the `xterm` manual page and adds exclamation mark, percent, dash, period, slash and ampersand to the list of characters that are deemed to be a part of a word. Recently, I've added tilde to this list (126).

Setting Banners

The `xterm` program can set the window title bar so you can place useful information into it. I put the name of the machine and the current working directory in the title bar.

I've published this tip before, but it always seems to provoke interest so I don't feel too bad about printing it again. (Incidentally, this also works with `dtterm`.)

You send standard terminal setting sequences to the running `xterm` program, causing it to change the title bar. The sequences form a private extension to the ANSI standard, so they will be accepted on any ANSI terminal and should be discarded when not recognized.

The sequences involve control characters and I will use the `echo` command notation to show this. So in the sequences below, `\033` is the single character Escape and `\007` is the character Control-G. You will need to quote them to your editor to get them inserted into the file.

In order to load a string into the title bar for X, you will need to send

```
\033]2;string\007
```

That's Escape, a closing square bracket and the digit "2" at the start of the line. You can also try this out with the `echo` command:

```
$ /bin/echo -n '\033]2;Hello\007\c'
```

I'm using `/bin/echo` because it supports the use of escape sequences. The built-in `echo` command in your shell may not. You can type `\033` to get the Escape character sent by the command and `\007` to get Control-G. The `\c` at the end of the string means that `echo` will suppress the new line that it normally appends to the end of its output. We don't want that because we are sending a sequence that is interpreted by the terminal emulator. If you now type this into your shell, you should see the title bar set to "Hello."

If you replace the "2" immediately before the semi-colon in the sequence above with "0," then the string will change the title and iconic name of the window. Also, you can change just the icon name by using "1."

You can now easily make a private command that will retitle your screen. Simply create a file called `retitle` in your private `bin` directory, which contains the following:

```
#!/bin/sh
/bin/echo '\033]2; '$*'\007\c'
```

and off you go. The `$$` shown above is replaced by the arguments to the script. Putting the escape sequence into a `cd` command takes quite a bit of explanation, which I don't have space for here.

The best source for information about `xterm` is the manual page, which, to be honest, is not exactly easy going. However, nothing ventured, nothing gained. →

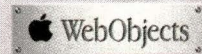
Peter Collinson runs his own UNIX consultancy, dedicated to earning enough money to allow him to pursue his own interests: doing whatever, whenever, wherever... He writes, teaches, consults and programs using Solaris running on a SPARCstation 2. Email: pc@cpg.com.

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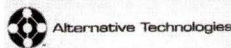
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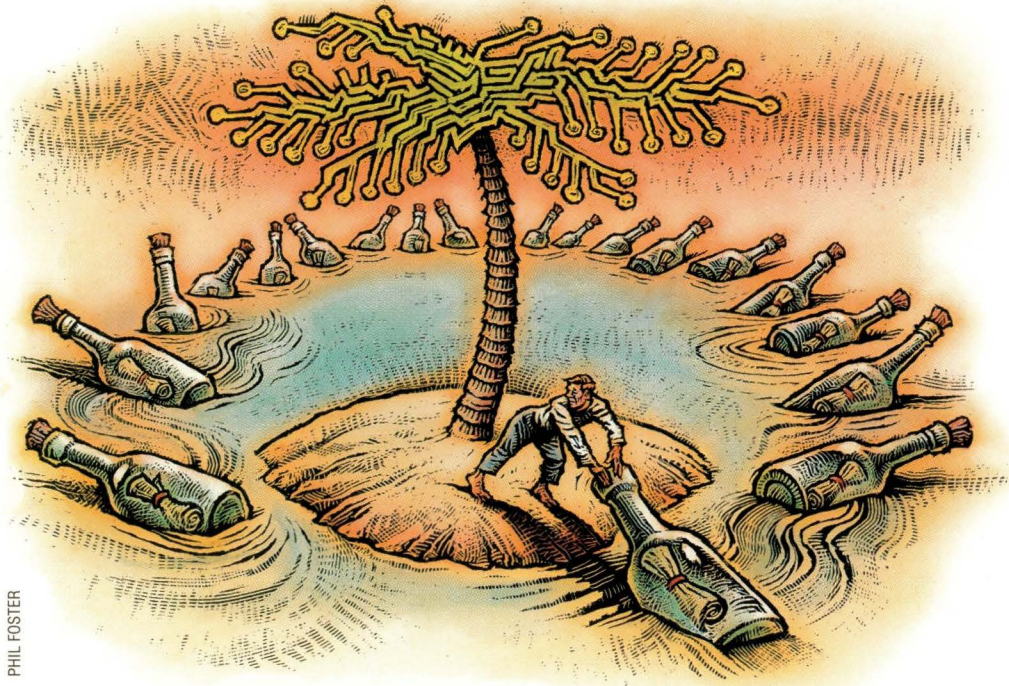
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PHIL FOSTER

You Can't Get There from Here

One of the most baffling problems that I've encountered as a systems administrator expressed itself as a pile of unreachable Web sites—an ever-growing population of URLs that left my little group of Internet Warriors staring at static “receiving data from...” messages. No data ever arrived. No time-out messages or “try later” rejoinders broke the monotony of our waits. The problem went on for months.

Some of my crew speculated that we'd been blacklisted by webmasters with chips on their shoulders owing to some earlier incident in which our site might have been used to forward spam. Others looked to me, the new sysadmin, to figure out what was going on. “If this kind of problem were typical,” they reasoned, “we'd be hearing complaints from every corner of the Internet. But, why us?”

Amid all the other problems that inject themselves into the average sysadmin's day, this problem was a con-

stant reminder that there was something going on just beyond my grasp. I'd poke at it in between more familiar challenges, hoping to identify a common thread among the sites from which we seemed to be blocked.

I could successfully ping any of the systems in the “trouble list,” as it came to be called. Clearly, it was not a routing problem. Email worked as well, so this had nothing to do with naming services.

I used `snoop` to watch the exchange of packets between my system and one of the trouble sites. The small initial exchange of packets (approximately nine) was quick. Once it was over, no further activity showed up on my screen.

I could use the `netstat -a` command and find, among the command's output, evidence that a connection was established between my system and the desired Web site. Still no data filled my browser. I could use `traceroute` and try to find clues in its spotty output. The preponderance of times and aster-

isks indicated that I was not getting responses, but the results weren't clearly related to the problem at hand.

One friend suggested I use a tool called Ping Plotter, which I obtained for a song (or maybe \$15) and installed on the neglected Windows NT system that sits to the right of the SPARC 20 in my cube. Ping Plotter drew nice diagrams showing routing and timing obtained from as many iterations over the route as I would give it time to make. But my routes didn't “dance” (change from one pass to the next) any more than my packets took hazardous overcrowded links across the country. Instead, they were stable and relatively fast. Many of my probes reached their destinations in less than 100 msec. A few resulted in “Destination Address Unreachable” messages. I was wearing grooves in my scalp from scratching my head.

The `ping -R` command, which, in similar fashion to `traceroute`, tries to report on the route taken, didn't

Figure 1. The ifconfig -a Command

```
lo0: flags=849<UP,LOOPBACK,RUNNING,MULTICAST> mtu 8232
    inet 127.0.0.1 netmask ff000000
le0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
    inet 202.203.45.67 netmask ffffffff broadcast 202.203.45.255
    ether 0:c0:78:50:1:fb
```

provide any insight either. Results like the following told me that whatever I was expecting, I wasn't going to get it:

```
boson# ping -R www.sun.com
no answer from wwwseast2.usec.sun.com
boson# ping www.sun.com
wwwseast2.usec.sun.com is alive
```

Eventually, I found myself forced to acknowledge that traceroute wasn't going to be of much use to me. The traceroute command, which attempts to elicit a response from every router between a host and a target system by manipulating the "time-to-live" field, sends UDP packets (by default) to random ports. At the same time, many routers along the way don't support UDP or refuse to respond to probes at the ports chosen.

Even with the results of ping, ping -R, traceroute, snoop and Ping Plotter in my hot little hand, I was without a solid theory as to why the trouble list continued to grow.

Finally, I started to ask some of my more clever friends for suggestions, speculations and shots in the dark. Some just said "Sorry, not my forte"; while others suggested tests I'd already run. One suggested a simple test involving my Ethernet interface: "It's possible that you're blocking on sending a large packet. Try reducing the MTU on your workstation to 256 bytes, fire up Netscape and then see if you can view the page—if it works, then you're barfing on MTU discovery."

MTU discovery is the subject of a collection of RFCs (1063, 1435, 1191 and 1981) for IPv6 and represents a technique for streamlining the passage of packets between routers by predetermining the largest size packet they can all handle without cutting the packets into pieces (or fragments). If the packets don't have to be broken apart and later reassembled, their passage over the Internet should, the theory goes, take less time. When MTU discovery is used, the "no fragment bit" is also set.

There is an MTU associated with each Ethernet interface as well. If you run the ifconfig -a command, you'll see a display like the one shown in Figure 1, which tells you, among other things, the MTU setting.

The MTU associated with my Ethernet controller (as opposed to lo0, which is my loopback) is set at 1,500 bytes. I reduced it to 256 as suggested. The command to do this is (as root, of course)

```
boson# ifconfig le0 mtu 256
```

I then boldly pointed my browser at the top entry in my

trouble list and hit Return. Instantly, the site came into view on my screen—even before my chin had reached the floor.

The next thing I did was make the same change for every one of my colleagues lucky enough to have a SPARCstation (or other UNIX system) on their desktop. I had no idea, and still have no idea, how the same change might have been made on the Macintosh- and Intel-based systems around the office. Then, with only muffled comments regarding progress, it was back to the drawing board. We'd only found a workaround, and a partial one at that. The search for an answer was ongoing.

Within the next month (yes, I said month), my thinking followed two threads: 1) finding a way to make the workaround universal; and 2) locating the source of the allegedly misbehaving router. By the time we determined the source of the problem, it had become hard to speculate further.

Ironically, the cause of the problem lay right outside our door. Two routers that connect us to the rest of the world had been configured to use a tunneling protocol, which added 20 bytes or so to the packets it moved on our behalf. This increase, along with the fact that the "no fragment bit" was set, kept the enlarged packets from reaching us.

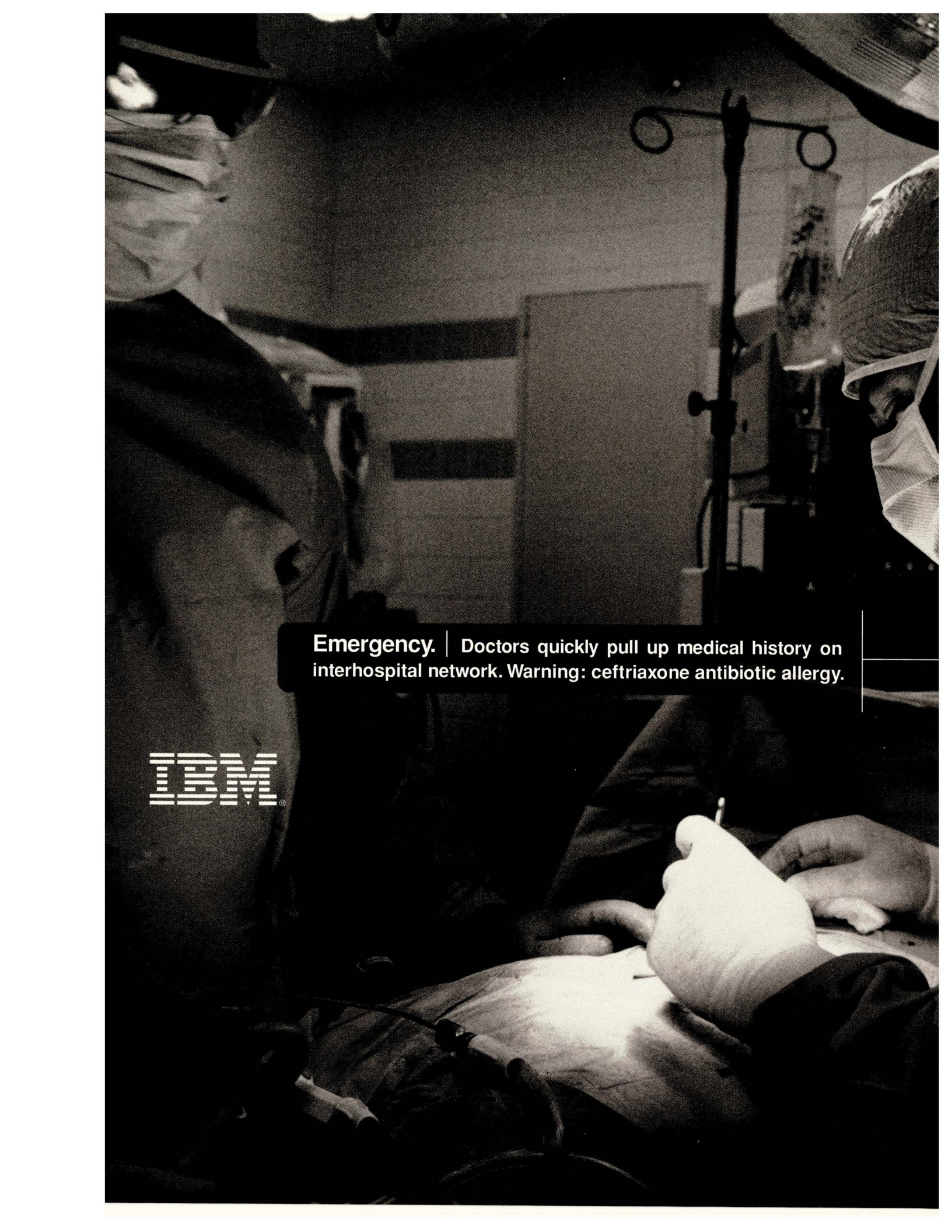


It was no surprise to find out that the 'Web site' problem was not a Web site problem after all.

Once the two routers were reconfigured with an Ethernet connection between them, the problem instantly disappeared. In addition, an odd problem that we'd seen from time to time, whereby certain sites had problems sending us email with large file attachments, was suddenly solved as well. With the cure in hand, it was no surprise to find out that the "Web site" problem was not a Web site problem after all.

I hope never again to have a problem of this complexity. It gives thinking "outside the box" a new meaning and reminds me how much I still have to learn. ⇨

S. Lee Henry is webmaster and sysadmin at Web Publishing Inc., San Francisco, CA. She lives on a sailboat in Marin County with her stepfamily. You can reach her via email at slee@cpg.com.



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LYNNE CANNOY

Important Password Advice

This month's column deals with an issue that is not Windows NT-specific: selecting effective passwords. On the contrary, this is an issue that all computer users face. It is also one of importance for every systems administrator, in the sense that it is their responsibility to educate and remind users about appropriate password usage practices.

Hopefully, most experienced computer users are familiar with the principles of selecting good passwords, the most important of which is to choose something that is easy to remember (so it doesn't need to be written down), but hard for others to guess. Accordingly, well-known names, numbers and other items associated with the user should be avoided, as should correctly spelled words and popular names. Good passwords contain more than one character type (lowercase and uppercase letters, numerals and symbols, Control and other characters) and transform the normal words on which they are based using misspell-

ings, letter substitutions or reorderings. And longer passwords are much preferred to shorter ones.

Equally important considerations apply to formulating password guidelines for users who have accounts at multiple sites. When I create an account for a new user, I always stress the importance of choosing a new password and not falling back on an old favorite. Similarly, I tell them not to use passwords from any other site at our site (and vice versa), either now or in the future. Such regulations strike some users as excessively paranoid, but they're really just common sense.

Too Many to Remember

These familiar principles and guidelines worked well and were easy to follow when users confined their computer activity to only a few separate installations. However, the Internet and its myriad of Web sites, many of which now require user names and passwords for access, have made this situation significantly more complicated. It is not

uncommon for a user to visit dozens of such sites on a regular basis. In theory, the best practice is to use a different password for each. However, realistically, few users are capable of remembering that many passwords, especially when some of the sites involved are visited rather infrequently. Clearly, we need to modify our usual password selection and usage advice to deal with the realities of the Internet and to be of more genuine help to users.

Treating every Web site requesting an account name and password equally merely exacerbates the problem. Instead, we can divide sites into classes based on the potential losses that might occur if the user name/password associated with them were discovered by an unscrupulous person; in other words, by what we have to lose. There are several classes of sites:

- Information-only sites—sites that merely make information available to their users. Although they require a password to gain access to that information, a user name/password is available for the

asking and has no cost associated with it. An example would be the support area of the Microsoft Corp. Web site. Such sites seem to collect user information strictly for marketing purposes, and still provide their informational content free of charge. From a user's point of view, the password used at such a site is unimportant; if anyone were to discover it, no loss or other negative consequences to the user would occur.

- Fee-based informational sites—sites that make information available to their users upon payment of a fee (usually on a subscription basis, but sometimes on per-visit basis). An example of this kind of site is the *Consumer Reports* subscription site, which makes additional information available to subscribers beyond what it places on its public Web site. The discovery of a password would allow an unauthorized person to gain access to this information, but would not usually bring any harm to the user himself, provided the site exercises normal security precautions and does not reveal sensitive information (such as credit card numbers) even to the account holder.

- Sites that support password-protected purchases and bids—sites where a user name/password is required to purchase something, but account information related to purchases is not stored. These sites only allow registered users to make purchases, but they do not require a full account (including billing and shipping addresses, credit card numbers and so on) to be set up and maintained. Rather, they force the user to enter this information with every order (or give them the option of doing so).

Auction sites such as Ebay.com are similar (from the buyer's

perspective). They require bidders to have a registered account, but the actual sale and the corresponding exchange of sensitive information takes place privately between the buyer and the seller. The security implications associated with this type of password are more serious than those for information-based sites, but the potential loss from a discovered password is still fairly limited. The hacker still needs additional information to make a purchase (in the case of Ebay.com, he could make a bogus bid while masquerading as the legitimate account holder, but could not force an actual purchase).

- Sites with ongoing purchasing accounts—these sites assign a user name/password to registered users and store their complete account information (including billing address, shipping addresses and multiple credit card numbers) to facilitate future purchases. An example is Amazon.com. The unauthorized discovery of an account password can have significant financial consequences, because the bad guy can make purchases using the legitimate user's information. The choice on the part of such sites to allow complete access on the basis of a single password clearly favors convenience over security.

Sites that store important information about the user, or something the user owns or administers, also fall into this category. For example, if the password for an account at a site where the official information associated with an Internet domain is stored were to be compromised, the hacker could modify that information, with consequences that could range from significant inconvenience to disaster.

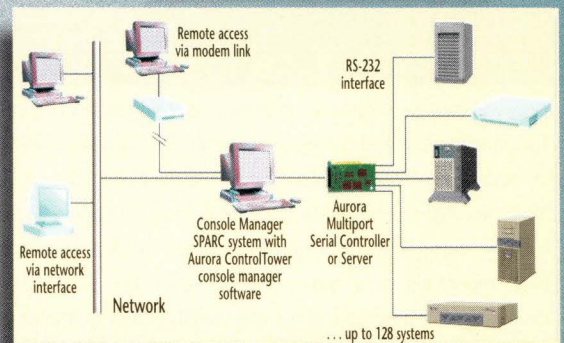
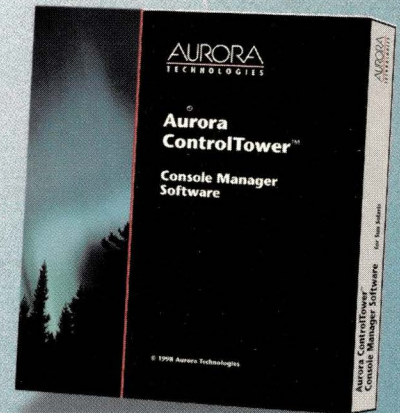
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• Sites associated with user finances—sites that allow users to access bank accounts, stock portfolios and similar financial instruments pose the greatest risk. Some are protected only by a user name/password, so the passwords for such sites must be chosen very carefully.

Note that even the most innocuous sites can change character over time. For example, a site that merely provides access to information, might add other services in the future. Therefore, the current password may need to be rethought.

Practical Advice

The different security needs of different kinds of sites make different demands on the rigorosity of password selection. Given that it is often impractical to have a unique password for every Internet site, I can make the following recommendations:

1. Don't use a password from any of your regular computer accounts for any Internet site (and vice versa).
2. Select all passwords for Internet sites using the same security principles as for any other password.
3. There is no harm in using the same password for all unimportant sites: that is, those requiring a nuisance password for access to otherwise free information.
4. You may also choose to use the same password for fee-based information sites (depending on the extent to which you wish to protect against unauthorized access to such sites), or you may choose to use a different one. But again, there is probably no harm in using the same one for more than one site.

5. Use a different password at each site where there is something to lose. Doing so may still result in a large number of passwords to be remembered, but there are strategies for dealing with this. The most obvious is to write them down. I personally don't prefer this approach; it may be that too many years of systems administration have made the mere idea of writing down any password anathema to me.

My approach is to have a different password at each site, but to use a consistent scheme for selecting them. For example, although this is not the scheme I use, I might generate each password by taking my favorite name that begins with the same letter as the most important word in the password, transforming the spelling according to some rule and appending my favorite number. By constructing each password in the same way, I can always reconstruct the password for a given site should I forget it. You should devise a password scheme that generates a deterministic password for a given site and prevents frequent duplicates (the latter is not true of the simple example I gave above).

I'm very interested in your reactions to this column and in hearing about your own practices and advice with respect to Internet passwords. Feel free to email me at aefrisch@lorentzian.com with your comments and suggestions. ➔

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

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Datagrams

by John S. Quarterman



Revisionist Internet History

On Tuesday, March 9, U.S. Vice President—and probable presidential candidate—Al Gore, was interviewed by Wolf Blitzer on CNN. According to an interpretation of that interview published in *Wired*, Gore claimed to have invented the Internet. Much outcry was immediately heard across the Internet mailing lists.

Is this revisionist history or corrective history? Vint Cerf is usually credited as the individual most responsible for the creation of the Internet. Have we been wrong all this time? Or maybe it's just campaign rhetoric, because the answer came in response to a question about how Gore differentiates himself from other likely Democratic presidential candidates.

In the CNN interview, Gore's actual words were, "During my service in the U.S. Congress, I took the initiative in creating the Internet." Let's return to this later.

I have some experience with network history, having written what is, so far

as I know, the first substantive work on network history, *The Matrix: Computer Networks and Conferencing Systems Worldwide* (published by Digital Press, 1990, ISBN 155558-033-5). I am a relative latecomer, having only been on the Net since 1974, but I do remember the early ARPANET mailing lists (SF-LOVERS, HUMAN-NETS and so on) firsthand, and I did run the second largest node on Usenet for some years, in addition to having arranged to have a book written about 4.3BSD (see below). Hence, I was interested to see that in "Writing Internet History" (*American Historical Review*, December 1998), Roy Rosenzweig examines four Internet history books. This review was brought to my attention (on an Internet mailing list about history) by Ronda Hauben, coauthor of one of the four books: *Netizens: On the History and Impact of Usenet and the Internet*, by Michael Hauben and Ronda Hauben (published by IEEE Computer Society, 1997, ISBN 0818677066). To me, the

article is a fascinating example of revisionist history. Let me quote some extracts and make a few comments.

In the article, Rosenzweig says (all quotations in this column are from Rosenzweig's article, except where otherwise noted) that *Netizens* "offers an interpretive perspective that should be central to any future Net history... They [Michael and Ronda Hauben] argue that the Internet has created a new kind of citizen, the 'netizens,' who they define as 'people who decide to devote time and effort into making the Net, this new part of the world, a better place—a regenerative and vibrant community and resource.' The Haubens see the democratic nature of the network growing out of its grass-roots source in the people who created Usenet."

It's amusing to hear some people claim that the essentials of the Internet (whether social or technical) were developed without any government intervention. That might be the case if Usenet really were the prime source, but Usenet



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was merely one of many sources. Usenet was created by people who couldn't get on the ARPANET because they did not have U.S. Department of Defense (DOD) research grants—Usenet was a sideshow. As soon as the Internet emerged from the cocoon of Defense Communications Agency (DCA) restrictions on ARPANET access, Usenet abandoned its UUCP carrier network and moved onto the Internet, bringing its users along with it, just like any sideshow at a carny is supposed to do.

Network UNIX

In his article, Rosenzweig goes on to say, "Ken Thompson and Dennis M. Ritchie, the bearded and long-haired Bell Labs' programmers who, in 1969, developed UNIX, the operating system behind Usenet, later described themselves as seeking 'a system around which a fellowship could form.'"

Indeed. But UNIX was also the operating system behind the early Internet, and was one of the key operating systems in the middle and late ARPANET (see RFC 681, "Network UNIX," <http://www.ietf.org/rfc/rfc0681.txt>). Thompson and Ritchie originally managed to develop UNIX, starting on a machine in an attic, largely by convincing AT&T Bell Labs that they were really working on a text-processing system for handling patents. That's anarchy in action.

"In different ways, both Levy and the Haubens help us to see that the more profound challenge to this 'open' vision of the Internet that was rooted (at least in part) in the 1960s came not from its heritage in the Defense Department but rather from an alternative closed system—corporate capitalism."

This reminds me of the year (1992) that Rick Adams, founder and president of the commercial Uunet, openly connected Russia to the Internet despite U.S. government bans. The academic and research Internet old guard refused to even count Russia among Internet-connected countries because it didn't have connectivity to NSFNET (but crassly commercial MIDS counted Russia in the March 1993 issue of *Matrix News*). Which system was more open in that instance?

You know, they're still arguing that old academic-is-by-right-better fight in Latin America; except in a few places like Brazil, where the advantages of commercial Internet service providers (ISPs) of greater availability and access to resources for academia and everyone else have become evident.

Public Utility?

"In the 1980s, when most forms of publicly owned goods and services—from public schools and public housing to public parks—were in decline and an ideology of privatization and deregulation was in ascendance, it seemed like conventional wisdom to turn this public utility over to private ownership."

Calling it a public utility grants it a revisionist status that it never had. The early Internet was attacked in some quarters for being elitist and not open to general access by the public. The ARPANET certainly was never open to the public; BITNET, CSNET, UUCP, Usenet, FidoNet and others sprang up for this reason. Only a few years ago, the Texas ISP Association (TISPA) was formed to counter a state government attempt to impose an ISP tax to fund expansion of the Internet to rural areas because some government officials didn't think the ISPs were reaching those areas fast enough.

Those of us who were on the compriv (commercialization and privatization) list know there was nothing simple or conventional about privatization of the Internet. The reasons for doing it were complex, including the fact that the grant-funded model didn't scale. Any mention of the Internet as a public utility tended to provoke visions of the Federal Communications Commission (FCC) and local Public Utilities Commissions (PUCs), as well as violent reaction.

"Yet this synthesis retains its own internal tensions and contradictions," Rosenzweig says. "While free marketeers today celebrate the Internet as the home of 'people's capitalism,' it also seems headed down the road to oligopoly. Three companies—the newly merged MCI WorldCom, Sprint and Cable & Wireless—probably control three quarters of the Internet backbone."

That's a nice word, "probably." And "three quarters," by what metric? Where

is Uunet in this? Uunet, the largest and richest ISP in the world? (It's part of WorldCom, I know.) What about PSINet, which reaches more than 30 countries? And what is "the Internet backbone?"

Rosenzweig goes on to say: "Yet the road toward monopolization and centralized control is not preordained. The current antitrust cases against Microsoft and Intel—or, less plausibly, the revival of popular antimonopoly sentiments—might alter the corporate landscape. In general, the tendencies toward both open and closed systems that have shaped the Internet from its origins remain with us today."

This last sentence I agree with. MCI had to divest itself of Internet MCI before merging with WorldCom, and it was CWIX's purchase of the network that brought it to special prominence. We seem to have reached limits on the upper size of ISPs.

But what of Verio, which has meanwhile cobbled itself together out of numerous smaller ISPs, much as General Motors formed itself to compete with Ford? GM may not be everyone's favorite model of a modern corporation, but the point is there is no fixed set of big ISPs; old ones merge and new ones spring up, while a cap on their size seems to have appeared.

"The degree to which a populist and democratic Internet survives and flourishes depends on larger social and political contexts."

Ah, the chimera of electronic democracy springs eternal.

"The future remains uncertain. But it is clear that any history of the Internet will have to locate this story within its social, political and cultural contexts."

That would be a good thing; it's too bad those contexts are so widely misunderstood.

High-ROI Anarchy

"Such a profound and complex development cannot be divorced from the idiosyncratic and personal visions of some scientists and bureaucrats whose sweat and dedication got the project up and running, from the social history of the field of computer science, from the Cold Warriors who provided massive

Datagrams

government funding of computers and networking as tools for fighting nuclear and conventional war, and from the countercultural radicalism that sought to redirect technology toward a more decentralized and nonhierarchical vision of society."

This kind of oversimplification ignores basic facts such as Jon Postel, who was the heart of the old boy network and was at least as much of a counterculture figure as Ritchie, Richard Stallman, Phil Zimmermann or Bill Joy.

There were certainly contentions and differing interpretations among those who built the ARPANET and the Internet as to what they were doing and why they were doing it. Hinting that the ARPANET was intended as a tool capable of surviving a nuclear war can bring out strong reactions from some of the people who were involved. Many of them never did and still don't consider themselves Cold Warriors. And in their own minds, probably they weren't, even though Peter Salus documented in his book, *Casting the Net* (published by Addison-Wesley Publishing Co, 1995, ISBN 0-201-87674-4), that the ARPANET is rooted in the fears of Sputnik and real sabotage on U.S. soil. Both versions can be and probably are true simultaneously: The roots of the ARPANET and the Internet are in the Cold War, but many of those working on the ARPANET were no doubt doing it for academic reasons.

As far as massive funding, the actual amount on the first ARPANET contract for the initial four sites, plus the BBN hardware and personnel cost, was \$1 million. The entire amount of money funneled into the ARPANET, and later the Internet, by the U.S. government was not massive compared with the average fighter jet or aircraft carrier. It probably wasn't even massive compared with the money the European Union poured into the failed mandate of the International Standards Organization for Open Systems Interconnection (ISO-OSI). (That would be an interesting comparison if somebody were to add up the sums.) Of course, this means that the return on investment (ROI) of taxpayers' money has been huge and continues to grow.

Governments and the Internet

Speaking of government intervention, where is the distinction between the useful facilitating kind, such as Vint Cerf orchestrated at the Advanced Research Projects Agency (ARPA), and others such as Steve Wolff later orchestrated at the National Science Foundation (NSF), and the heavy-handed

mandating kind favored by proponents of ISO-OSI? When I was asked by Romanian Television in Bucharest back in 1995 what I would recommend the government do about the Internet, I told them the same thing I always say: "Don't interfere." Governments very seldom get networking right. The early government funding of the ARPANET and the Internet are some of the few

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cases I know of where a government has done it right. Compare that to the Japanese government's approach of funding OSI projects until a very late date, while refusing to grant international carriage licenses to any commercial ISPs until 1994. Japan is still catching up. Europe caught on earlier, in 1991, after waiting for many years for OSI's marketing to come true, and finally discovering that TCP/IP had the product: the Internet.

What of the entity and its class that many considered the real enemy in the old days, namely AT&T? It may be hard to recognize in these post-1985, post-break up days that AT&T and the whole Post, Telephone and Telegraph (PTT) dedicated-circuit, centralized-control, government-mandated, properly-constituted, national-delegation mindset (with which ISO-OSI was in tune) was what nearly everyone (ARPANET, Usenet, UUCP, FidoNet and so on) was reacting against. AT&T itself didn't seem to know half of what its own people were doing. For several years, a sizeable proportion of Usenet was supported for free by AT&T.

Rough Consensus and Working Code

The working center of the Internet is the Internet Engineering Task Force (IETF). The IETF doesn't believe in kings, presidents or elections, rather it believes in rough consensus and running code (see RFC 1958, "Architectural Principles of the Internet," <http://www.ietf.org/rfc/rfc1958.txt>). The Internet is not about nice, conventional democracy. You can't have democracy if you have neither delimited membership nor voting. The IETF is about a radical kind of anarchy, which requires personal responsibility. It is based on sweat, not head counts; earned merit, not populism.

For that matter, the "counterculture" was a dated surface artifact reflecting something deeper. Who would call Linus Torvalds countercultural? Yet he represents the direct tradition of radical meritocracy of pioneers such as Kirk McKusick, Sam Leffler, Joy, Thompson, Ritchie and others before them. Torvalds' particular Linux bazaar stands in relief because it consciously uses the

power of the Internet itself as an organizing principle to an extent not previously seen, and thus stands on the shoulders of those earlier giants (see "The Cathedral and the Bazaar" by Eric S. Raymond, <http://www.mids.org/mn/805/cb1.html>).

It is easy to say that the University of California at Berkeley Computer Systems Research Group (CSRG), run successively by Joy, Leffler, McKusick and Mike Karels, was the opposite of anarchic because it was funded by ARPA and the state of California. But ever since Sixth Edition UNIX (V6) from Bell Labs, an increasing amount of the actual work on UNIX was done by an unpaid ad hoc consortium of people all over the world, from Amsterdam to Melbourne and from Pittsburgh to Austin, using the ARPANET and then the Internet and UUCP to write, test and incorporate parts of the operating system. It was such a Berkeley version, 4.3BSD, that was the basis of the most popular and influential implementation of TCP/IP. The development process of 4.3BSD is documented; see *The Design and Implementation of the 4.3BSD UNIX Operating System*, by Leffler, et al (published by Addison-Wesley, 1989, ISBN 0-201-06196-1) and *The Design and Implementation of the 4.4BSD Operating System*, by Keith Bostic, et al (published by Addison-Wesley, 1996, ISBN 0-201-54979-4).

What is the real source of the uniqueness of the Internet? It is not merely in democracy or government or capitalism. Its roots are in academia and the research tradition dating back to Los Alamos. It's in Quakers and Kropotkin, Tolkien and Tolstoy. The depths of the Internet have hardly been touched, much less plumbed.

Instead, we see old discussions resurfacing, or being reinvented, such as the Internet as a public utility, freenets as the paradigm of network access or government-mandated, tax-funded universal network access, while commercial development of the Internet is often seen as bad. This is ironic, considering that the Internet most users have always known (considering that by far most of them have only been on the Internet a few years) is very largely a commercial

creation. The World Wide Web was a research curiosity until it was commercialized, after which it became the public face of the Internet, so ubiquitous that many people have trouble distinguishing it from the Internet itself.

ICANN and National TLDs

Interestingly enough, Internet Corporation for Assigned Names and Numbers (ICANN), which was in its first version designed by that archetypical counterculture figure, Postel, has become a focal point of discussions about the nature of the Internet. Latin American users, in particular, have suddenly become much more active and are presenting viewpoints quite different from those of Europe, America or Asia. ICANN has already mutated as a result of such input.

One of the biggest problems with ICANN is quite the opposite of privatization; rather ICANN continues to promote a unilateral Postel decision to give away national Domain Name System (DNS) top-level domains (TLDs), or country-code top-level domains (ccTLDs), to national governments (see "Haiti, Déjà Vu," *SunExpert*, February 1998, Page 63, <http://sw.expert.com/C7/SE.C7.FEB.98.pdf>). This was never the ARPANET or the Internet tradition. This new initiative of ccTLD nationalization is actively opposed by the Latin American networking community, among others.

Public debate on these issues would be good. Unfortunately, we don't get much of it. ICANN, like its predecessor, won't discuss the ccTLD issue (see "Interview with Esther Dyson," *S/W Expert*, April 1999, Page 40, <http://sw.expert.com/C7/SE.C7.APR.99.pdf>).

Wired on Gore

Let's revisit what Gore said, and what *Wired* said about that. *Wired* opines at length that the ARPANET was invented while Gore was in virtual knee breeches, and proceeds to mention networks that preceded the Internet boom of the 1990s, such as UUCP. There appears to be some sort of confusion about the difference between the ARPANET and other networks and the Internet, which steers wide of the mark. Not only has

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Wired made this mistake, almost all of the public outcry against Gore's statement that I've seen has been based on misinterpretations of what the man said and of how the Internet actually evolved.

Almost all the complaints I've seen about Gore's statement do *not* come from the people who should have the most to say about it. The one who should know as well as anybody, Vint Cerf, had quite a different opinion (see <http://www.msnbc.com/news/249325.asp>). He notes that (then senator) Gore was holding hearings about the Internet as early as 1986, and as a senator, and later as vice president, has done as much as any politician to promote it. If I may paraphrase, Gore built the Internet in the same way as a mayor builds a bridge: neither by drawing up blueprints nor by welding steel, but rather by facilitating its construction.

However, Cerf is too tactful to mention that Gore has also been one of the principal proponents of the Clipper chip and key escrow, which would be horrible for the Internet if they were to come to pass. And that he did nothing to stop the unconstitutional Communications Decency Act (see <http://www.mids.org/mn/707/cda.html>). But nobody's perfect.

Multitudes

Today we see too many tunnel visions and too little big picture. Your vision may not be my vision, and I don't know which of the many fractious, overlapping, contentious and nonetheless thus far usually collaborating versions of "we" you may speak for. Diversity is good for the network kaleidoscope in which we can see others and ourselves by eyes otherwise unknown. And diversity is good for the network ecology. Applications that don't evolve fast enough or in the right direction (such as Gopher) are not selected; those that do (such as the WWW) expand at greater than biological rates.

It could be the Internet speaking in Walt Whitman's "Song of Myself":

Do I contradict myself?

*Very well then I contradict myself,
(I am large, I contain multitudes.)*

Thanks to Peter Salus for the ARPANET funding information, some

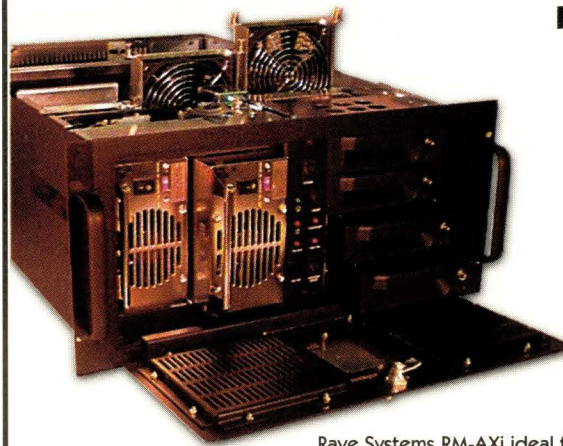
RFC references and other commentary. I also thank Daniel P. Dern, Dan Franklin and others for their comments that fed into this column. They are nonetheless not responsible for the interpretations expressed here, which are my own. →

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"I beheld the wretch—the miserable monster whom I created."

— *Frankenstein*, Mary Wollstonecraft Shelley

"How much easier it is to be critical than to be correct."

— Benjamin Disraeli

Odds and Ends

Ah, May. We can't help but think of the late Bill Rotsler's cartoon of a cat sitting in a window distracted by a butterfly with the caption: "If cats had a longer attention span, they could rule the world." Just so we don't compete with the short attention span engendered by spring fever, we'll be covering a set of topics we've had kicking around in the attic for a while, none of which are enough to fill a complete column. Thus, we present you with our Franken-column.

But first, we found reader reaction to our February column, "Differences Among Women," educational (*SunExpert*, Page 38, <http://sw.expert.com/C9/SE.C9.FEB.99.pdf>).

Differences Among Correspondents

Sometimes, life imitates that simple harmonic motion experiment from freshman physics. When we wrote a column on technology and reading, "A Short History of Reading" (*SunExpert*,

November 1998, Page 58, <http://sw.expert.com/C9/SE.C9.NOV.98.pdf>), we were surprised that the first two notes we received about it were both from women. We used this as a springboard for our February column. (As you know, there's sufficient publication offset that our observations and counter-observations occur in three-month waves.)

The level of reader interest in that column was higher than we'd anticipated. We must have struck a nerve—or a pair of nerves, as it turns out.

One reader, Pete Kernan, now has a Web page about four-tuples, <http://theory2.phys.cwru.edu/~pete/sequence.html>. There is also a related entry, A045794, in the "On-Line Encyclopedia of Integer Sequences," <http://www.research.att.com/~njas/sequences/index.html> (look for "Haemer," "Copeland" or "1 1 1 3 3 4 9").

We promised to report on the sex ratio of the responses to our column, and here it is: Within a one-month

period, we got 61 pieces of email from 34 unsolicited readers. Of these, nine respondents were women (including Ann Janssen, one of the correspondents to the November column) and 25 were men. The correspondents even included the husband-and-wife team of Shelly Shumway and Arthur Smith.

One (male) reader, Sal Mamone, sent us a pointer to some statistics he gathered about sex differences among his computer science students (see "Empirical Study of Motivation in a Entry-Level Programming Course," ACM SIGPLAN Notices, March 1992). We're not sure Sal's statistics completely apply—he was teaching COBOL and we think that puts an entirely different skew into the results—but they are interesting.

All the responses were interesting and gratifying, but what jumped out at us was the sexual dimorphism. Women sent email saying, "Interesting column, here's my opinion"; men sent email saying, "Interesting column, here's my code/math." We suspect that we could

write a Perl script to sort the responses by sex. One woman sent a technical response (containing math/code); three men sent nontechnical responses. The two sexes sent identical percentages of cross-dressed mail.

But we've still received no responses from Antarctica.

Monopolies and You

It should be apparent by now that we're open-source bigots. We firmly believe in open systems with commodity hardware and, for the most part, nonproprietary software. But there are forces in the world that disagree with us. The largest of those is currently (and probably still will be, by the time you read this) on trial for violations of antitrust laws. We speak, of course, about Microsoft Corp.

We won't go into detail about the trial because whatever we say will be out-of-date by the time this is in print, but we'll note some interesting reactions:

- Amid the calls to break Microsoft into various slices, Perl consultant and author Tom Christiansen has suggested a different solution: He'd rather see the government make all of Microsoft's source code subject to the GNU Public License.
- An IBM Corp. spokesman has suggested that being sued for antitrust violations will destroy Microsoft. After all, he reasons, once IBM ran into antitrust trouble—a lawsuit that lasted for eight years, from the last day of the Johnson administration to the first day of the Carter administration—the company spent all its time consulting with lawyers about its plans rather than making new ones. We aren't sure if lawyers had anything to do with IBM's stupidity about the PC market and relative hardware pricing; that's what actually brought the former largest computer company in the world to the brink of death.
- There's a movement afoot from Linux users to get Microsoft and the hardware vendors to refund their license fees. In general, the Linux community buys commodity hardware but never boots the installed versions of Windows that are preinstalled on the machines. Open-source advocate Eric Raymond led a protest march over this issue at Microsoft's Silicon Valley offices in February. (See <http://www.netcraft.com.au/geoffrey/toshiba.html> for another example.)
- If Microsoft is broken up, we expect the century's first forced corporate breakup will be instructive. When Standard Oil was dismembered by the U.S. Supreme Court in 1911, conventional wisdom was that John D. Rockefeller's fortune would suffer. Quite the contrary, he was three times as rich within five years.

• Our guess is that no matter what Judge Thomas Penfield Jackson rules at the trial itself—which we expect will be against Microsoft in some form—Microsoft will appeal the verdict. The applicable appeals court has already demonstrated its computer illiteracy in its infamous “the browser is part of the operating system because Microsoft says so” decision. This means that all bets are off on the final outcome.

Off By One

We've tripped over a variety of off-by-one errors in our time. In fact, we've complained about some of these before in this column. How do they show up and how do we prevent them?

Some examples of obfuscated code, and the fixes for them, may be instructive.

Taking our cue from Disraeli, in October 1996 (see “The Date Class, Part 2,” *RS/Magazine*, Page 32) we provided an example complete with fix, of the %U and %W specifiers to the date command and the strftime() interface. These two specifiers return the week number; in the case of %W, it's the number of weeks beginning on Sunday since January 1 of the current year. In many (nay, most) implementations, these are calculated incorrectly. Given a populated tm structure and the realization that the number of weeks since the beginning of the year is the same as the number of Sundays, it's pretty easy to calculate:

```
sun_week (tm)
struct tm *tm;
{
    int lastsun = tm->tm_yday -
        tm->tm_wday;
    return (lastsun+7)/7;
}
```

On the other hand, we have been known to get things wrong from time to time. A while back, we built a routine to overwrite a section of a file with nulls. Because the files could be large, we wanted the program to print a status bar to tell us how far along it was. It could print a dot for each block it wrote, but it would be far more effective to print a line of fixed length and then add a dot for each 5% of the write completed.

The code for writing the blocks is pretty obvious:

```
fprintf(stderr, "-20s (%07ld) ",
    filename, size);
/* insert [set up for status bar] here */
while( size > 0L )
{
    if( size >= BUFSIZ )
        write(fp,nullbuf,BUFSIZ);
    else
        write(fp,nullbuf,size);
    size -= BUFSIZ;
    /* insert [show status] here */
}
```

But how do we print the status? Our first cut looked something like this:

```
#define REPORT 20
/* set up for status bar */
osize = size;
nn = size / REPORT;
cnt = nn * (REPORT-1);

...

/* show status */
```



```
while( size < cnt )
{
  cnt -= nn;
  fprintf(stderr, ".");
}
```

But this, of course, results in an incorrect bar length if the file size is less than 20, or if rounding makes the initial value of `cnt` an odd number.

The correct code is as follows:

```
#define REPORT 20
/* set up for status bar */
osize = size;
nn = REPORT;

...

/* show status */
while( nn > 0 && size < (osize*nn/REPORT) )
{
  nn--;
  fprintf(stderr, ".");
}
```

An equally odd calculation occurs in the TeX macros for Ronald L. Graham, Donald E. Knuth and Oren Patashnik's *Concrete Mathematics: A Foundation for Computer Science*, Second Edition (published by Addison-Wesley Publishing Co., 1994, ISBN 0-201-55802-5). TeX provides the time of day in minutes since midnight. (We'll leave alternate implementations as an exercise for the reader.) Converting that to the traditional *hours:minutes* format requires a bit of fiddling. Usually, we use the following:

```
\def\formattedtime{\hrs = \time
  \divide \hrs by 60
  \mins = \time
  \divide \mins by 60
  \multiply \mins by -60
  \advance \mins by \time
  \number \hrs
  : \ifnum \mins < 10 0 \fi \number \mins
}
```

On the other hand, we did a bit of head scratching over the following fragment from the *Concrete Mathematics* macros before the inevitable "aha!":

```
\def\hours{\count0=\time
  \divide\count0 by60 % find the o'clock
  \multiply\count0 by40
  \advance\count0\time % convert to hhmm
  \advance\count0 10000
  \expandafter\gobbleone\number\count0\relax
}
\def\gobbleone1{}
```

The calculation of `time` divided by 60 multiplied by 40 provides 40 multiplied by the hours. Because the number of minutes since midnight already contains the hour multiplied by 60, this has the effect of leaving the hours multiplied by 100 in the result. Thus, we are left with hours multiplied by 100, plus minutes. Adding 10,000 guarantees that there is a leading zero, if necessary. Unfortunately, it's preceded by a leading one; fortunately, that character is eaten by `gobbleone` in a bit of TeX macro legerdemain.

HTML and troff

Let's change gears now. By virtue of our being open-source bigots, we are also in favor of open formats. This means proprietary documents produced by the likes of Microsoft Word and Excel make us see various shades of red. (OK, they make Haemer see red. Copeland is color-blind, so he just sees a darker shade of gray.) It also means we really like markup languages such as `troff` and HTML—in fact, we generally write this column in the former and then convert it to the latter.

There are a number of tricks we could use for this conversion, including a variety of public-domain conversion tools. But we do something that may not be as obvious: We convert our `troff` source to HTML by running it through `nroff` with a special macro package.

This all came to mind a few weeks ago when Softway Systems colleague John McMullen was converting a variety of `troff` documentation to online Web pages and asked for some assistance. We won't show you the whole macro package, but just some interesting pieces.

Our replacement for the `-mm` list macros had been as follows:

```
.\ " ===== LISTS
.de AL \ " numbered list
.nr list_type 1
<OL>
..
.de BL \ " bullet list
.nr list_type 2
<UL>
..
.de LE
.if \n[list_type]=1 </OL>
.if \n[list_type]=2 </UL>
.nr list_type 0
..
.de LI
.if \n[list_type]=1 <LI>
.if \n[list_type]=2 <LI>
..
```

John pointed out that we didn't support nested lists, and supplied the replacement code shown in Listing 1; which you'll note actually has comments in it. (For ease of reading, `@br` is a macro that replaces the `br` directive in `troff`; `br` itself becomes a macro that produces an HTML `
` tag.)

It's not possible to provide a macro to handle every eventu-

Listing 1. Replacement Code

```

.\" ===== LISTS
.\" When we enter a new list, we prepend the
.\" correct termination tag to the string
.\" list_end. When we end a list, we use that
.\" string as the argument list to the .LE
.\" macro, print the first argument and redefine
.\" the string If the string length is zero,
.\" we know there's a problem.
.de AL \" numbered list
.@br
<OL>
.ds list_end "</OL> \\[list_end]
..
.\" we could specify bullets versus dashes
.\" (HTML 3.2) but it's not a vital issue in my
.\" experience, but with .AL people care.
.de BL \" bullet list
.@br
<UL>
.ds list_end "</UL> \\[list_end]
..
.de DL \" dash list
.BL
..
.de end_list
.ie \[n[.]]=0 \{
. tm ".LE: List ending without being in a list
.\}
.el \{
\[$1
.shift
.rm list_end
.ds list_end "\[$@
.\}
..
.de LE
.@br
.end_list \\[list_end]
.if "\[$1"1" <P>
..
.de LI
.@br
<LI>
..

```



ality in our text, so the HTML macros define the following:

```
.ds HTML@Printing xx
```

Because `groff` provides a way to test the existence of a string, `.if dHTML@Printing...`, we can provide different coding for the `troff` and HTML versions. For example,

```
.ds rr re\*'sume\*'

```

```
.if d HTML@Printing .ds rr r&eacute;sum&eacute;;

```

And because most usage of the `HTML@Printing` flag is related to accents, we finally wrote an accent filter:

```

#! /usr/local/bin/perl -p
# Accent filter for -mm to HTML conversion.
# Note this only works for valid combinations.

s/([AEIOUaeiou])\\*:/\&$1uml;/g;
s/([AEIOUaeiou])\\*;/\&$1uml;/g;
s/([AEIOUaeiou])\\*`/\&$1grave;/g;
s/([AEIOUYaeiou])\\*´/\&$1acute;/g;
s/([AEIOUaeiou])\\*^/\&$1circ;/g;
s/([AN0ano])\\*~/\&$1tilde;/g;
s/([Cc])\\*;/\&$1cedil;/g;
s/\\(AE/\&AE1ig;/g;
s/\\(ae/\&aelig;/g;

```

This nicely converts input such as

```

U*:ber, u*:ber,
ha\*^t, nin\*~o,
fac\*,ade, \(\aeon

```

into

```

&Uuml;ber, &uuml;ber,
h&acirc;t, ni&ntilde;o,
fa&ccedil;ade, &aelig;on

```

for printing as

```

Über, über, hât, niño, façade, æon

```

We leave it as an exercise for the reader to fill in the other interesting `troff` special characters with HTML/8859-1 escape sequences, such as inverted exclamation points and the common fractions.

Next time, we'll write a review of I18N tricks and techniques. By the time you read that, the Microsoft trial may be in appeal, all of your off-by-one bugs may be gone and you may have finished converting your `troff` documents to HTML.

Until then, happy trails. ➡

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

Java Class

by Jim Frost



NAOMI SHEA

Building a Bean Pot

Last month, we learned how to construct a Java bean; an interesting exercise, but not very useful without some way to use it. To that end, this month, we will develop the veritable bean pot—a bean application infrastructure. This turns out to be easy to do and the end result is remarkably powerful.

Sun Microsystems espouses the use of serialized Java objects for saving bean configurations in its JavaBeans Development Kit, or BDK (see http://www.java.sun.com/beans/software/bdk_download.html). I find this to be needlessly obtuse—serialized files are difficult to work with and have some compatibility problems between different runtime versions. Instead, our bean framework is inspired by the one found in Art Technology Group's Dynamo Application Server (http://www.atg.com/products/das/das_main.html; full disclosure: I am an employee of ATG), which uses standard Java properties files managed by the `java.util.Properties` class. Properties files are

much easier to work with and allow us to explore several interesting parts of Sun's bean management classes.

The Bean Manager

In our bean application framework, the `BeanManager` class (see Listing 1) performs two important tasks: It instantiates beans that don't yet exist and it provides a name space for looking up beans that have been instantiated.

When our application would like to load a new bean, it calls `BeanManager.findBean(String)`. This method first looks in a hash table to see if the bean you're asking for has already been loaded; if it has, it returns the bean's instance. The application can then use the bean in any way it sees fit.

If the bean is heretofore unknown, then we must instantiate it. We do this by first looking for a Java properties file of the same name with a `.properties` extension. This file will provide configuration information for our bean and its properties (more on that later). A special

property, `class`, specifies the Java class name for the bean.

Once we have the name of the bean class, we use the standard Java dynamic class loading and instantiation to create a bean instance. At this point we have a live bean, although one which is not yet fully configured. We wrap the instance in a `BeanHandle` object and insert the handle into hash tables so that we can look it up again either by name or instance.

Manipulating Properties

It's the job of the `BeanHandle` object (see Listing 2, Page 58) to manage the properties provided by the bean. Its constructor uses the `introspector`—a Java class that discovers and packages bean information for use by applications—to obtain a `java.beans.BeanInfo` object that describes the bean (see last month's column, "Beans, Beans, Everywhere," *S/W Expert*, April 1999, Page 49, <http://sw.expert.com/CA/SE.C10.APR.99.pdf> for more information on how the `introspector` manages this task). The

Listing 1. The BeanManager Class (abridged)

```
package beanmanager;

import java.beans.*;
import java.io.*;
import java.util.*;

/**
 * This class manages a set of beans in a namespace.
 */
public class BeanManager
{
    private Hashtable beansByName = new Hashtable();
    private Hashtable beansByInstance = new Hashtable();

    /**
     * Finds a bean in the bean namespace, loading it if necessary.
     */
    public Object findBean(String beanName)
    {
        BeanHandle beanHandle = (BeanHandle)beansByName.get(beanName);
        if (beanHandle != null)
            return beanHandle.getInstance();

        // the bean does not yet exist, look for its properties file
        Properties beanProps = loadBeanProperties(beanName);
        if (beanProps == null)
            return null;

        // look for the bean's class name, indicated by the "class" property
        String beanClassName = beanProps.getProperty("class");
        if (beanClassName == null) {
            System.err.println("No class specified for " + beanName);
            return null;
        }

        // load the bean class
        Class beanClass;
        try {
            beanClass = Class.forName(beanClassName);
        }
        catch (ClassNotFoundException e) {
            System.err.println("Unable to find " + beanClassName);
            return null;
        }

        // create an instance of the bean class
        Object beanInstance;
        try {
            beanInstance = beanClass.newInstance();
        }
        catch (IllegalAccessException e) {
            System.err.println(beanName + " does not have a public default constructor");
            return null;
        }
        catch (InstantiationException e) {
            System.err.println("Unable to instantiate " + beanName + ": " + e.toString());
            return null;
        }

        // at this point we have a live bean. add it to the namespace
        // so that others can hook up with it. it's important to do this
        // before setting the bean properties so that we can handle
        // reference loops.
        beanHandle = new BeanHandle(this, beanName, beanClass, beanInstance);
        beansByName.put(beanName, beanHandle);
        beansByInstance.put(beanInstance, beanHandle);

        // set the properties of the bean
        beanHandle.setProperties(beanProps);

        // the bean is completely instantiated. see if it wants to
        // know about its completion.
        if (beanInstance instanceof BeanInstantiationListener)
            ((BeanInstantiationListener)beanInstance).beanInstantiated(beanHandle);
    }
}
```

Continued on Page 56


```
        return beanInstance; // all done!
    }

    /**
     * Retrieves the property information for a bean.
     */
    private Properties loadBeanProperties(String beanName)
    {
        String propFileName = beanName + ".properties";
        FileInputStream inStream = null;
        try {
            inStream = new FileInputStream(propFileName);
            Properties beanProps = new Properties();
            beanProps.load(inStream);
            return beanProps;
        }
        catch (IOException e) { // failed
            System.err.println("Unable to load " + beanName + ": " + e.toString());
            return null;
        }
        finally {
            if (inStream != null) {
                try {
                    inStream.close();
                }
                catch (IOException e) {}
            }
        }
    }
    // ... code elided for brevity ...
}
```

`getPropertyDescriptors()` method returns a list of `PropertyDescriptor` objects, which describe each property provided by the bean.

Each `PropertyDescriptor` contains the name of the property and its type, information about the methods used to get/set the value of the property and some other attributes that are mostly interesting to GUIs. The `BeanHandle` constructor takes the list of property descriptors and inserts them into a hash table by name so they can be easily found later.

Once a bean has been instantiated by the bean manager, it calls `BeanHandle.setProperty(Properties)` to configure the bean. This method simply iterates over the properties provided and calls `BeanHandle.setPropertyAsText(String, String)` to set the individual properties.

The `setPropertyAsText()` method is the heart of the bean application framework. Its job is to convert a string representation of a property value into the actual property value. These can be either literal values (for example, for basic types like `int`, `float` or `String`) or references to other objects.

To facilitate the conversion of text values (such as those from the bean properties file) into types that can be manipulated by a program, the JavaBeans framework provides a set of classes called *property editors*. It is the job of a property editor to take one representation of a value and convert it into another. For example, the `setPropertyAsText()` method finds the property descriptor for the indicated property, saved previously in a hash table, and uses it to determine the property's type. Then, it calls `PropertyEditorManager.findEditor(Class)` to look up the property editor associated with that type. If one is found, which is typically the case if it's a basic Java type, the `PropertyEditor.setAsText(String)` method is

called to insert the value from the properties file into the editor, and then `PropertyEditor.getValue()` is used to retrieve the converted value. This value is set in the bean using `BeanHandle.setProperty(String, Object)` and our bean is one step closer to being configured.

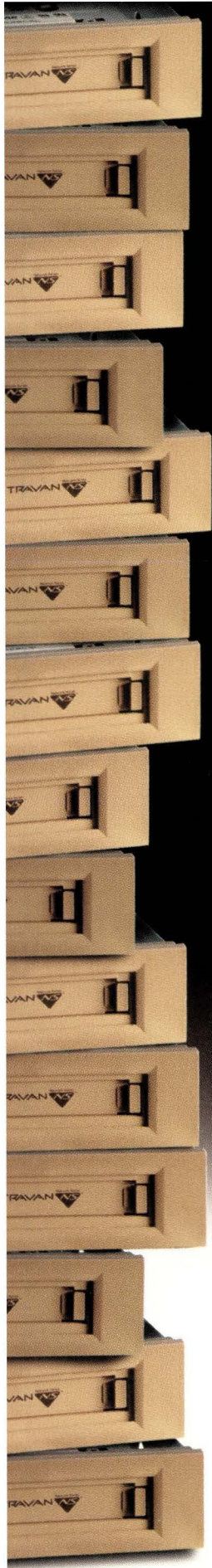
The `setProperty(String, Object)` method works by looking up the property writer method in the property descriptor and calling it with the object instance and the converted value. It is the last piece of the puzzle needed to completely configure a bean.

Once all bean properties have been set, the bean manager looks to see if the bean implements the `BeanInstantiationListener` interface; if so, it calls the `beanInstantiated()` method. This allows an object to perform any tasks it is required to do after it is fully configured.

Blessed Be the Tie that Binds

At this point, we can instantiate and configure a bean from a description in a properties file. But in order to turn a set of beans into a complete application, we need a way to bind them together. This task is managed by `setPropertyAsText()` as well. Any property value that cannot be converted by a property editor is assumed to be the name of another bean, and is resolved into an object via the bean manager.

This is an extremely powerful mechanism; it allows an entire application to be built by beans that reference each other solely in configuration files. This provides the mechanism by which we turn a set of beans into a complete application *without requiring any intermediate source code*, and the interaction between beans is as fast as straight Java code because they reference each other directly.



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Listing 2. The BeanHandle Object (abridged)

```
package beanmanager;

import java.beans.*;
import java.lang.reflect.*;
import java.util.*;

/**
 * Information about a bean instance and some utility methods for
 * manipulating it.
 */
public class BeanHandle
{
    private BeanManager manager;
    private String name;
    private Class beanClass;
    private Object instance;
    private BeanInfo beanInfo;
    private Hashtable propertyDescriptors = new Hashtable();

    /**
     * Constructs a new bean handle.
     */
    public BeanHandle(BeanManager manager,
                     String name,
                     Class beanClass,
                     Object instance)
    {
        this.manager = manager;
        this.name = name;
        this.beanClass = beanClass;
        this.instance = instance;

        // look up the bean's information
        try {
            beanInfo = Introspector.getBeanInfo(beanClass);
        }
        catch (IntrospectionException e) {
            System.err.println(name + ": Unable to find bean information");
            return;
        }

        // find all the bean properties and hash them
        PropertyDescriptor[] pds = beanInfo.getPropertyDescriptors();
        for (int i = 0; i < pds.length; i++) {
            propertyDescriptors.put(pds[i].getName(), pds[i]);
        }
    }

    // ... code elided for brevity ...

    /**
     * Returns the property descriptor for the indicated property.
     */
    public PropertyDescriptor getPropertyDescriptor(String propName)
    {
        return (PropertyDescriptor)propertyDescriptors.get(propName);
    }

    /**
     * Sets a bean's properties from a set of properties.
     */
    public void setProperties(Properties beanProps)
    {
        // walk through the properties that have been specified for the
        // bean and set them.
        Enumeration propEnum = beanProps.propertyNames();
        while (propEnum.hasMoreElements()) {
            String propName = (String)propEnum.nextElement();
            String fullPropName = name + "." + propName;

            if (propName.equals("class")) // not really a property
                continue;
            String propTextValue = beanProps.getProperty(propName);
            try {
                setPropertyAsText(propName, propTextValue);
            }
        }
    }
}
```


Java Class

```
        catch (IllegalAccessException e) {
            propertyError(propName, "Property writer is not public");
        }
        catch (IllegalArgumentException e) {
            propertyError(propName, "Property value does not match property type");
        }
        catch (InvocationTargetException e) {
            propertyError(propName, "Exception while setting value: " +
e.getTargetException().toString());
        }
    }
}

/**
 * Sets a property in the bean.
 */
public void setProperty(String propName, Object propValue)
    throws IllegalAccessException, IllegalArgumentException, InvocationTargetException
{
    PropertyDescriptor pd = getPropertyDescriptor(propName);
    if (pd == null) {
        propertyError(propName, "No such property");
        return;
    }
    Method writeMethod = pd.getWriteMethod();
    if (writeMethod == null) { // not writable
        propertyError(propName, "Read-only property");
        return;
    }
    writeMethod.invoke(instance, new Object[] { propValue });
}

/**
 * Sets a property in the bean to a text value.
 */
public void setPropertyAsText(String propName, String propTextValue)
    throws IllegalAccessException, IllegalArgumentException, InvocationTargetException
{
    // find the property descriptor for the specified property
    PropertyDescriptor pd = getPropertyDescriptor(propName);
    if (pd == null) {
        propertyError(propName, "No such property");
        return;
    }

    // find the type of the property
    Class propType = pd.getPropertyType();
    Object propValue = null;

    // see if there's a property editor for this type. note that
    // this does not honor custom property editors.
    PropertyEditor propEditor = PropertyEditorManager.findEditor(propType);
    if (propEditor != null) { // use the editor
        propEditor.setAsText(propTextValue);
        propValue = propEditor.getValue();
    }

    // no property editor, assign from bean namespace if it's
    // an object type.
    else if (Object.class.isAssignableFrom(propType)) {
        if (!propTextValue.equals("null")) {
            propValue = manager.findBean(propTextValue);
            if (propValue == null) {
                propertyError(propName, "No bean named " + propTextValue);
                return;
            }
        }
    }
    else { // no idea what to do about this property.
        propertyError(propName, "No property editor for " + propType.getName());
        return;
    }
    // go set the property
    setProperty(propName, propValue);
}
// ... code elided for brevity ...
}
```


Listing 3. The Message Application Beans

```
package mybeans;

import java.io.*;
import beanmanager.*;

/**
 * A bean that can write a message.
 */
public class Message
    implements BeanInstantiationListener
{
    private String message;
    private MessageWriter writer;

    // Property accessors

    public String getMessage() { return message; }

    public void setMessage(String newMessage) { message = newMessage; }

    public MessageWriter getWriter() { return writer; }

    public void setWriter(MessageWriter newWriter) { writer = newWriter; }

    // BeanInstantiationListener interface implementation

    public void beanInstantiated(BeanHandle beanHandle)
    { writer.writeMessage(message); }
}

/**
 * An interface for classes that write out messages.
 */
public interface MessageWriter
{
    // Called to write out a message.
    void writeMessage(String message);
}

/**
 * A bean that writes messages to the console.
 */
public class ConsoleMessageWriter
    implements MessageWriter
{
    // MessageWriter interface implementation
    public void writeMessage(String message) { System.out.println(message); }
}

/**
 * A bean that writes messages to an output stream.
 */
public class FileMessageWriter
    implements MessageWriter
{
    private String filename;
    private boolean append;
    private PrintWriter out;

    // Property accessors

    public boolean getAppend() { return append; }

    public void setAppend(boolean newAppend) { append = newAppend; }

    public String getFilename() { return filename; }

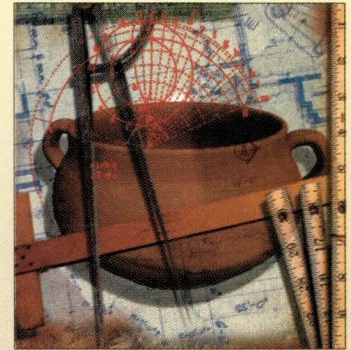
    public void setFilename(String newFilename)
    {
```



```
filename = newFilename;

// try to open the file
try {
    out = new PrintWriter(new FileWriter(filename, append));
}
catch (IOException e) {
    System.err.println(filename + ": " + e.toString());
}

// MessageWriter interface implementation
public void writeMessage(String message)
{
    if (out != null) {
        out.println(message);
        out.flush();
    }
}
}
```



Hello World!

To illustrate the use and flexibility of our bean framework, let's implement two variants of the traditional "Hello World!" program. Listing 3 lists the beans that our application will use. The Message bean knows the text of our message and has a reference to another bean, MessageWriter, which is used to print it out. Two different MessageWriter beans are provided: a ConsoleMessageWriter, which prints the message to standard output, and a FileMessageWriter, which prints it into a file.

Two properties files configure our application to print "Hello World!" to the console. They are Message.properties:

```
# The bean class
class=mybeans.Message
# The message we want to write
message=Hello world!
# How we want to write it
writer=ConsoleWriter
```

and ConsoleWriter.properties:

```
class=mybeans.ConsoleMessageWriter
# No properties necessary
```

To run our example, simply provide the name of the main bean class to the bean manager:

```
$ java beanmanager.BeanManager Message
Hello World!
```

But what if the user wants the message to go somewhere else? Well, with our bean framework she need only provide a different implementation of the MessageWriter interface that does whatever she wants and change the Message bean configuration file's writer property to point to hers instead.

To make the change, modify Message.properties to read:

```
# The bean class
```

```
class=mybeans.Message
# The message we want to write
message=Hello world!
# How we want to write it
writer=FileWriter
```

and create a FileWriter.properties file:

```
class=mybeans.FileMessageWriter
# The file to write messages into
filename=message.out
# True if messages should be appended
# to the file rather than overwritten
append=true
```

Now when you run the bean application, the message goes to the message.out file. You've significantly changed the behavior of the Message application without making any changes to the code—only changes to the properties files that describe the beans.

Holes in the Bean Pot

Using this simple framework—only a few hundred lines of code—you can build applications of arbitrary complexity entirely out of JavaBeans—and the application can be reconfigured or augmented with minimal muss and fuss. Although useful, this framework (as is) does not implement two important features: It cannot deal with sets of event listeners (which makes it difficult to use if your beans are event-driven), and it does not understand array property values. These features are left as an exercise for the reader.

If you would like to experiment with this bean framework, which I strongly encourage, you may download it and the sample beans via anonymous FTP from <ftp.expert.com/pub/JavaClass/05.1999/>. Next month, we'll use this framework to build a simple Internet server. ➡

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

When to



You've no doubt heard rumblings through the grapevine that if a business isn't fully operational 24 hours a day, it's not going to succeed in the present global marketplace. But is it absolutely necessary for companies to make their servers constantly available?

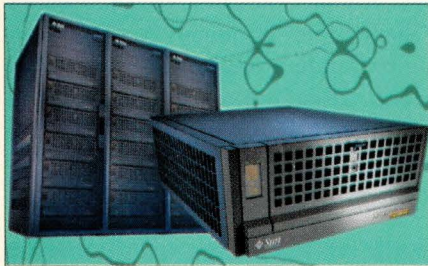
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Circle 102

New StorEdge Array from Sun

Sun Microsystems' StorEdge A5100 Fibre Channel Storage Array reportedly provides a 14-drive enclosure that supports high-end 18.2-GB 7,200-rpm disk drives. The array comes with a diagnostic



tool kit for performing FC-AL tests and monitoring the configuration.

The A5100 runs on a range of Sun servers, including Enterprise 3000-10000 servers, SPARCserver 1000E and 2000E, Enterprise 450 and 250, Enterprise 2 and Sun Ultra 60. It also runs on Windows NT. Pricing starts at \$35,000.

Sun Microsystems Inc.
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<http://www.sun.com>
Circle 103

Multivendor Network Management Solution

Lucent Technologies has announced the availability of OneVision Management Systems, a four-component software suite for network operators. OneVision provides interdomain and network service management features, as well as support for multiple protocols and interfaces used in Asynchronous Transfer Mode (ATM), Frame Relay and Internet Protocol (IP) networks.

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In addition, the OneVision Interdomain Management System component is designed to provide end-to-end service provisioning and fault management across multivendor, multidomain and multitechnology network environments, including Synchronous Optical Network (SONET), and the European equivalent, Synchronous Digital Hierarchy (SDH), ATM, Frame Relay and IP.

OneVision also comes with a Customer Service Management System component, which allows network operators to provide integrated network and service management on a customer-specific basis across multiple technology domains by correlating network data to customers

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NEW PRODUCTS

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

USB-Based Authentication

A new USB-based cryptographic authentication token, called iKey M2, is now available from Rainbow Technologies. iKey M2 stores up to four digital certificates and offers 1024-bit RSA support through PKCS #11. Rainbow is positioning the token as an alternative to strong encryption for secure email, Web-based access control and virtual private networks (VPNs). With iKey, users can implement strong token-based, two-factor authentication using X509v3 digital certificates and



Lightweight Directory Access Protocol (LDAP)-based directories for authentication services, the company says.

iKey is IPSecurity/Internet Key Exchange (IPSec/IKE)-compatible, provides MD5 hashing, has an 8-KB memory and an on-key processor, and inserts directly into the computer's USB port. iKey M2 offers users a low-cost alternative for strong encryption, the company says. A single iKey unit costs \$49 (bulk discounts are available). A software development kit is available for \$79, which includes sample applications and API libraries.

Rainbow Technologies Inc.

50 Technology Drive
Irvine, CA 92618
<http://www.rainbow.com>
Circle 101

UNIX Virus Protection

Sophos has announced Sophos Anti-Virus for UNIX, an antivirus software package that can be installed on several UNIX file servers and workstations.

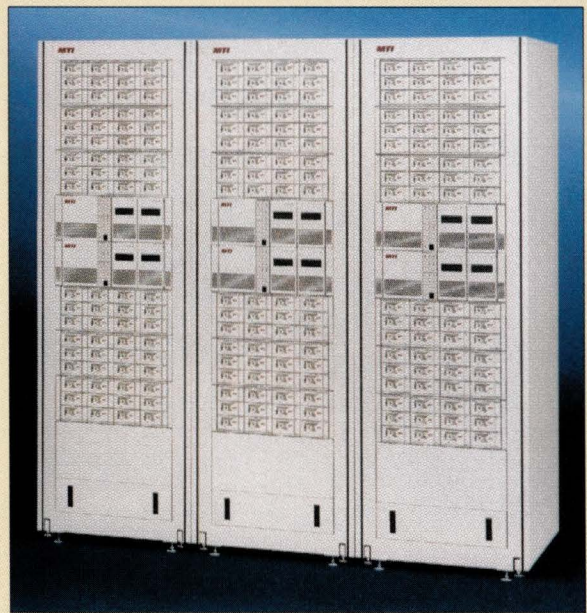
Viruses are detected using Sophos' Virus Description Language (VDL) and alerts are distributed via email. The software provides automatic centralized reporting of every virus incident, the company says. Each month, Sophos sends every user a new copy of the program that includes the latest virus protection. Client copies of Sophos Anti-Virus are automatically updated whenever a more recent version is detected on the network, Sophos says. However, workstation copies of the software can only be removed by the network administrator.

RAID System Offers Flexibility

MTI Technology's Gladiator 3500 enterprise RAID data storage system is designed for high-availability, high-performance Ultra SCSI environments such as online transaction processing (OLTP), decision support, data warehousing, data mining, workgroup computing and Inter/intranet applications. Depending on the application, the I/O parameters can be adjusted to balance host-to-storage interchange across multiple drives to increase performance, MTI says.

The Gladiator 3500 features MTI's Scalable Modular Architecture (SMA), a technology framework that separates the RAID engine from disk storage. SMA comprises two major components: RAID Elements and Storage Elements. Fault-tolerant RAID Elements include high-performance RAID processors, cache memory and redundant hot-swappable power supplies. Storage Elements are designed for modular capacity expansion and include redundant, hot-swappable power supplies and up to 12 hot-swappable disk drives, the company says.

The Gladiator 3500 features up to 256 MB of mirrored processor cache per RAID Element, as well as built-in systems to monitor, configure and provide alert status to administrators via the system's RAID-Manager software. The RAID Element host connection features two 40-MB/s Ultra SCSI ports per controller and supports up to 855 GB of storage per RAID Element. It features dual-active RAID controllers, as well as component redundancy for host connections, power supplies, power connections and fans. Data is routinely evaluated for synchronization to ensure reli-



able reconstruction in the event of a failure, and all active components are hot-swappable, MTI says.

The Gladiator 3500 supports a number of operating systems, including HP-UX, IRIX, Solaris and Windows NT. Pricing for an entry-level system starts at \$61,050.

MTI Technology Corp.

4905 E. La Palma Ave.
Anaheim, CA 92807
<http://www.mti.com>
Circle 100



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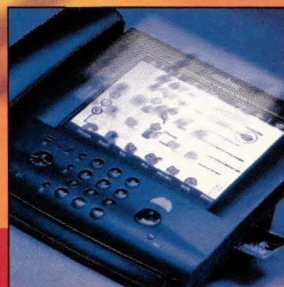
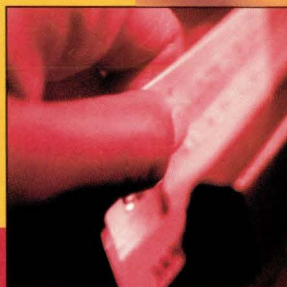
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Go to <http://java.sun.com/javaone/>

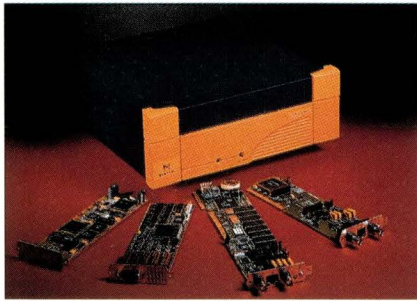


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SETMGX

Convergence Technology in a Switch

Memotec Communications has introduced the CX950 Multiservice Access Switch. With CX950, analog and digital compressed audio, video, legacy data and LAN traffic can be carried over a wide range of networking protocols, the company says.



The switch supports x.25, ISDN and Frame Relay, and is the first of Memotec's CX family of convergence products to offer T1/E1 Asynchronous Transfer Mode (ATM) access for public and private network environments. To deploy ATM capabilities, customers can add the ATM T1/E1 Access Module to the CX950 with no change to their software, the company says.

CX950 Multiservice Access Switch ships with Memotec's Common Software Platform and interoperates with all other Memotec CX products. Pricing for CX9500 starts at \$4,500.

Memotec Communications Inc.
600 McCaffrey St.
Montreal, Quebec
Canada H4T 1N1
<http://www.memotec.com>
Circle 183

Encrypted Remote Access

Radguard has introduced cIPro-client 2.0, the latest version of the company's remote access software. Version 2.0 is a full service IPSecurity/Internet Key Exchange (IPSec/IKE) encryption package for remote users and telecommuters, Radguard says. With cIPro, a user can access various computers based on a unique ID. It allows business travelers or employees working from home to communicate securely with their corporate networks using any Windows-based communications software.

Scheduled to be available later this month, cIPro-client 2.0 costs \$125 for a single-user system. It supports all Windows 95/98/NT-based communications programs, as well as Ethernet, Fast Ethernet, FDDI and ISDN. According to Radguard, cIPro-client 2.0 is appropriate for Network Driver Interface Specification (NDIS) LAN/WAN adapters, such as PCMCIA, PCI or ISA cards, and is compatible with other IPSec/IKE-compliant solutions.

Radguard Inc.
575 Corporate Drive
Mahwah, NJ 07430
<http://www.radguard.com>
Circle 184

Enhanced Multimedia Conferencing Software

The latest version of MeetingPoint Conference Server is now available from White Pine Software. MeetingPoint 3.5.1 offers group conferencing and collaboration capabilities between users of H.323-based clients, White Pine's CU-SeeMe Pro and Sun Microsystems Inc.'s Sun Forum T.120 collaboration clients.

MeetingPoint is said to provide automatic backup and recovery mechanisms, as well as an automated system for monitoring and adjusting audio latency over IP networks. It is an ideal system for large-scale deployment of MeetingPoint H.323 videoconferencing servers, the company says.

MeetingPoint 3.5.1 is available for Solaris and Windows NT. Pricing starts at \$8,995 for a 10-user license and varies depending on the number of simultaneous users.

White Pine Software Inc.
542 Amherst St.
Nashua, NH 03063
<http://www.wpine.com>
Circle 185

Group Scheduling Software from Sun

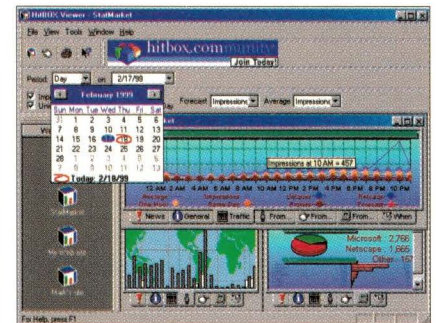
Sun Microsystems has introduced Sun Calendar Server 1.0, an extension to its Internet Mail Server. Based on Internet Engineering Task Force (IETF) standards for calendaring systems, the software can be edited using a Web browser. In addition, users can per-

sonalize their schedules, as well as coordinate meetings with other users across the network. Sun Calendar Server offers a security framework based on client permission parameters. It costs \$875 per server and is available for Solaris and Intel platforms.

Sun Microsystems Inc.
901 San Antonio Road
Palo Alto, CA 94303
<http://www.sun.com>
Circle 186

Tracking Software Adds Windows Interface

Users of WebSideStory's HitBOX Tracker Web site traffic analysis service can now download the free HitBOX Tracker Viewer for Windows. Viewer for Windows is a new interface displaying real-time data from HitBOX Tracker. It is capable of displaying more than 125 real-time statistics, measuring things such as referring domains, referring URLs, search engine traffic, a visitor's Internet service provider (ISP) and the number of unique visitors.



Other features include the ability to check multiple Web page statistics simultaneously and to export data to Microsoft Corp. Excel spreadsheets, the company says. HitBOX Tracker is a free service webmasters can access by registering at WebSideStory's site and downloading a small piece of code to be pasted into their Web page. The code allows the HitBOX service to keep track of visitors to the registered site. The results can be viewed using Viewer for Windows or by visiting the WebSideStory site, the company says.

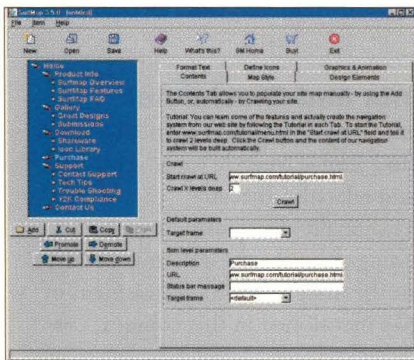
WebSideStory Inc.
6450 Lusk Blvd., Ste. E-205
San Diego, CA 92121
<http://www.websidestory.com>
Circle 187

URL/New Products

Navigation Tool Upgrade

SurfMap has added new features to its search and navigation software. With SurfMap Version 3.5.0, webmasters can create a navigation system, interactive index or site map, the company says. Its point-and-click interface is said to allow Web designers to create and implement 100% Pure Java-certified navigation applets without requiring any programming.

SurfMap includes a crawling capability that automatically navigates



through a site to create a graphical representation of its contents. New features include support for menu highlighting, crawling behind firewalls, crawling sites that require login, relative and absolute URL translation, crawling metadata and a new built-in tutorial and integrated online help feature.

SurfMap can be purchased for \$99 directly from the company's Web site and runs on most flavors of UNIX, as well as Windows 95/98/NT.

SurfMap Inc.

3385 Harvester Road, Floor 2
Burlington, Ontario
Canada L7N 3N2
<http://www.surfmap.com>

Circle 181

Web-Based Project Management

Mesa Systems Guild has added Mesa/VistaPM Pro to its line of Web-based project management software. Mesa/VistaPM Pro is specifically

designed for project teams of less than 100 people and will join Mesa/Vista Enterprise, which is designed for large organizations managing a broad range of complex projects, and Mesa/Vista-PM, which is a free offering designed for single projects, the company says.

Mesa/VistaPM Pro provides sharing, navigation and collaboration capabilities on entire product schedules. Project managers can use the product to create graphs and reports detailing a project's progress. The automatic notification feature, for example, reportedly allows team members to monitor the status of upcoming tasks.

Mesa/VistaPM Pro costs \$4,000 per server for an unlimited number of users. It runs on Solaris, HP-UX and Windows NT.

Mesa Systems Guild Inc.

60 Quaker Lane
Warwick, RI 02886
<http://www.mesasys.com>

Circle 182

Adobe Touts Web Capture Tool

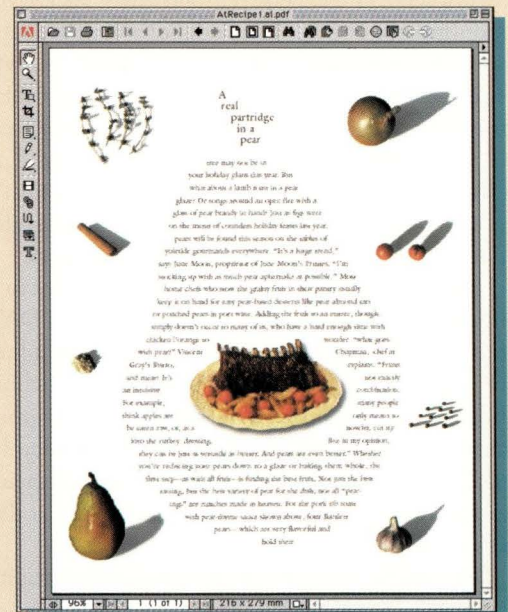
Acrobat 4.0, the latest release of Adobe Systems' Acrobat software for creating Portable Document Format (PDF) files, now features a Web Capture utility, which allows users to download, annotate, scale, print and distribute fully formatted Web pages. Acrobat 4.0 converts live Web pages into PDF files that preserve the pages' graphics, fonts, colors and active hyperlinks. In addition, Acrobat 4.0 comes with a full set of security and annotation tools (annotation tools include the ability to add "sticky notes" and audio clips to files), the company says.

Acrobat 4.0 also supports digital signatures, which enable users to authenticate and safeguard information by allowing authors and key personnel to "sign" electronic documents. Those users who need to convert Microsoft Corp. Word, Excel or PowerPoint files into PDF format can now do so with Acrobat's new PDFMaker utility, Adobe says.

Acrobat 4.0 is available for \$249 for Macintosh and Windows platforms. However, the Web Capture and digital signatures features are currently only available in the Windows version.

Adobe Systems Inc.

345 Park Ave.
San Jose, CA 95110
<http://www.adobe.com>
Circle 180



server, LDAP software development kit(s) and LDAP maintenance tools demands delicate, careful analysis. Even when technical decisions are clear, organizational dynamics often handicap LDAP deployment. Efficient LDAP usage depends on adherence to standards and high-quality data, which strains the capacity for teamwork in many departments. Many of the initial benefits of LDAP deployment have to do with a reduction in maintenance costs. Sexier and more dramatic issues such as Y2K, multimedia and teamware easily command more attention than the "internal plumbing" that LDAP often seems to represent.

Whither LDAP?

LDAP's profile has improved dramatically in the past year. Novell Directory Services (NDS) is now compatible with LDAP, and Microsoft promises the same for its Active Directory. Netscape's Smith is proud of the progress his team has made since its first product release: "I am certain that Directory Server 3.1 is an exceptionally robust product." Customers have responded by purchasing 50 million user licenses in the past six months. Netscape lowers development hurdles by binding LDAP to several languages, including Java, JavaScript, Open Database Connectivity (ODBC) and Visual Basic. Well-known open-source projects such as Apache, FreeBSD, Linux, Perl, Portable Hypertext Processor (PHP), Sendmail, Python and Tcl all expanded their LDAP connections in 1998. In addition, the OpenLDAP Project emerged as "a collaborative effort to develop a robust, commercial-grade, fully featured and open-source LDAP suite of applications and development tools," according to its Web site.

Several prospective "killer apps" dependent on LDAP have also appeared. Perhaps the most interesting of these is Sun Microsystems Inc.'s Sun.Net remote access product. Sun.Net combines Internet commodity pricing with sophisticated security and access features to allow remote workers to use corporate computing applications, internal Web sites and network services inexpensively and safely. As Dr. Stuart Wells, senior director of Sun's Network Software products, explains, "This new technology will provide a secure, cost-effective connection from the public Internet...without the costs normally associated with building a virtual private network [VPN]—it's true ubiquitous access to corporate IT resources and your virtual enterprise." LDAP's contribution is to manage an access-control scheme that's flexible enough to span the requirements of both security and efficiency.

Netscape's Smith emphasizes LDAP's ability to help administrators solve several problems at once. "LDAP directories are valuable because they can help Web administrators solve a number of difficult problems. These include authentication of users, authorization (based on users, groups, roles and so on), sharing of configuration information between multiple instances of applications, server management and a variety of problems where an inexpensive, fast database is needed," Smith says.

LDAP is emerging as a technology organizations reuse in a range of development projects. Smith told us one of his favorite success stories is Ford Motor Co.'s Supplier Network.

This suite of Web-based applications running on Ford's intranet has exacting requirements for large-scale authentication and authorization. "The performance characteristics, ease of integration and standard access protocol are some of the things that made them choose an LDAP directory service instead of an RDBMS," Smith says.

Even LDAP's thorniest problems seem to be improving. Schema standardization is progressing, with heavyweights like Cisco Systems Inc. and Microsoft supporting standards such as the Desktop Management Task Force Inc.'s Directory Enabled Networks (DEN) specification. Last year saw an explosion of activity in metadirectory technologies, which promise to rationalize many of the current challenges, especially the quality of data, in maintaining LDAP information. On the key technical point of when the IETF LDAP replication standard will be approved and widely implemented, Smith says: "We will see early products sometime in 1999, but the standard itself probably won't be stable until sometime in 2000."

LDAP's a keeper. Whatever hardware and applications you use, you're likely to be connecting to LDAP within the next few years. This is a good time to read *Understanding and Deploying LDAP Directory Services* to be sure you're ready for the changes.

Acknowledgments and Disclaimer

Our thanks to Merrill Cook, Alexandre Ferrieux, Randy Kunkee, Larry Virden and Jean-Claude Wippler for their discussions on LDAP and related subjects.

One of us (Laird) occasionally does business with Macmillan Technical Publishing. Bluntly, the amounts involved are too small to threaten the integrity of our assessment of the two Macmillan books mentioned in this column. ➔

Companies Mentioned in this Article

Cisco Systems Inc.
170 W. Tasman Drive
San Jose, CA 95134
<http://www.cisco.com>
Circle 171

Desktop Management Task Force Inc.
200 S.W. Market St.
Ste. 450
Portland, OR 97201
<http://www.dmtf.org>
Circle 172

Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
<http://www.microsoft.com>
Circle 173

Netegrity Inc.
245 Winter St.
Waltham, MA 02154
<http://www.netegrity.com>
Circle 174

Netscape Communications Corp.
501 E. Middlefield Road
Mountain View, CA 94043
<http://www.netscape.com>
Circle 175

Novell Inc.
2211 N. First St.
San Jose, CA 95131
<http://www.novell.com>
Circle 176

OpenLDAP Project
270 Redwood Shores Pwy.
Ste. 107
Redwood City, CA 94065
<http://www.openldap.org>
Circle 177

Sun Microsystems Inc.
901 San Antonio Road
Palo Alto, CA 94303
<http://www.sun.com>
Circle 178

information delivery (accounts, passwords and so on) typical of directories.

Another difference between LDAP and DBMSs is an emphasis on replication. It might be advantageous to, say, store directory information about a particular department's employees on that department's server. Then, most LDAP inquiries from that department can be answered locally. The LDAP standard describes how data elements can be kept on more than one host and how different hosts cooperate to retrieve information not accessible locally. Distribution and replication of LDAP data stores are part of the definition of the protocol, although the complete specification of the latter is still under discussion. Netscape Directory Architect Mark Smith offers this definition:

"LDAP is an Internet standard protocol for accessing and updating online directory information. Online directories are most commonly used to store information about people and their roles and relationships, but LDAP can be used for any kind of data. A full definition of LDAP involves discussion of four important models:

- The LDAP information model, which defines the kind of data you can put into the directory.
- The LDAP naming model, which defines how you organize and refer to your directory data.
- The LDAP functional model, which defines how you access and update the information in your directory.
- The LDAP security model, which defines how directory information can be protected from unauthorized access."

Driving Force for LDAP

Smith is uniquely qualified to speak on LDAP. He was a driving force behind the development of the University of Michigan's LDAP reference implementation and a key designer of the university's directory service. Netscape hired him in 1996, along with coauthors of *Understanding and Deploying LDAP Directory Services* Good and Howes (also of the University of Michigan), and the center of the LDAP world moved from Ann Arbor, MI, to Mountain View, CA. The following year, Smith and Howes wrote *LDAP: Programming Directory-Enabled Applications with Lightweight Directory Access Protocol*. Also published by Macmillan, this was the standard printed reference before the publication of *Understanding and Deploying LDAP Directory Services*. Throughout this time, Smith has kept up with work for the Internet Engineering Task Force (IETF), most visibly as the author of several RFCs and Internet Drafts.

With the publication of *Understanding and Deploying LDAP Directory Services*, there's finally an authoritative "LDAP Bible," as the book's preface jokes. More precisely, "anyone who wants to know more about LDAP...will find the book useful." The authors emphasize that the book is primarily intended for three types of reader: decision makers, designers and administrators. In many ways, the "why" of LDAP has been more difficult to grasp than the "how." Most early LDAP publications were technical papers written to help programmers get started. Only now does this publication make clear the business significance of directory services, particularly in

the maintenance phase. Most of the life cycle of LDAP applications is in administration, of course, so this focus is both overdue and welcome.

One of the merits of the book is it's organized realistically. Readers often don't want to read a technical book from cover to cover, but pick up a volume with one or two particular questions in mind, so the best books lead readers to particular answers efficiently. The 846 pages of *Understanding and Deploying LDAP Directory Services* appear in six parts. The organization is strong and clear so readers will be able to find the answers they need (Should we be using LDAP? What steps do I take to populate my directories accurately? Where can I find out more?) without mishap.

LDAP's Limitations

So if LDAP is so great, why aren't you using it?

First, the technology is relatively young. It was largely a research project until 1996. When *LDAP: Programming Directory-Enabled Applications with Lightweight Directory Access Protocol* was published in 1997, the book was most useful to working coders who already knew what they were building. At this point, LDAP inherited much of its feel from X.500, an earlier directory protocol of most importance to big projects in large organizations. Most LDAP histories emphasize its early development as a gateway to X.500.

Perhaps the biggest hurdle to LDAP's adoption is that, like most decisions about platforms, middleware or infrastructure, use of LDAP is intrinsically strategic.



Marketplace messages since then have been confusing. For much of this time, Microsoft Corp. and Novell Inc., the two vendors that most urgently need directory solutions for their respective products, have favored proprietary technologies. While Netscape has been way ahead of the field in its LDAP implementation, the early 1.x releases of the Directory Server failed to meet customer expectations.

Perhaps the biggest hurdle to LDAP's adoption is that, like most decisions about platforms, middleware or infrastructure, use of LDAP is intrinsically *strategic*. In contrast, you might change Web servers because of a single feature, such as reliability or performance. LDAP commitments are usually more involved than this. Selection of the right bundle of LDAP

Cameron Laird and Kathryn Soraiz manage their own software consultancy, Network Engineered Solutions, from just outside Houston, TX.

LDAP Comes of Age

It's time to talk about the Lightweight Directory Access Protocol (LDAP).



We've begun writing a column on LDAP every couple of weeks since last summer, then laid it aside in favor of more urgent topics. LDAP's story is a complex one, and knowledge about it is unlikely to pay off as quickly as it does for the latest scoops on operating system reliability or a powerful new application server. The Christmastime release of *Understanding and Deploying LDAP Directory Services*, by Timothy A. Howes, Mark C. Smith and Gordon S. Good (published by Macmillan Technical Publishing, 1998, ISBN 1578700701), however, capped a succession of LDAP events in 1998 that deserve mention.

Let's take a look at what happened and why it's likely to matter to you.

What is LDAP?

Before starting in on the technical characteristics of LDAP, it's useful to get a picture of the kinds of problems it solves. Let's use a typical workday as an example: You log into your Windows NT domain, your UNIX server and the license managers for a couple of monitoring applications. You complain to Human Resources that your paychecks are *still* being routed to the old building. You curse the efficiency of the janitorial staff because you left the latest company telephone list in the trash, forgetting that Chris in Graphics has a new extension. And you think to yourself, "Can't all these computers get together and stop making me answer the same questions over and over?"

LDAP promises to come to your rescue. LDAP is a protocol, like File Transfer Protocol (FTP), Hypertext Transfer Protocol (HTTP) or Simple Mail Transfer

Protocol (SMTP). HTTP and SMTP, for example, are designed to provide for efficient transactions of Web pages and email messages, respectively. LDAP's target is information that fits into a directory, such as names, addresses, passwords, access authorizations, native languages and so on. LDAP is designed for a client/server architecture, which manages and uses directory information.

A useful LDAP application, therefore, has several pieces. For example, Netegrity Inc.'s SiteMinder product is an authorization and policy manager for Web applications. It includes components that manage information about Web visitors and provides access to that information.

Does that sound like a job for a DBMS? It is. In several aspects LDAP is a special-purpose DBMS. SiteMinder was originally tested on a relational DBMS like Oracle from Oracle Corp. By moving to LDAP, Netegrity was able to lower licensing costs and management overhead and improve SiteMinder performance and scalability.

LDAP: Not Just a DBMS

Don't be misled into thinking LDAP is simply an inexpensive DBMS, however. Strictly speaking, LDAP is just the networking protocol. It's possible to feed that protocol through a gateway from a conventional DBMS and, in fact, several installations do exactly this. Very often, those who work with it say "LDAP" to abbreviate the entire system, including a specific data store and query interface, as well as the networking pieces that communicate through the protocol. SiteMinder uses Netscape Communications Corp.'s Directory Server as its data store. Directory Server, now available in Version 4.0, is tuned to high-performance

under the name Windows NT 2000 Load Balancing Service.

On the UNIX side, no system vendor has made any formal announcement about including load-balancing capabilities in its operating system thus far, but Acuitive's Hoover predicts they will come in the form of low-end clustering solutions such as Sun's Full Moon.

Smarts in Switches

Another area where load balancing is being applied is directly within network hardware, mainly in the form of "smart" switches. Companies taking this approach include Alteon Networks Inc., San Jose, CA, ArrowPoint Communications Inc., Westford, MA, and the aforementioned HolonTech. For these companies, taking the switch approach over the appliance approach is just a matter of evolutionary sense. "When researchers wrote the original router code, they ran it on a general-purpose Sun workstation, where it ran much slower than it needed to," says Dan Tuchler, director of product marketing for switches at Alteon. Then, Cisco started making machines dedicated to routing, which got better performance. "Now, no one would dream of making a software-based router," he says. Likewise, load balancing will eventually be handled largely by networking equipment, Tuchler says.

What differentiates a switch from a router-like PC is simply the amount of raw throughput it can handle. By directing traffic lower down on the protocol stack—OSI Layer 2 rather than Layer 4 or above—switches can run proverbial circles around an appliance. In informal tests, for example, Alteon clocked its ACEswitch running at 10,000 TCP connections per second, instead of the 2,000 to 3,000 TCP connections per second typical with load-balancing appliances.

But opponents argue that traditional switches aren't equipped with enough CPU power to adequately service the large amounts of processing that load balancing requires.

"Everyone thinks that a switch must be faster than a router, but in the 100-Mb/s Ethernet environment that hasn't been the case," says Bill Kish, chief engineer at Coyote Point Systems. "Switches are real good at moving Ethernet packets from one port to another," he says, but when you add on OSI Layer 4 capabilities, a switch's CPU can get overloaded very quickly. "Load balancing on a switch can actually be slower than on a device like Equalizer," according to Kish.

"Switches that get away from their original design typically



HolonTech's HyperFlow products are switch-based cluster managers designed to provide high availability and scalable performance in an Internet environment.

run slower," says Collaborative Research's Christy. "The good news and the bad news about switches is that you must know what you want to do with them from the beginning, so that you can design them with the proper ASICs from the outset."

To take another Alteon example, ACEswitches are equipped with special ASICs, as well as two specialized RISC processors on each port, for up to 20 processors. In contrast, traditional switches usually come with one processor. This allows the ACEswitch to perform more processing than a normal switch by distributing the processing over several ports, Alteon's Tuchler says.

Load-balancing switches are especially interesting in light of future Internet growth. "The Internet is doubling every 100 days," says HolonTech's Johnson, "[and] many more visitors are going to come pounding on your doors." With that in mind, Tuchler asks: "Why would you want to put in a solution that you're just going to have to rip out?"

Interestingly enough, where load-balancing switches will really shine is not so much in commercial Web sites, but rather corporate intranets. "Big Web sites don't really have a bandwidth problem," says Acuitive's Hoover, "because everyone is connecting to them over the WAN. But intranets, where there are 100-Mb/s and sometimes gigabit pipes, that's a different story." ➔

Companies Mentioned in this Article

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235 Littleton Road, Ste. 3
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Radware Inc.
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Valence Research Inc.
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Seattle, WA 98119
<http://www.f5.com>
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Equalizer from Coyote Point Systems is one of a number of 'black box' network appliance products to follow in the footsteps of Cisco's LocalDirector.

ware in the kernel of an embedded UNIX operating system, such as BSDI from Berkeley Software Design Inc.

One example of a load-balancing appliance that runs atop of BSDI is F5's BIG/ip. "They take the networking code and the basic UNIX-like model of process management, and they add the technology that redirects network traffic," says Doug Turner, director of product marketing at BSDI in Colorado Springs, CO. What this approach offers a product such as BIG/ip is performance, says Turner. "The basic goal is to keep everything running within the kernel. If stuff starts happening at the operating system level, things grind to a halt," he says.

But from a vendor's point of view, running on top of a well-known UNIX operating system has other advantages—namely, the ability to "get new features to market fast," says Mark Hoover president of Acuitive Inc., a network computing consulting firm based in Wilmington, DE, "because you don't have to do any hardware development."

As such, load-balancing appliances can offer very rich feature sets. Above and beyond simple Web server load balancing, many appliance vendors also offer load balancing for geographically distributed sites (Cisco, Coyote Point, F5, HydraWEB), cache servers (Radware), firewalls (Radware) and secure proxies (HydraWEB), with many product enhancements still to come, vendors assure customers.

If anything, says BSDI's Turner, "when resources such as memory and disk space abound on a machine, the first product to come to market tends to have way too much stuff on it because the developers haven't had time to pare it down." And, he adds, "even when you're running a fairly simple box, it's nice to have a full set of UNIX utilities on hand to help you troubleshoot your system."

It's networking-oriented customers who appreciate the load-balancing appliance's foolproof, black box nature, says Peter Christy, principal at Collaborative Research. Assuming that what you're looking for from a load balancer is reliability, and that Web server software is what's causing the failure, "it makes much more intuitive sense to add a simple black box appliance—that doesn't have a complex operating system, that doesn't have a disk—than to add more software," says Christy. That said, it's no surprise the appliance model dominates the load-balancing market, both in terms of sales and the overall number of products.

In the long run, however, it's unclear whether load-balancing appliances will continue to enjoy the popularity they do

now. As more and more users come aboard the Internet, the basic PC-based appliance architecture will not be able to deal with the sheer amounts of traffic it will be asked to handle, critics say. "There are just some basic limitations to what you can do with a PC," says Dave Johnson, product marketing manager at HolonTech Corp., San Jose, CA, maker of Hyper-Flow switch-based load-balancing products.

And while the load-balancing appliance's assets (simplicity, rich feature sets) position it as the front-runner for the foreseeable future, some industry observers, like Glen Kosaka, director of product marketing at Resonate Inc., a Sunnyvale, CA-based load-balancing software vendor, see the load-balancing appliance as a "dying breed."

It's a Software Problem

Shortly after Cisco introduced LocalDirector, Resonate introduced Dispatch, another early load-balancing product. Unlike Cisco and its throngs of imitators, Resonate opted to take what has proved to be an unusual approach: Dispatch comes as pure software running on commercial UNIX servers from Sun Microsystems Inc.

If it's easy to implement new features in an appliance, it's even easier if you're running on top of a commercial operating system. Not only do you not need to do any hardware development, but you don't need to fiddle with the operating system either. As such, pure-software, load-balancing solutions have been characterized by very rich feature sets, appropriate to Web sites running on complex, multitier architectures.

Above and beyond load-balancing capabilities, software-only providers also tend to offer comprehensive Web site management frameworks, where load balancing is just one of the services offered. Resonate, for example, recently announced Resonate Commander, which is said to perform tasks such as monitoring resources, gathering trend/performance data and generating automated responses to problems. ClusterCATS, from BrightTiger Technologies, Acton, MA, another pure-software, load-balancing product vendor, also offers a wide range of services besides Web server load balancing, including content distribution and synchronization capabilities and resource auto-discovery.

While a software-only approach is not for everyone, analysts believe a software approach to load balancing has a definite place in the market. Web sites made up of a chain of interrelated servers—the Web server, application server, database server and so on—but that do not have stringent throughput requirements, might choose to go with a pure-software solution, says Acuitive's Hoover. At these sorts of complex sites, the load-balancing software can be distributed across each device in the chain, thereby avoiding some of the performance problems inherent with running all the software on a single machine. But, Hoover says, "these sorts of solutions tend to be pretty expensive because they require quite a bit of customization."

Software-based load balancing will also figure in the low end of the market, Hoover says. Case in point: Last August, Microsoft Corp., Redmond, WA, acquired Windows NT-focused, load-balancing vendor Valence Research Inc., Beaverton, OR, and has since announced that it will offer the Valence software

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Load Balancing: Slicing it Three Ways

With all kinds of vendors staking their claim in the 'load-balancing' market, it behooves a prospective customer to find out what's available and where these products are going before deciding what's best for their site.



Imagine for a minute that you're the administrator of a heavy-traffic corporate Web site. It's Friday afternoon, and you're going skiing for the weekend. Five o'clock rolls around. You log out, say a little prayer to the Beeper Gods and walk out the door with your fingers crossed. Monday morning, fully refreshed after a long, uninterrupted weekend, you saunter into the office only to find that four of the 12 machines in your Web server cluster are down. "Curses! Why didn't my beeper go off?" But on further examination, you find the reason your beeper was silent all weekend is because the Web site itself, although a bit slower than usual, is fine.

This anecdote is only partially imagined; the part about the ski getaway and the Beeper Gods is fiction. But the rest did happen to one anonymous customer of load-balancing product vendor Radware Inc., Mahwah, NJ. The lucky administrator had recently installed the Radware Web Server Director load-balancing appliance, which, when it got wind of the downed servers, dutifully redirected incoming HTTP traffic to the remaining healthy servers in the cluster.

"Computer people live in fear of their beepers going off at 2:00 a.m.," says Michael Long, vice president of marketing at Radware. Load balancers, he says, can help keep those beepers quiet.

It's not surprising, then, that Web site administrators are gobbling up load-balancing products. The market for load balancers grew from zero to \$150 million

between 1996 and 1998, according to a recent report on the Internet traffic management market published by Collaborative Research, Los Altos, CA. And by 2002, Collaborative Research predicts the load-balancing market will be worth \$900 million. With this kind of growth, companies from all walks of life are staking their claim to the load-balancing market, peddling a wide range of wares. So as a prospective load-balancing customer, it's important to understand what kinds of products are available, where they come from and, most important, where they are going before settling on the best product for your site.

Load-Balancing Appliances

Even by Internet standards, the load-balancing market hasn't been around very long. It was only three years ago—in the summer of 1996—that Cisco Systems Inc., San Jose, CA, announced LocalDirector, the first full-fledged load-balancing product. Because it was the first product on the market, and because it was from a large, well-known network equipment vendor, most industry observers agree LocalDirector cast the mold for many subsequent load-balancing products. This "black box" appliance has inspired many competitors, among them Web Server Director from Radware; BIG/ip from F5 Labs Inc., Seattle, WA; Equalizer from Coyote Point Systems Inc., Sunnyvale, CA; and Hydra from HydraWEB Technologies Inc., New York, NY.

From a hardware perspective, load-balancing appliances look remarkably like PCs, equipped with a couple of Ethernet cards and running load-balancing soft-

Clustering

Will Clusters Go Mainstream?

DBMS vendors were the first group of suppliers to tweak their servers, and Informix Software Inc., Menlo Park, CA, Oracle and Sybase Inc., Emeryville, CA, all offer DBMSs designed to run in clusters. Sun Cluster ships with approximately a dozen high-availability agents, which help third-party products take advantage of the clustering features, says Sun's Nandkeshwar, and the company expects that number to grow significantly during 1999.

Although there are still plenty of hurdles, there are signs that clustering is making its way into the corporate mainstream. The biggest push has come from Microsoft Corp., Redmond, WA, which released Microsoft Cluster Server (MSCS) in late 1997.

"Whenever Microsoft moves into a new market, it will receive significantly more coverage and attention," says Strategic Research's Newton. PC server suppliers viewed clustering as a way to differentiate themselves in a commodity market and slashed prices for their systems to as little as \$20,000; an easier number for small businesses to swallow.

But the new low-priced systems do have limitations. More expensive systems typically provide instantaneous failover, compared to an average of 30 seconds or more for PC systems. Moreover, UNIX systems offer better systems administration tools than NT solutions.

Also, PC options do not offer much in the way of scalability: Microsoft's system is currently limited to two servers per cluster, while UNIX systems

work with up to 32 systems. MSCS uses a share-nothing architecture, which means that all resources, including hard disk drives, are assigned to specific servers. The alternative, a shared-disk architecture, lets processes running on multiple servers write to a single file on a single disk improving performance.

A shared-disk architecture requires sophisticated locking mechanisms to

UNIX systems offer better systems administration tools than NT solutions

prevent conflicts—a feature that Windows NT lacks. Microsoft is expected to deliver better clustering features

with Windows 2000, when it arrives later this year.

Microsoft's blessing is only one of the reasons why observers anticipate a big increase in the number of clustered systems sold during the next few years. Changing business factors are also sparking interest. "Clustering is moving downstream because more applications are becoming business-critical," says Strategic Research's Newton.

Market research firms have pegged the average cost of downtime for an enterprise resource planning (ERP) application at \$10,000 to \$15,000 per minute. "We have seen a lot of companies running SAP's R/3 ERP applications recently add clustering to their servers," says Oracle's Lindar.

Companies are finding that users, customers and suppliers are constantly accessing their messaging and DBMS servers and want to improve their availability. For instance, SBC Internet Ser-

VICES Inc., an Internet service provider (ISP) based in San Francisco, CA, has about 100 Sun servers throughout its organization. While none have clustering features, the ISP is considering adding such features to its email and DBMS servers. "If we have an outage with those systems, it could impact 100,000 users," says Chris Torlinsky, systems engineer at the company.

The added expense is a minor issue for SBC. "We can easily justify making the upgrade by examining the impact downtime has on our business," says Torlinsky. The company is interested in Veritas and Sun clustering products and is looking to add those features to its servers in the next six to nine months.

With more companies taking a closer look at clustering, Strategic Research predicts the number of UNIX servers with such features sold worldwide will increase from 25,989 in 1998 to 91,212 in 2003 (see Figure 1, Page 68) and will represent roughly 26% of all new server purchases. "Clustering was once viewed as an exotic, high-end feature that only large corporations needed. But the technology has evolved, so more and more medium and small companies are taking advantage of it," says Strategic Research's Newton.

So rather than talking about how important computers are to their businesses, companies are starting to demonstrate that they will no longer tolerate downtime. ➔

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COMPANIES MENTIONED IN THIS ARTICLE

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<http://www.fulltimesoftware.com>
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Menlo Park, CA 94025
<http://www.informix.com>
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Redmond, WA 98052
<http://www.microsoft.com>
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Emeryville, CA 94608
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Veritas Software Corp.
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Mountain View, CA 94043
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Clustering

than 4,000 copies of its clustering wares on Sun systems last year.

FullTime Software's FullTime Cluster 4.2, which was released in April, features application- and

resource-level monitoring and automatic switchover so users can control key resources and service levels. The product works with any combination of shared-disk, network-shared and replicated data so each application can use the data source that suits it best.

The competitive landscape could change dramatically during the next few years. For example, Sun plans to incorporate clustering capabilities in its Solaris operating system. "As we incorporate clustering in Solaris, I expect interest in third-party clustering solutions will dissipate," says Sun's Nandkeshwar.

Not surprisingly, Veritas has a different outlook. "Sun will never offer clustering software that runs on other vendors' operating systems, but some of our customers will desire products that operate in a heterogeneous environ-

ment," says Veritas' Burgener, who estimates that 11% of the firm's customers now fall into this category.

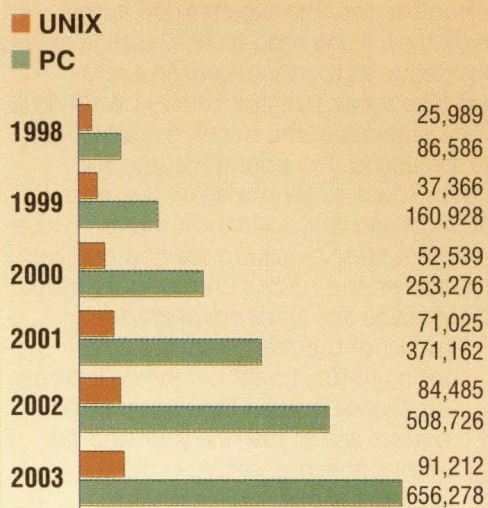
Although vendors have moved aggressively to improve their clustering capabilities, customers have shied away from the technology for a variety of reasons. First, clustered servers can be difficult to manage. Configuring servers so they will gracefully take over when a failure occurs can be difficult. Second, systems administrators have to deal with identical storage systems usually connected by high-speed interconnects such as Fibre Channel. Third, clustered servers tend to require expert systems analysis and a fair amount of integration, whereas nonclustered systems are generally easier to install and maintain.

Vendors are trying to address this problem by offering bundled clusters rather than having users put them together. The bundled systems typically come with two or more nodes, an operating system, cables, disk arrays, cluster storage and cluster management software. The turnkey solutions provide a tool kit, which companies can use to determine how much clustering they need. The packages are most helpful to small and midsize businesses, which may not have the staff or expertise to maintain a cluster but can hand those chores over to a local VAR that specializes in clustering.

Another issue is that cluster management can be cumbersome because the tools are new and don't offer as many features as users desire. "I wish a server would notify us about a problem before it fails so we can take steps to move to a backup system," says Nicholas-Applegate's Buckley. In addition, clustered servers function as autonomous systems, while most administrators would prefer that they present a single system image.

Application software is another issue. Companies want to take advantage of the available processing power in a cluster but most applications are designed to operate on a single server. Third parties can tweak their applications so they are cluster-aware and use all available processing power.

Figure 1. Cluster Server Shipments



Source: Strategic Research Corp., Santa Barbara, CA

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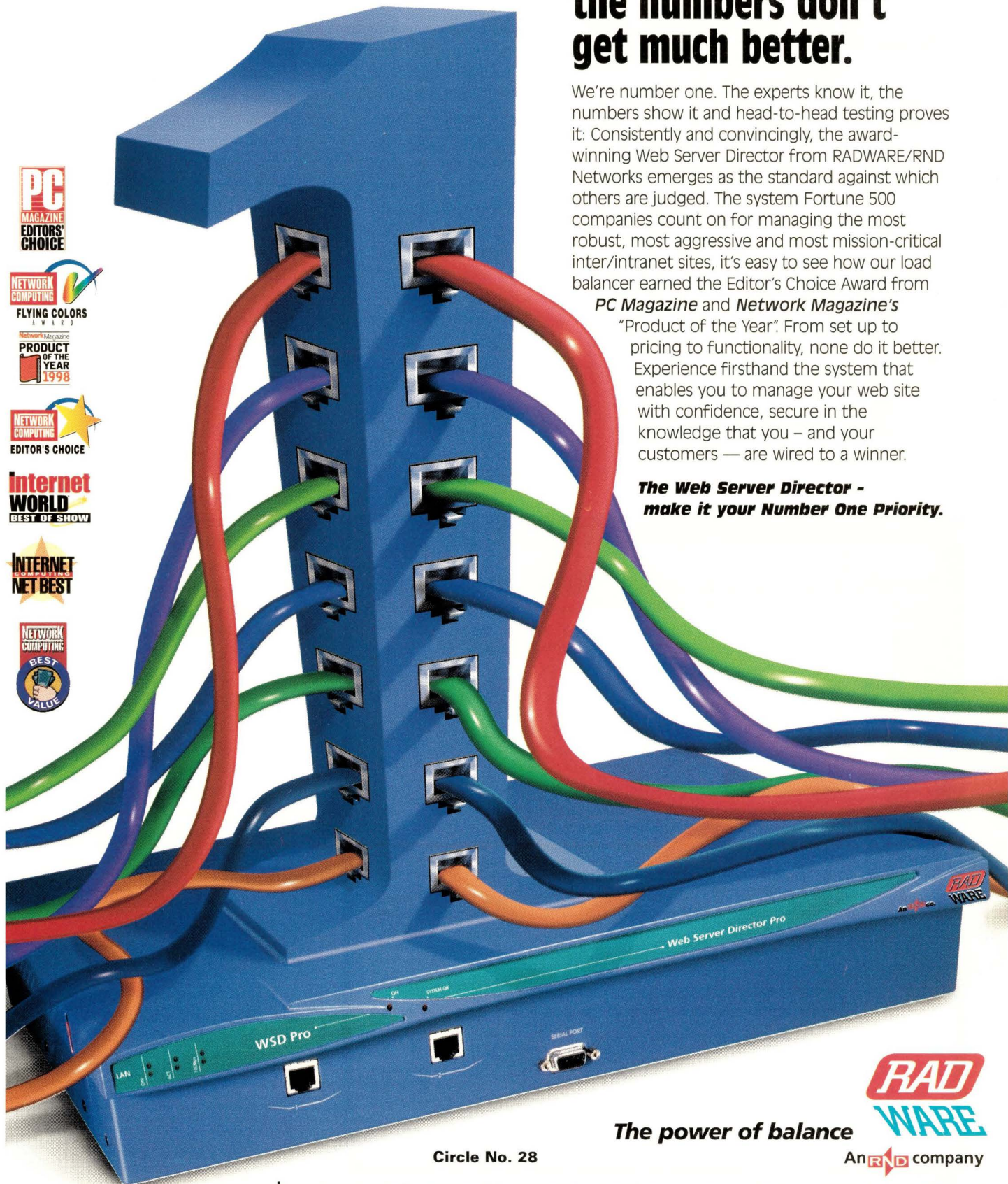
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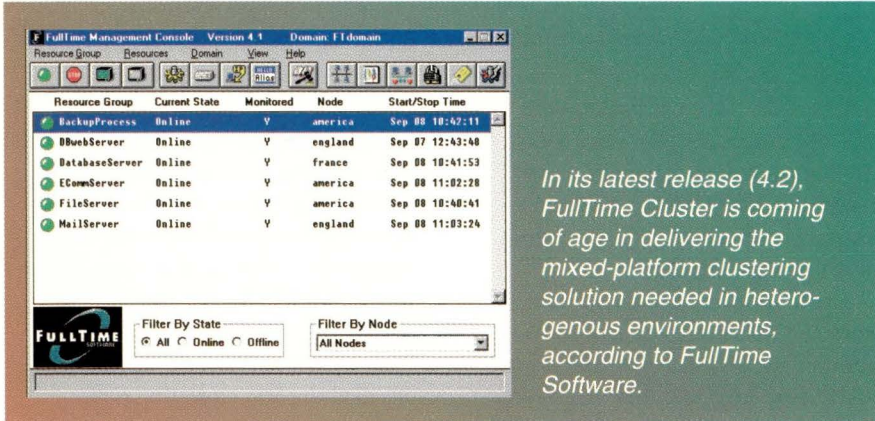
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The power of balance



An RND company

Clustering



In its latest release (4.2), FullTime Cluster is coming of age in delivering the mixed-platform clustering solution needed in heterogeneous environments, according to FullTime Software.

Resource Group	Current State	Monitored	Node	Start/Stop Time
BackupProcess	Online	Y	america	Sep 08 10:52:11
DBWebServer	Online	Y	england	Sep 07 12:43:48
DatabaseServer	Online	Y	france	Sep 08 10:41:53
ECmsServer	Online	Y	america	Sep 08 11:02:28
FileServer	Online	Y	america	Sep 08 10:40:41
MailServer	Online	Y	england	Sep 08 11:03:24

processing power as a higher-end system,” Nelson says.

Another advantage is the company can take one server off-line for routine maintenance or testing and leave the others up to serve its customers. “In our business, we are never sure when users will access the site, so we want to keep our servers up as much as possible,” Nelson says.

A growing number of firms find themselves in a similar position. “The rising importance of the Internet is

changing the way companies view their servers,” says Dom Lindar, director of server marketing at Oracle Corp., Redwood Shores, CA. “The need for continuous availability becomes more obvious as companies move to electronic commerce. Web surfers won’t wait to place an order while a server is down because a similar product or service is only a few clicks away.”

Even though Sun hardware is used for many e-commerce sites, few Sun users have moved to clusters. “A lot

of our companies come to us only after they have experienced a server or application outage and realize how much damage that can do. Some have been down for several days,” says Kelly Polanski, product marketing manager at clustering solutions vendor FullTime Software, San Mateo, CA.

Another reason for the low percentage of clustering users is the technology is a relatively new offering for Sun. “HP and IBM have had more of a data center focus and were quicker to see the need for clustering capabilities than Sun,” says Eric Burgener, group product manager at Veritas.

Playing Catch-Up

Sun has made up a lot of ground in this area. D.H. Brown & Associates Inc., a Port Chester, NY-based market research firm, conducts an annual survey that evaluates different servers’ clustering capabilities. “Historically, Sun has not been rated highly in our survey, but this year the company jumped into second place,” says Harvey Hinden, director of the high-availability and cluster group at D.H. Brown.

The hardware supplier has been working to improve its offerings and delivered Sun Cluster 2.2 in March. This version supports four nodes rather than two, and accommodates 256 processors and I/O channels and up to 256 GB of memory. Typically, UNIX servers run a single, low-utilization application, therefore outages and degradation increase at high-utilization levels because UNIX has lacked a file system to prevent multiple applications from corrupting one another. The Sun Cluster software solves this problem by taking advantage of the new file system capabilities within Solaris 7.

Sun’s competition comes mainly from Veritas and FullTime Software (which was acquired by Legato Systems Inc., Palo Alto, CA, in October). Veritas’ FirstWatch is designed to safeguard mission-critical applications running on a variety of hardware platforms. The product monitors hardware and software and can be configured to support up to 32 nodes. Available since 1994, FirstWatch is a favorite among Sun users: Veritas claims it sold more

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Circle No. 23

S/W Expert ■ May 1999

Clustering

to minutes—maybe even seconds—per year. Yet few organizations currently take advantage of the technology.

“I would estimate that 5% to 10% of the servers we have sold include clustering capabilities,” says Neville Nandkeshwar, product line manager for Solaris clusters at Sun Microsystems Inc., Palo Alto, CA.

Additional costs, difficult maintenance and a lack of applications that operate efficiently with clusters have combined to keep the numbers low. While analysts and suppliers expect more companies to adopt clustering technology, the trend is predicated on vendors making it easier for customers to add clustering features to their own servers.

Ideally, companies would like their systems to be online all the time, but machines—even high-end servers—fail. Hardware suppliers have been improving product reliability with features such as hot-pluggable disk drives and redundant components, which are now standard in midrange and even low-end servers. Yet, servers do go down for a variety of reasons. The most obvious is unscheduled outages, which occur because of system overloads, improperly configured software or component failures. But planned system changes, such as application migration or upgrades, and daily chores, such as system backups, can also prevent users from accessing servers.

The various factors add up to hours of downtime each year. With a PC server, users are unable to access information an average of about 100 hours each year; even high-end Sun servers are typically off-line for 20 or more hours each year, according to market research firm Gartner Group Inc., Stamford, CT. Moving to a clustered system can cut those hours to minutes. “Clustered systems now offer close to 100% availability—a number traditionally associated with mainframes,” says Kris Newton, research manager for Santa Barbara, CA-based research firm Strategic Research Corp.

But users have often relied on other options to improve system availability. Most companies regularly back up their data and many have multiple servers,

which can share processing chores. But clustering offers far greater reliability than backups because it replicates data continuously, whereas backups are typically completed just once a day. Backups only help maintain server availability if a company relies on a second server, something now found in many organizations.

In addition to backups, various storage systems can improve system uptime. For instance, implementing RAID 5 or RAID 50 disk arrays and hot-swappable adapter card slots can lower downtime—often at a price far less than clustering.

Clusters at What Price?

Clustering can be expensive (starting at around \$2,000 per node), increasing server costs by as much as 30% to 50%, according to analysts. Because of the high price tag, many companies have selectively implemented clustering features on some of their systems.

For instance, Nicholas-Applegate Capital Management Inc., a San Diego, CA-based financial services firm with 500 employees, has 120 Sun servers but uses clustering only for an online trading system and a DBMS server. “We rely on those servers to deliver services to our customers, so they have to be available 24 hours a day, seven days a week,” says David Buckley, UNIX systems manager at the company.

The financial services firm examined clustering options from Sun and Veritas Software Corp., Mountain View, CA. “We felt it would be easier to trouble-

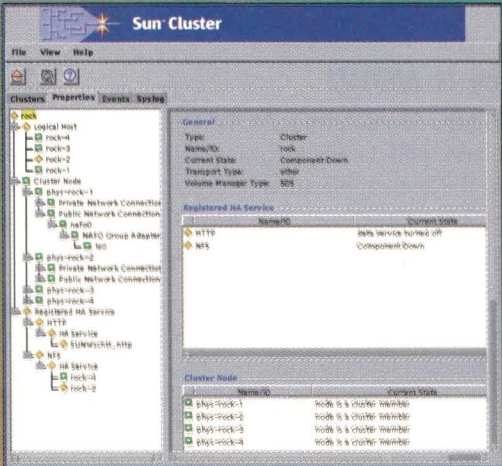
shoot and manage the system if we stayed with one supplier, so we opted for the Sun product,” Buckley says.

Ironically, the decision created a problem for the firm when it installed clustering features on the trading system in the summer of 1997. “There was a bug in the Solaris kernel that would arise when memory availability was low and I/O usage was heavy,” explains Buckley. The problem was fixed a few months after the company installed the Sun clustering system.

During the 18 months since then, the system has been off-line for only 45 seconds. “Almost immediately, when the main system started to have problems, the clustering system switched processing to the backup server,” says Buckley. Clustering was added to the DBMS server in December 1998 and, so far, it has experienced no outages.

Business growth led Net-Temps Inc. to clustering. Net-Temps is a three year-old North Chelmsford, MA-based firm that offers candidates and recruiters online job information. “We started off with a 128-Kb/s ISDN line to the Internet, upgraded to a T1 [1.544 Mb/s] connection, [and] now have two T1s and are looking at installing a third,” says Jason Nelson, systems administrator at the company.

As the business swelled so did the company’s processing requirements, starting with one Sun E450 server and growing to three. “We did not want to keep throwing out hardware and buying new boxes. Clustering has enabled us to pool our servers and get as much



In March, Sun bolstered its offerings with the release of Sun Cluster 2.2. This latest version clusters up to four servers to meet the needs of any workgroup, department or data center, Sun says.

Cluster Node	Name/ID	Current State
phys-rock-1		node is a cluster member
phys-rock-2		node is a cluster member
phys-rock-3		node is a cluster member
phys-rock-4		node is a cluster member



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**A Big Bang
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Pick a Cluster

by Paul Korzeniowski

Corporations openly talk about how important computers have become to their daily operation. Companies now do business on the Internet 24 hours a day and have tied themselves more tightly to suppliers that tout round-the-clock availability. So talk of not being able to afford any system downtime is no longer limited to financial institutions and telephone companies, but is common in large, medium and even small organizations.

But is it really vital for firms to have their servers constantly available? Judging from the number of companies that have taken steps to insure that downtime is minuscule, one would have to say no. Clustering, or linking servers in pairs or groups and duplicating data among the machines so a backup takes over if a main server fails, offers companies the ability to limit downtime

New Products

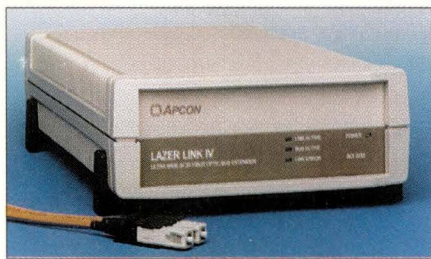
and services. A standard GUI is provided for on-screen management, including access control and security features. In addition, Lucent uses a Common Object Request Broker Architecture (CORBA) interface that is said to provide a framework for converging data, transport and circuit-switched networks.

OneVision Management Systems for network operators are available in single integrated packages or as components in Lucent's Service Ready Transport, Data Service Management and Data-Centric Long Distance solutions. The suite is available for UNIX and NT platforms. Price is based on server capacity; contact vendor for details.

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The Lazer Link IV SCSI bus extender from Apcon is designed to meet the requirements of busy networks by providing real-time access to peripheral devices such as DLT tapes, CD-ROMs and RAID arrays, the company says.



Lazer Link IV extends a SCSI bus up to 500m from the host server while supporting rates of up to 40 MB/s. Because it is transparent to the SCSI bus, no additional software is needed for installation and operation, making connections to existing SCSI devices easy, Apcon says.

The unit is available in Single-Ended (SE), Differential (D) and Low-Voltage Differential (LVD) models to support a wide variety of SCSI peripherals. To increase their capabilities, and for users who may be working with mixed SCSI devices, SE Lazer Link IVs are compatible and can operate with any LVD or D Lazer Link unit to provide conversion from one bus type to another, Apcon says. Systems

administrators can use the bus extender to consolidate SCSI peripherals in one common location for effective management and to develop centralized server sites where data security is a critical issue, the company says.

A 68-pin female high-density connector is provided on the rear panel of the unit for easy installation to any host or peripheral device. In addition, internal bus termination can be disabled for systems that require external termination. The Lazer Link IV Model ACI-2032 costs \$1,995.

Apcon Inc.
17938 S.W. Upper Boones
Ferry Road
Portland, OR 97224
<http://www.apcon.com>
Circle 105

Workstations for Rugged Environments

Systems Integration Plus has introduced two new rack-mount UltraSPARC workstations based on Sun Microsystems Inc.'s 64-bit SPARCengine Ultra AXi and Ultra AXmp. The machines are aimed at demanding applications such as computer telephony, imaging, network infrastructure, Inter/intranet servers, industrial control and mission-critical defense systems, the company says.

The Ultra AXi-based system, the C419AXi, is specifically designed for rugged industrial environments. It comes with six PCI slots for low-cost expansion, as well as support for Creator Graphics, Sun's format for enabling high-performance graphics displays. The C419AXi offers the following processor speed and L2 cache options: 270 MHz/256 KB, 300 MHz/512 KB, 333 MHz/2 MB and 360 MHz/2 MB. Onboard functions include serial/parallel I/O, 40-MB/s dual-channel Ultra Wide SCSI, 10/100BaseT Ethernet and UPA interface for Creator Graphics module options.

Peripheral choices include large-capacity hard disk, floppy drive and CD-ROM. Removable drive capability is available via one 5.25-inch, front-accessible open drive bay. I/O expansion is provided by six 33-MHz 32-bit PCI card slots, allowing full-length cards in all slots. Pricing for the SIP-SYS-C419AXi starts at \$4,495.

The Ultra AXmp-based system, the C519AXmp, offers rack-mount multiprocessing power for embedded applications. It provides three times the compute density of comparable office systems with near-linear multiprocessing performance and I/O scalability, the company says. The primary attribute of this system is its four-way multiprocessing capability, using high memory bandwidth from standard memory devices. The product's UltraSPARC S-series processor modules (up to four are supported) are available with the following processor speed and L2 cache options: 300 MHz/2 MB, 360 MHz/2 MB and 400 MHz/4 MB. Onboard functions are the same as for the C419AXi.

Peripheral choices include large-capacity hard disk, floppy drive and CD-ROM. Removable drive capability is available via three 5.25-inch open drive bays and one internal 3.5-inch drive bay. I/O expansion is provided by four 33-MHz 64-bit PCI expansion slots and two 66-MHz 64-bit card slots. The SIP-SYS-C519AXmp is priced starting at \$21,995 for a dual-processor configuration with 512 MB of DRAM.

Systems Integration Plus Inc.
15230 N. 75th St., Ste. 1000
Scottsdale, AZ 85260
<http://sip.vme.com>
Circle 106

Finally, IE 5.0

Microsoft has released Internet Explorer (IE) 5.0, the latest version of its popular Web browser. Several new features have been added, including a Windows Radio Toolbar, which provides "one click" access to streaming audio content that plays uninterrupted while users browse the Web. Direct access is available through the toolbar to radio broadcasts from stations worldwide, including news broadcasts from the BBC and live music from the House of Blues.

Enhancements have also been made to the browser's Intellisense features, which automate oft-repeated tasks. This includes the AutoConfiguration feature, which is said to locate and connect to the appropriate proxy server. In addition, IE 5.0 provides a listing of sites similar to the one being viewed. Called Related Links, this feature is designed to improve

Upgrades, Enhancements, Additions...

◆ E-Comms has added a new Java-based GUI to its E-Commander disaster recovery and network monitoring system. The new GUI uses Fujitsu's NetPrism multiplatform network device management software. With the help of NetPrism, E-Commander uses Web browser technology to provide easy-to-use remote hardware management over the network. This allows network administrators to manage E-Commander from a single workstation. Furthermore, administrators can use E-Commander to provide power cycling, device switching and environmental controls regardless of the number of diverse operating systems involved, the company says. E-Commander is the single Ethernet connection point (IP address) for the application modules that connect to the remote network devices. TCP/IP-compatible, it uses SNMP for the in-band network management function. E-Commander runs on Solaris and Windows NT and costs \$1,995. **E-Comms Inc.**, 5720 144th St. N.W., Gig Harbor, WA 98332, <http://www.e-comms.com>. **Circle 107**

◆ Tower Technology has upgraded its TowerJ Enterprise Java Deployment Platform. TowerJ 3.0 now includes the company's DynaFlex runtime virtual machine, allowing for the dynamic updating of the application by Java byte code, natively compiled DLLs or shared libraries. The new release also adds a partitioning option to the company's system-optimizing native compiler, which is said to allow developers to create optimized native DLLs from Java byte code classes. Pricing for the TowerJ 3.0 development kit starts at \$5,000. It runs on HP-UX, Tru64 (formerly Digital UNIX), Solaris, AIX, IRIX, Linux, Windows NT and NT for Alpha. **Tower Technology Corp.**, 1501 W. Koenig Lane, Austin, TX 78756, <http://www.towerj.com>. **Circle 108**

◆ EverLink secure communications and remote access software from Anyware Technology now offers a new setup wizard for faster installation, as well as a new user interface that is said to offer better user customization. Users can create buddy lists, instantly view the status of other users and send/receive messages, files and documents more easily, the company says. EverLink is a Java-based peer-to-peer solution for private and secure email, file transfers and real-time chat over wide area networks (WANs), intranets and the Internet. It enables systems administrators to authorize individual user access to designated areas behind the corporate firewall, rather than granting all admitted users universal access to the entire network. It comprises two integrated components: the EverLink Client and EntryGuard Server. The EverLink Client runs on Solaris, OS/2, Mac OS and Windows 95/98/NT. The EntryGuard Server runs on Solaris and Windows NT. Pricing for the software ranges from \$845 for 25 users to \$19,995 for 10,000 users. **Anyware Technology Inc.**, 17837 Rowland St., City of Industry, CA 91748, <http://www.anywaretechnology.com>. **Circle 109**

◆ Sun Microsystems' WorkShop 5.0 family of development tools provides 64-bit application development for the Solaris operating system and support for the new ANSI/ISO C++ industry standard. The addition of ANSI C++ support will make it easier to port code from other operating environments to Solaris, according to Sun, and other features like automatic dynamic memory management

should also help speed development and deployment. In addition, the software provides backwards compatibility to older C++ code, so developers can migrate existing C++ applications to the new ANSI/ISO C++ standard at their own pace. The Sun WorkShop 5.0 product line includes Sun Visual WorkShop C++ 5.0, Sun WorkShop Professional 5.0 and Sun Performance WorkShop FORTRAN 5.0 software. Pricing for Sun WorkShop 5.0 starts at \$1,895 per single-user license. **Sun Microsystems Inc.**, 901 San Antonio Road, Palo Alto, CA 94303, <http://www.sun.com>. **Circle 110**

◆ Solaris VPN client software is now available from Compatible Systems for its IntraPort family of VPN Access Servers. Previously, IntraPort only offered clients for Windows 95/NT Linux and Mac OS. The IntraPort VPN Access Server provides remote Internet access, in addition to supporting LAN-to-LAN systems ranging in size from 64 simultaneous client connections to more than 40,000 simultaneous sessions, the company says. IntraPort VPN Access Server includes an unlimited-user license to all client platforms. IntraPort provides IPsec tunneling for TCP/IP and supports legacy protocols such as IPX and AppleTalk. Contact vendor for pricing. **Compatible Systems Corp.**, P.O. Box 17220, Boulder, CO 80308, <http://www.compatible.com>. **Circle 111**

◆ Wall Data has released Cyberprise Server 2.5 Enterprise Edition for Solaris. With Cyberprise, Wall Data says, organizations can build "corporate portals," allowing employees, partners and customers to access corporate data and applications. The company says Cyberprise can scale for up to 10,000 concurrent users and offers personalization features for content and application access. It also comes with user management, security integration and application deployment and management features. Cyberprise Server 2.5 Enterprise Edition includes Channel Manager, which lets administrators assign permission rights; License Manager, which delivers an active license-counting function, manages software versioning and automates software distribution; and Performance Manager, which establishes a fault-tolerant, high-performance and load-balanced server cluster. Pricing for Cyberprise Server 2.5 Enterprise Edition for Solaris starts at \$25,000 for 1,000 users. **Wall Data Inc.**, 11332 N.E. 122nd Way, Kirkland, WA 98034, <http://www.walldata.com>. **Circle 112**

◆ Open System Solutions has released Private I (pronounced, eye) 5.1 syslog management software, which is designed to offer enterprise-level syslog network monitoring. Private I offers monitoring and reporting capabilities of traffic through firewalls, routers and virtual private networks (VPNs), the company says. It's designed to detect problems and network usage patterns. Raw syslog output is stored in a relational database, the company says, and the software provides real-time alerting and historical reporting on network attacks, bandwidth deployment, device optimization and employee usage of Internet services. Private I is available on HP-UX, Solaris and Windows NT. Contact vendor for pricing. **Open System Solutions Inc.**, 93 W. St., Ste. E, Medfield, MA 02052, <http://www.opensystems.com>. **Circle 113**

New Products

the searching process. IE 5.0 also comes with Outlook Express, an email component. Microsoft says it has made several significant performance improvements over IE 4.0.

IE 5.0 can be downloaded for free from <http://www.microsoft.com/windows/ie/download/ie5a11.htm>. It's available for Windows 3.1/95/98/NT, Mac OS, Solaris and HP-UX.

Microsoft Corp.

1 Microsoft Way

Redmond, WA 98052

<http://www.microsoft.com>

Circle 114

Tools to Consolidate Departmental Data

EMC has introduced a series of new products designed to provide customers with an integrated enterprise-class storage area network (SAN). The new products are the EMC Connectrix Enterprise Storage Network System, EMC Connectrix Management Software Suite and EMC Symmetrix Enterprise Storage Systems.

The Connectrix Enterprise Storage Network System is said to be a fully integrated Fibre Channel network connectivity solution, offering up to 64-port switched Fibre Channel (FC-SW) connectivity between EMC Symmetrix Enterprise Storage Systems and distributed servers. It offers high availability through remote diagnostics and hot-swappable redundant processors, memory, port controllers, power supplies and cooling systems. Failover to redundant components is designed to be immediate, nondisruptive and automatic, EMC says. It costs \$528,000.

The Connectrix Management Software Suite reportedly helps customers simplify the management of enterprisewide information from a central location. It includes two components: Connectrix Manager Software for a centralized network management view of multiple Connectrix systems and integration with enterprise management systems such as Computer Associates International Inc.'s CA Unicenter and Hewlett-Packard Co.'s HP OpenView; and Connectrix Product Manager Software, which allows customers to quickly manage and monitor each individual Connectrix Enterprise Director

switch. Pricing for the Connectrix Manager Software is \$50,000, while the Connectrix Product Manager Software costs \$25,000 per Enterprise Director switch.

The Symmetrix Enterprise Storage Systems comprise the following: Symmetrix 3930 and 5930 systems, which offer high-capacity enterprise storage of more than 9 TB; Symmetrix 3830 and 5830 systems for up to 3.5 TB of storage; and Symmetrix 3630 and 5630 systems for 1 TB of storage. The Symmetrix 3000 systems are configured for a range of PC and midrange operating systems, including Solaris, AIX, IRIX, NetWare, Digital UNIX, HP-UX, OS/400, SCO UNIX and Sequent Dynix. The Symmetrix 5000 systems are configured for mainframe systems. Pricing for the Symmetrix Enterprise Storage Systems starts at \$294,000.

EMC Corp.

35 Parkwood Drive

Hopkinton, MA 01748

<http://www.emc.com>

Circle 115

Tatung Targets High End

Tatung's new COMPstation U4MP Series Model 4400 is equipped with four 400-MHz UltraSPARC-II processors, 4 MB of external cache per processor and is available in rack-mount and tower configurations.

Both configurations come preinstalled with Solaris 7 and offer three software extension options: Solaris Easy Access Server, Solaris Enterprise Server and Solaris ISP Server. Model 4400 supports two 66-MHz 64-bit PCI devices and four 33-MHz 64-bit PCI devices to provide multiple options for peripherals and add-ons. Standard configurations include four 400-MHz UltraSPARC-II processors, 1-GB RAM and 9-GB hard disk storage. Other features include dual Ultra Wide SCSI channels, two serial ports, one parallel port and 10/100BaseT Ethernet interface.

The 19-inch rack-mount option fits into existing server banks and adapts easily to OEM, communications, commercial and industrial requirements, Tatung says. With an 8.75- by 17.25- by 26-inch footprint, the rack-mount configuration is said to allow for easy vertical

stacking. It features up to six drive bays that can house four 5.25-inch slots and two 3.5-inch slots. Options include up to 2 GB of RAM and 80 GB of hard disk storage, ATM connectivity and Ultra Wide SCSI. Pricing starts at \$37,570.

The tower configuration can fit up to 14 drive bays. Redundant power supplies reportedly provide added protection against power module failure, and the cabinet is mounted on wheels for easy mobility. Pricing for the tower configuration starts at \$39,570.

Tatung Science & Technology Inc.

1840 McCarthy Blvd.

Milpitas, CA 95035

<http://www.tsti.com>

Circle 116

Windows, AIX Live in Harmony

Thanks to IBM, organizations that experience interoperability problems with file and print servers for AIX and Windows files might soon have help. IBM has introduced AIX Fast Connect for Windows, which allows Microsoft Corp. Windows clients to access IBM AIX file and print services without the installation of additional client software, IBM says. The benefit here is that it opens the door for AIX to be part of a Microsoft network neighborhood.

Windows clients can access AIX files via Journaled File System (JFS), CD File System (CDF), Network File System (NFS)-mounted subsystems and AIX printing services using Microsoft's Common Internet File System (CIFS) and Server Message Block (SMB) protocols over TCP/IP.

AIX Fast Connect is said to provide Windows 95/98/NT systems with base file and print server capabilities and costs \$1,495. IBM also offers AIX Fast Connect for OS/2 for \$1,795.

IBM Corp.

Contact local sales office

<http://www.ibm.com>

Correction

In "New Products" April 1999, Page 74, we reported that the Aerial Ultra AXi Super-Server from PerifiTech costs \$10,299 for 1,128 MB of storage. It should have read \$10,299 for 128 MB of storage. We regret this error.

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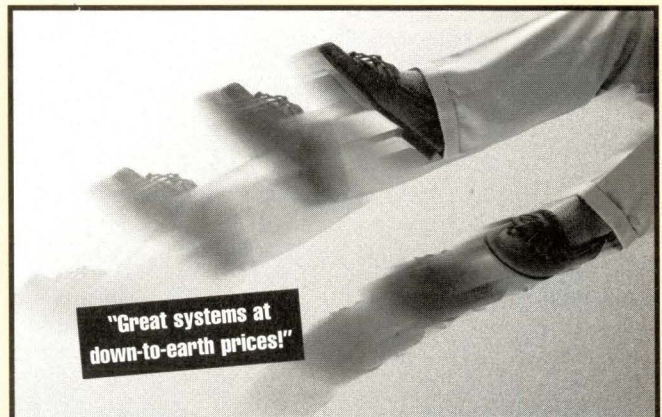
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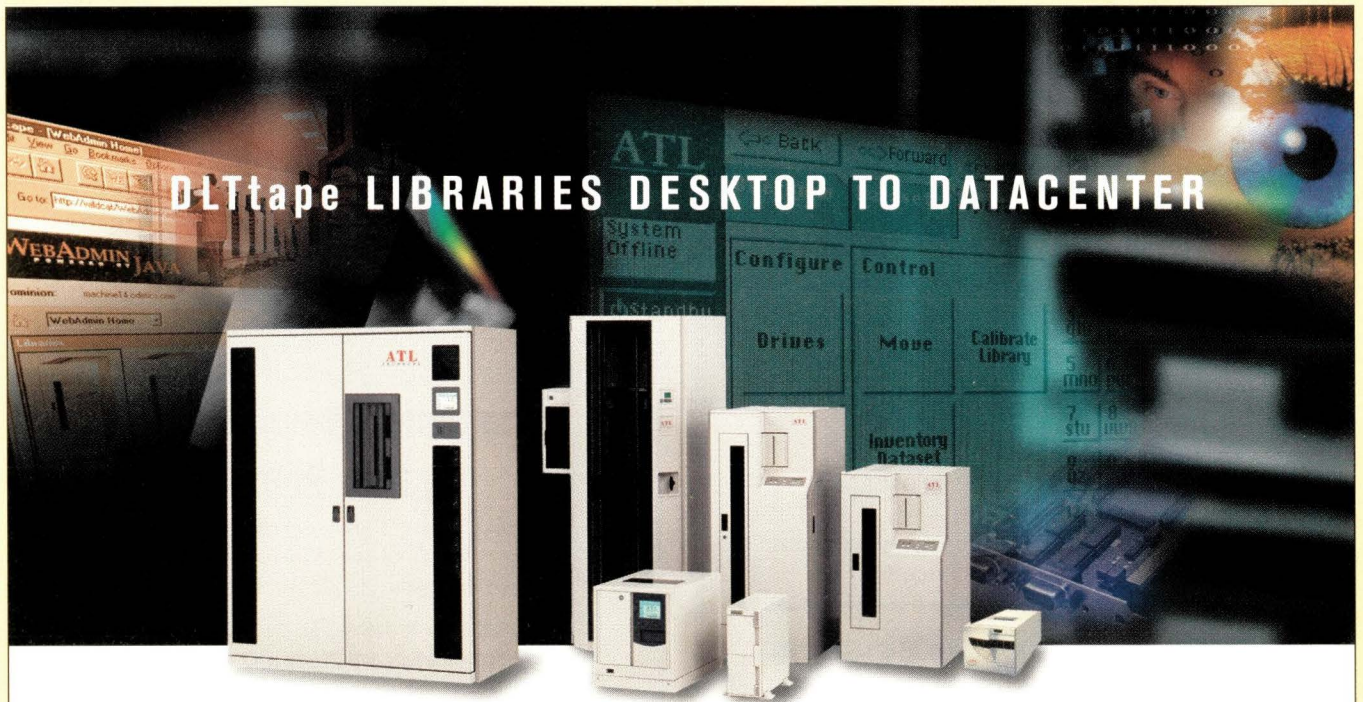
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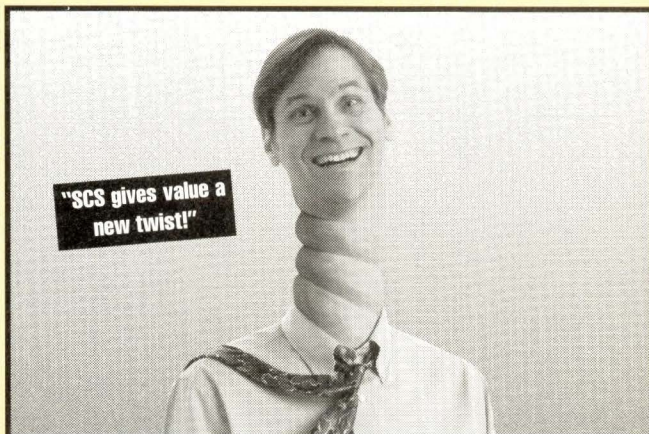
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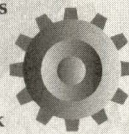
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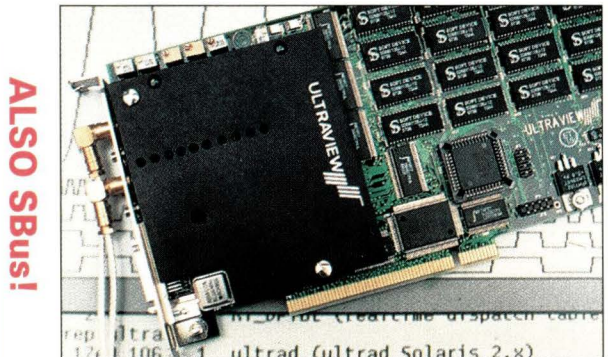
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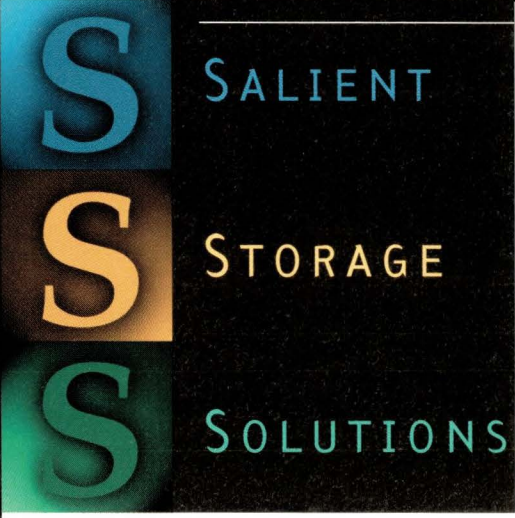
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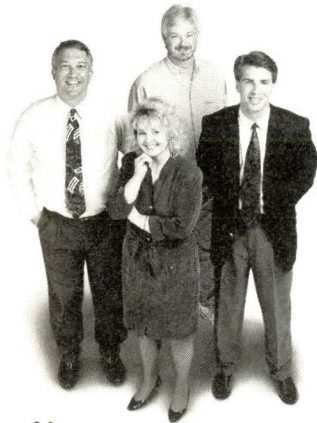
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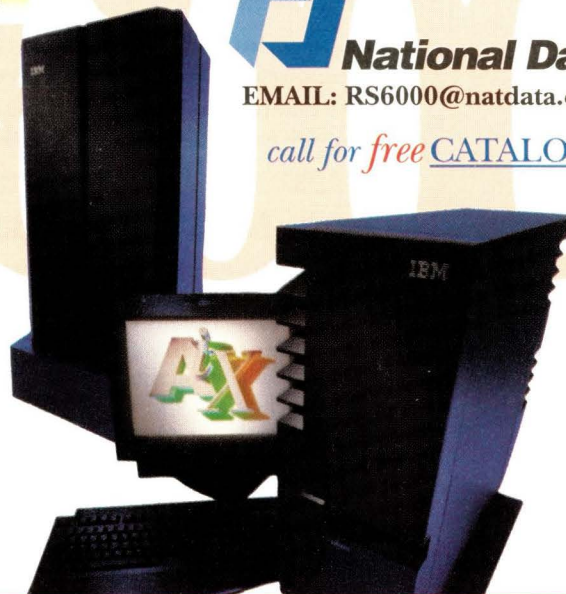
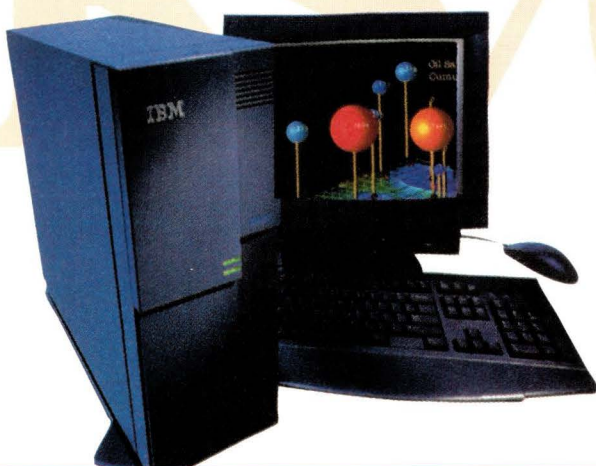
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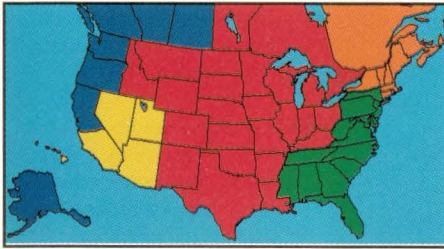
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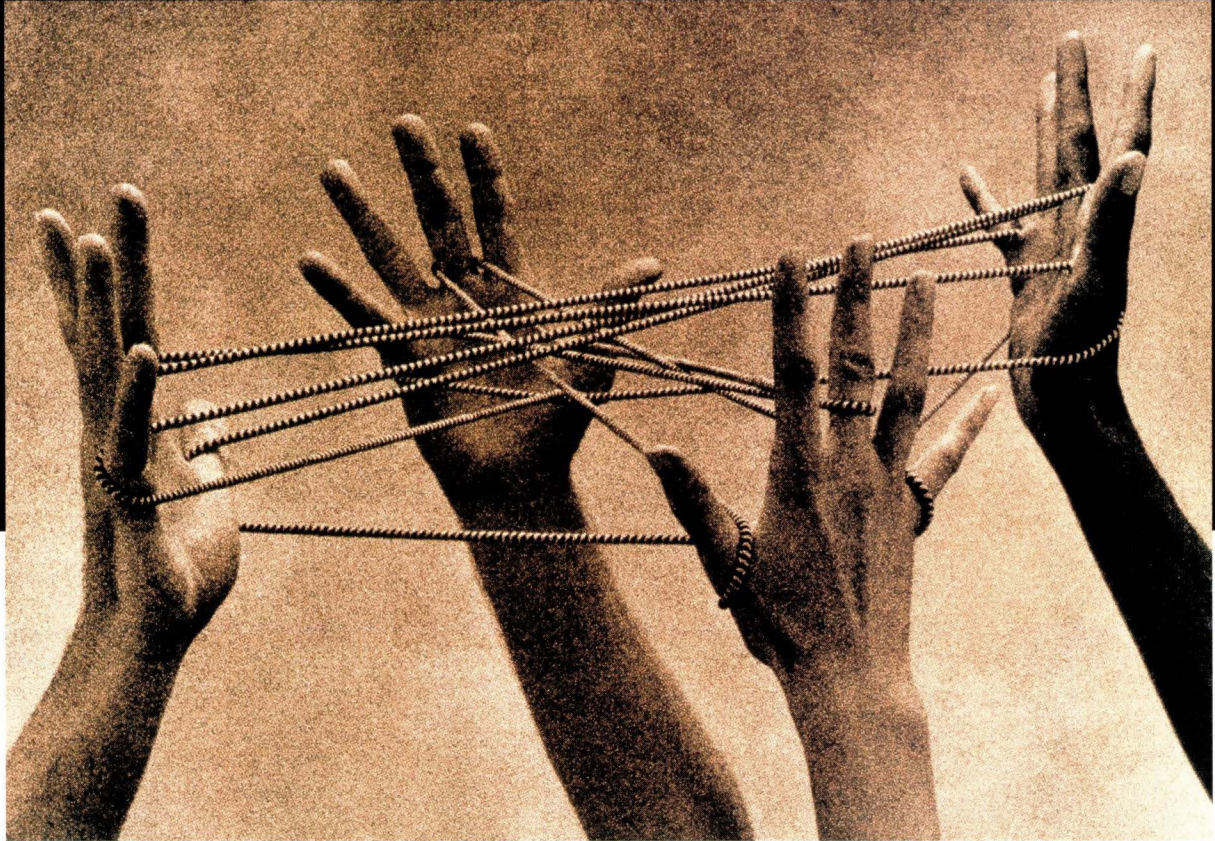
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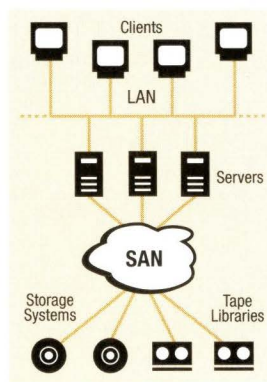
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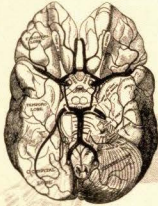
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T h e

A N A T O M Y

Of An Enterprise-Class Library

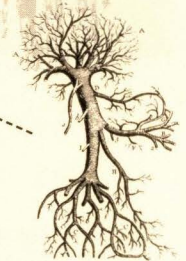
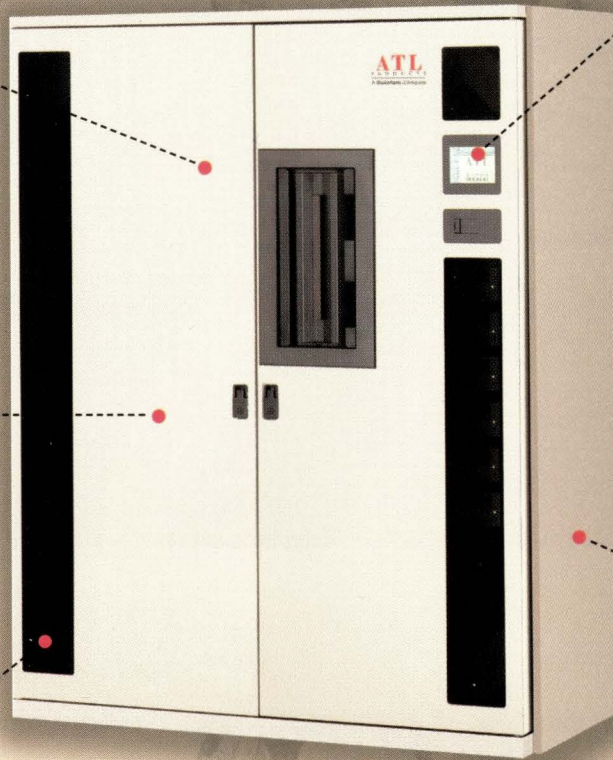
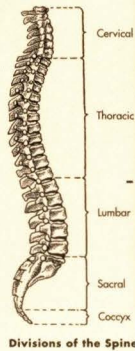
I. The Brain – Much like "some" human brains, the P3000 has a massive capacity to store and move information. This intelligent library has a native capacity of 11.4 terabytes and blazing performance of 288 gigabytes per hour.



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

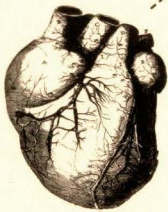
III. The Skeleton – The human body has two arms and two legs. The P3000 delivers the same high availability (HA) design with redundant AC cords, power supplies and fans. Plus, the power supplies, fans and DLTape drives can be hot-swapped.

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



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

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



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



DLT TAPE LIBRARIES DESKTOP TO DATACENTER

ATL
PRODUCTS
A Quantum Company



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