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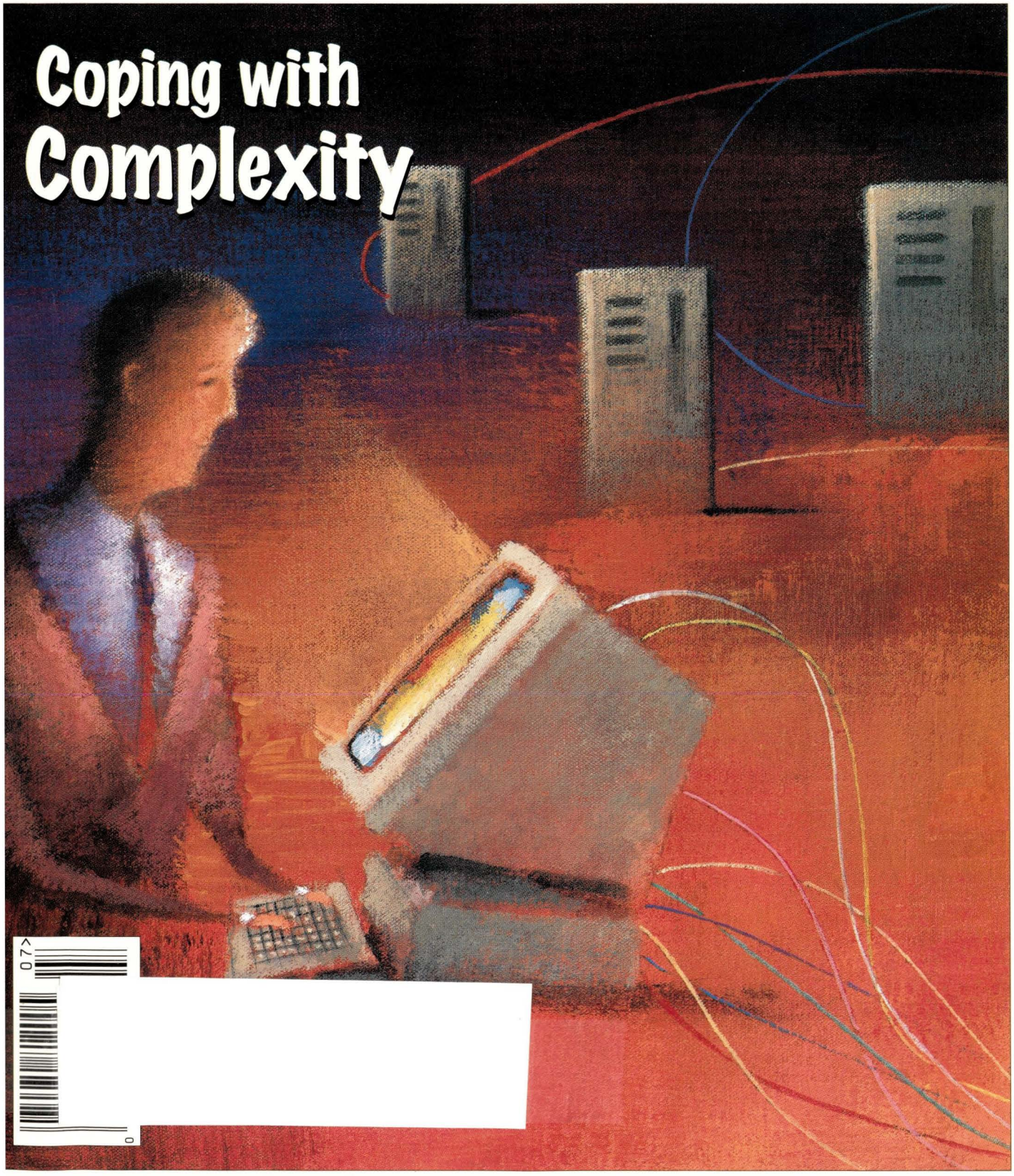
The Server/Workstation Magazine



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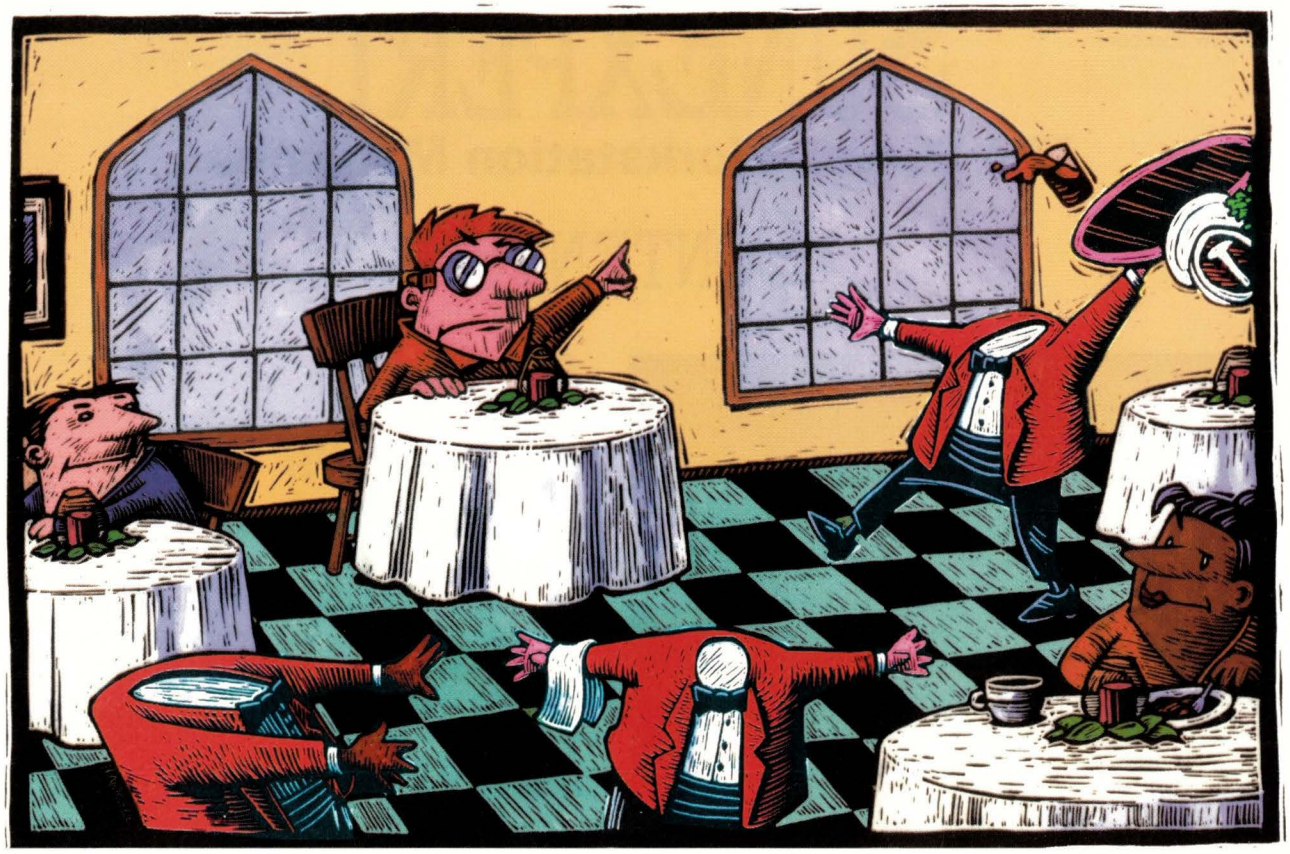

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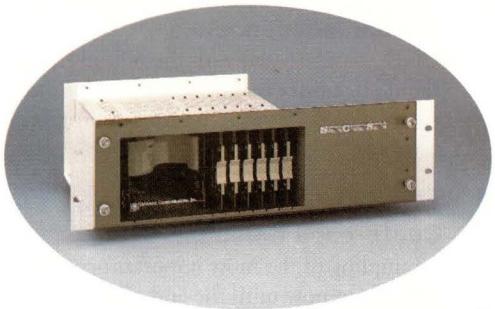

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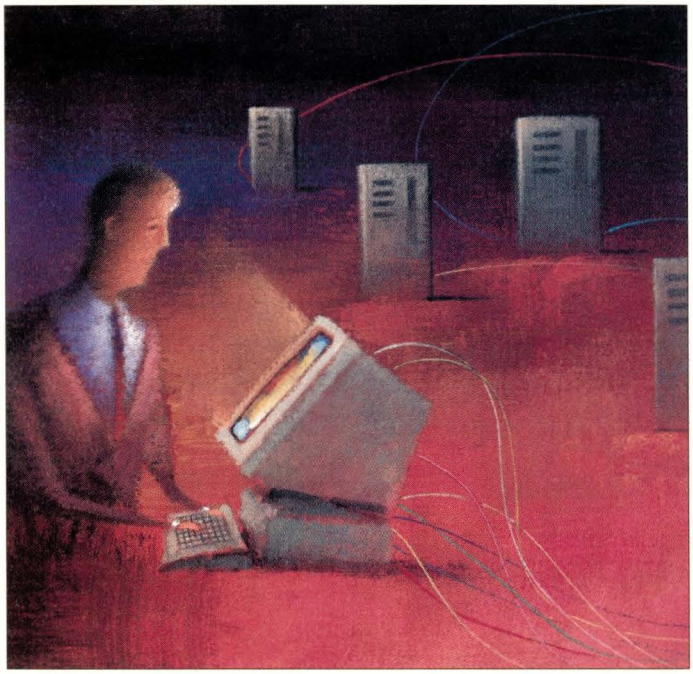

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SUPPLEMENT

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69 NC Standard Bearers Get Busy

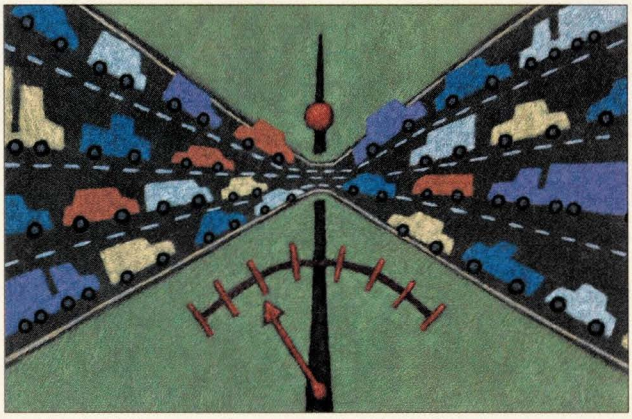
by Suzanne Hildreth, Staff Editor

For proponents of network computing, 1998 has been an active year so far. Besides fending off discouraging reports from analysts, NC defenders have been hard at work hammering out standards and specifications that, they hope, will give NCs some much needed credibility with consumers.

72 Survey: A Sampling of Network Computers

compiled by Maureen McKeon

A snapshot of what the major NC vendors have to offer.



78 Balancing Network Resources

by Suzanne Hildreth, Staff Editor

In what seems a desperate demand for more bandwidth, more disk space and more and faster processors, some companies are opting for alternative network connections in the form of bandwidth management and load-balancing products.

Columns illustrated by
STEPHEN SCHILDBACH

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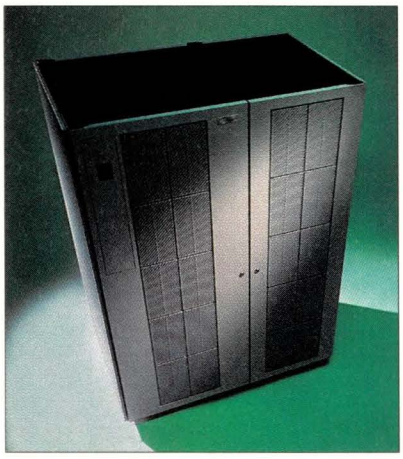

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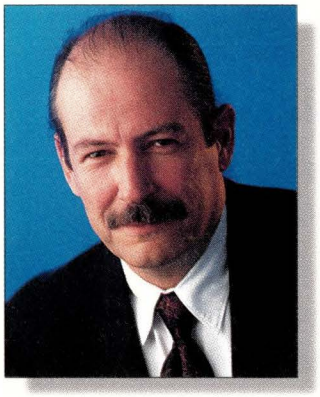

Can't We Keep it Simple?

Users complain to the help desk that an application is sluggish. Perhaps, the client machine is overworked. Closing inactive applications doesn't help. Start looking for a misconfigured router. Examine how the database query is structured. Look at the load levels on all the servers.

This month's cover story by Alexandra Barrett, "Coping with Complexity," Page 62, examines the issues surrounding the need for end-to-end applications management. Alex discovers that, "Realistically, in a distributed client/server environment, the problem could be just about anywhere." And it seems the difficulty is geometrically proportional to the complexity of the environment. In today's crazy guilt of client/server distributed computing it is sometimes true that the root cause of the problem is never really located. The trouble just comes and goes.

Of course, vendors in this space are usually all too happy to sell you application-specific modules designed to plug into their wares. Although the modules available to any one IT organization depend on the management framework it has adopted. Generally, application management software vendors have offerings covering several major application types: enterprise resource planning products from companies such as SAP AG, Baan Co., Oracle Corp., and PeopleSoft Inc.; groupware applications such as Lotus Development Corp.'s Notes; and middleware, for example, IBM Corp.'s MQSeries and BEA Systems Inc.'s Tuxedo. In addition, modules for managing Internet services such as Netscape Communication Corp.'s SuiteSpot are cropping up. But as a rule of thumb, remember that applications management is a relative newcomer to the list of services offered by management frameworks.

In the meantime, customers are taking matters into their own hands, choosing to integrate their application management tools into a centralized network and systems management framework, for example, Unicenter TNG, from Computer Associates International Inc.; the Tivoli Management Environment (TME), from Tivoli Systems Inc.; or Hewlett-Packard Co.'s OpenView.

Be sure to check out this month's WebServer Magazine Supplement if you're yearning for what promises to be a less complicated data processing environment. The cover story by Sue Hildreth, "NC Standard Bearers Get Busy," Page 69, takes a look at the progress of the NC over the past few months. There's also a survey of available systems. Let us know what you think of these alternative machines in particular and the supplement itself in general. Simplify, simplify.

Doug Pryor

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fibre channel & DLT libraries

Two important trends are converging in the data storage market: the emergence of fibre channel as a storage area network (SAN) solution and the increasing acceptance of automated tape libraries. Automated tape libraries provide predictable, cost-effective and reliable backup and restoration of data.

Tape libraries provide automation of backup and other storage management functions without the risk of human error, misplacing tapes, and overwriting current data. Systems and network administration resources can be used more effectively, and the reliability of the backup increases significantly.

Fibre channel is a high-speed communications protocol that can be used to interconnect a wide variety of servers and storage subsystems. Data can be transmitted and received across a fibre channel link which can be either a copper wire (up to 25 meters), a short-wave optical fiber (up to 500 meters), or a long-wave optical fiber (up to 10 kilometers). Fibre channel provides the connectivity and distance operations of a local area network with higher bandwidth versus what SCSI provides today.

One of the most exciting applications of fibre channel is to provide centralized backup from multiple servers to a tape library. A number of fibre channel benefits fit extremely well with automated tape backup.

Performance

With the increasing amount of disk capacity that requires backup and with the reduced backup time window, the 100 megabyte per second transfer rate of fibre channel provides significant value.

Distance

IT organizations use SCSI connections today to get adequate performance, but are limited to about 25 meters of distance. Fibre channel can support

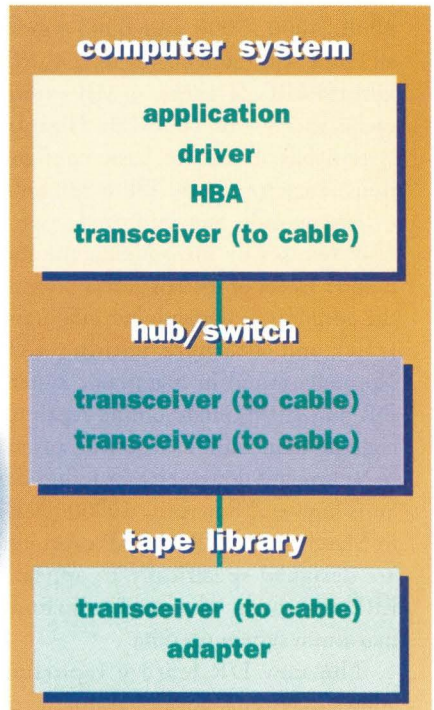
connections between floors in a building, across a campus and up to 10 kilometers for disaster prevention.

Hot Plug

A new server can be added to a centralized fibre channel backup network without impacting current backup between other servers and the tape library.

Centralized Management

Even though the servers may be distributed across a campus, the management of the backup process can be controlled centrally, assuring consistent reliability.



In the example above, the storage management software sends move-media commands to the tape library. Once the command is executed, the storage management software moves data across the fibre channel to the tape drive in the tape library.

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SunExpert NEWS

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Sun Enhances Mid-Range Servers

In May, Sun Microsystems Inc. expanded its presence in the enterprise resource planning (ERP) market when it began shipping four new mid-range servers–the Enterprise 3500, 4500, 5500 and 6500. The new servers, intended to supplant the Ultra 3000, 4000, 5000 and 6000 models, all come with either 250- or 336-MHz UltraSPARC II chips, 4-MB external cache and 84- or 100-MHz Gigaplane system bus. Prices for basic configurations range from $49,700 to $204,400.

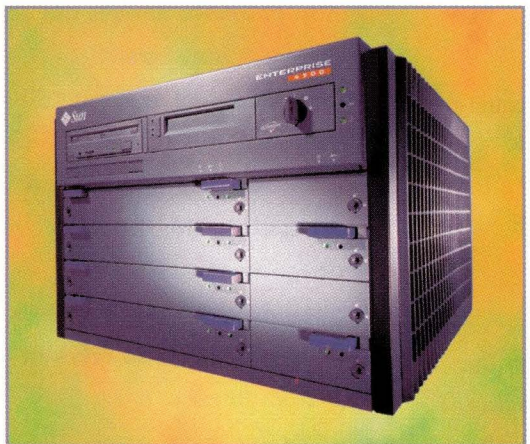
Last month, Sun improved upon its May releases by introducing the most unique aspect of its new server offerings, the addition of dynamic reconfiguration (DR) and alternate pathing (AP). Normally found in mainframe systems, DR and AP facilitate online repair and configuration without requiring a system to be brought down. First introduced on Sun's high-end Enterprise 10000 released in March 1997, DR and AP capabilities are designed specifically to appeal to ERP customers who need to maintain maximum system up-time.

The new DR feature reportedly allows a systems administrator to off-load a process from a faulty server component so the component can be replaced without bringing down the system. AP allows an I/O path to be redirected without interrupting an application.

"The most interesting feature of these servers is the DR feature that allows administrators to off-load a process from a defective component in the server without stopping the application. You can hot swap the defective part without turning the system off. It's a very unique capability that's typical of mainframes," says Harvey Hindin, director of High Availability and Clustering Services for D.H. Brown Associates Inc., Port Chester, NY. "If you're in any segment of enterprise resource planning, that's going to get you pretty excited, because the whole idea of ERP is that the system has to stay up."

DR and AP features are intended to complement multiserver, high-availability solutions, such as clustering.

"Most vendors recommend clustering [to achieve high availability]. We're in support of that, but within a single system, if you need to do online repairs, this gives you the ability to hot swap components without bringing the system down," says Nancy Weintraub, Enterprise Programs and Enterprise Server Products group strategy manager for Sun Computer Systems.

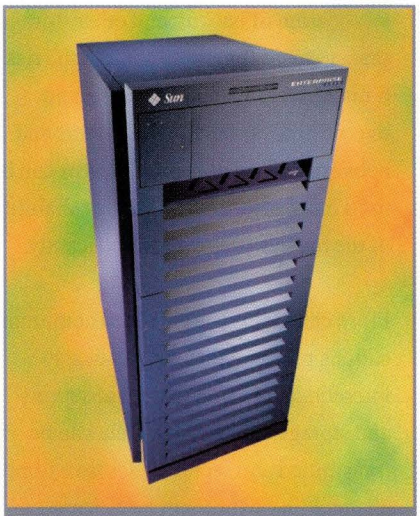


Sun's new mid-range servers, Enterprise 3500, 4500 (above), 5500 and 6500, all offer dynamic reconfiguration and alternate pathing features, normally found in mainframe systems.

The pricing and specifications on Sun's new servers are as follows:

• Enterprise 3500, priced at $55,700 for a model with two 336-MHz CPUs (or $49,700 for two 250-MHz CPUs) and 256 MB of memory, has a 9.1-GB hot-swappable disk drive and is expandable to eight 250- or 336-MHz CPUs. It has 8 GB of memory and nine 3.5-inch disk drives.

• Enterprise 4500 costs $91,400 for a configuration with two 336-MHz CPUs (or $85,400 for a 250-MHz model), 256 MB of memory and one 8.4-GB disk drive. It is expandable to 14 CPUs, 14 GB of memory and four 8.4-GB disk drives.



The top-of-the-line Enterprise 6500 can hold a maximum of 30 CPUs, two 8.4-GB disk boards (each containing two drives) and more than 375 GB of rack-mounted storage in the system cabinet.

• Enterprise 5500 costs $102,400 for a two-CPU, 336-MHz model (or $96,400 for the 250-MHz version), and comes with 256 MB of memory and an 8.4-GB disk board, which contains two drives. The 5500 is expandable to 14 CPUs, 14 GB of memory and four 8.4-GB disk boards (each containing two drives).

• The top-of-the-line Enterprise 6500 can hold a maximum of 30 CPUs, two 8.4-GB disk boards (each containing two drives) more than 375 GB of rack-mounted storage in the system cabinet and 30 GB of memory. A basic configuration with 8.4 GB of internal storage, 256 MB of memory and two CPUs costs $198,400 for a

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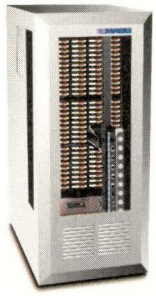

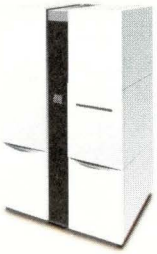

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250-MHz model and $204,400 for a 336-MHz version.

All of the servers are currently shipping with DR and AP capabilities for all I/O components, and will come with DR for the CPUs later this year (the patch is free to customers who purchased a service contract).

Industry experts say the new servers significantly strengthen Sun's position in the ERP market. Sun, which only recently entered the ERP arena, reported that sales of its server and storage products in ERP applications increased by 400% in 1997, and the company has announced its intent to focus on the mid-range ERPmarket–targeting companies with revenues of between $100 million and $1 billion–in the coming year.

Industry experts say the new servers significantly strengthen Sun's position in the ERP market.

Sun formally began competing for ERP business in early 1997, with the debut of its high-end server, the Starfire Enterprise 10000, says David Floyer, director of research for International Data Corp., Framingham, MA. "In 1997, they didn't have a top-end product. Starfire suddenly vaulted them into the high-end position, where Hewlett-Packard [Co.] was all along. HP and Sun are now neck-and-neck," Floyer says.

HP, Palo Alto, CA, was quick to counter Sun's new server announcements with claims of superiority in performance for its ERP products, namely the HP 9000 Enterprise Server line.

"Sun is still learning about the concerns of the ERP market," says Todd Thiemann, programs manager for HP America's marketing center. "Enterprise customers care about three top issues: investment protection, performance and scalability, and high availability. I really don't see Sun's announcements as addressing those concerns."

Included in its ERP announcements, Sun also unveiled an upgrade to its SyMON management software for systems management. Unlike the prior release, SyMON 1.6, which provided monitoring and failure prediction capabilities, the new Enterprise SyMON software allows administrators to manage the system via a Java-based GUI that can be viewed from any console on the network. The software features DR management, which has automated settings that will kick in to self-correct system errors if preset thresholds are crossed.

Enterprise SyMON can be integrated with enterprise management systems such as Tivoli Management Software from Tivoli Systems Inc., Austin, TX, an IBM Corp. subsidiary, or with Sun's Solstice Enterprise Manager Software. Details on pricing for the SyMON Enterprise software will be available in August.–*sjh*

X Window Upgrade

The Open Group, Cambridge, MA, has added some new features to Version 6.4 of its X Window System, the client-server software that allows PCs and other desktop clients to access UNIX applications on a server. This latest version, X11R6.4 introduced in March, has added power management features, upgraded resource configuration features, a colormap utilization protocol and Xinerama–the ability for multiple X Window server screens to function as one large monitor.

In X11R6.4, a systems administrator or user can set power management features that will put the monitor into sus-

Microsoft Promotes UNIX/NT Connectivity

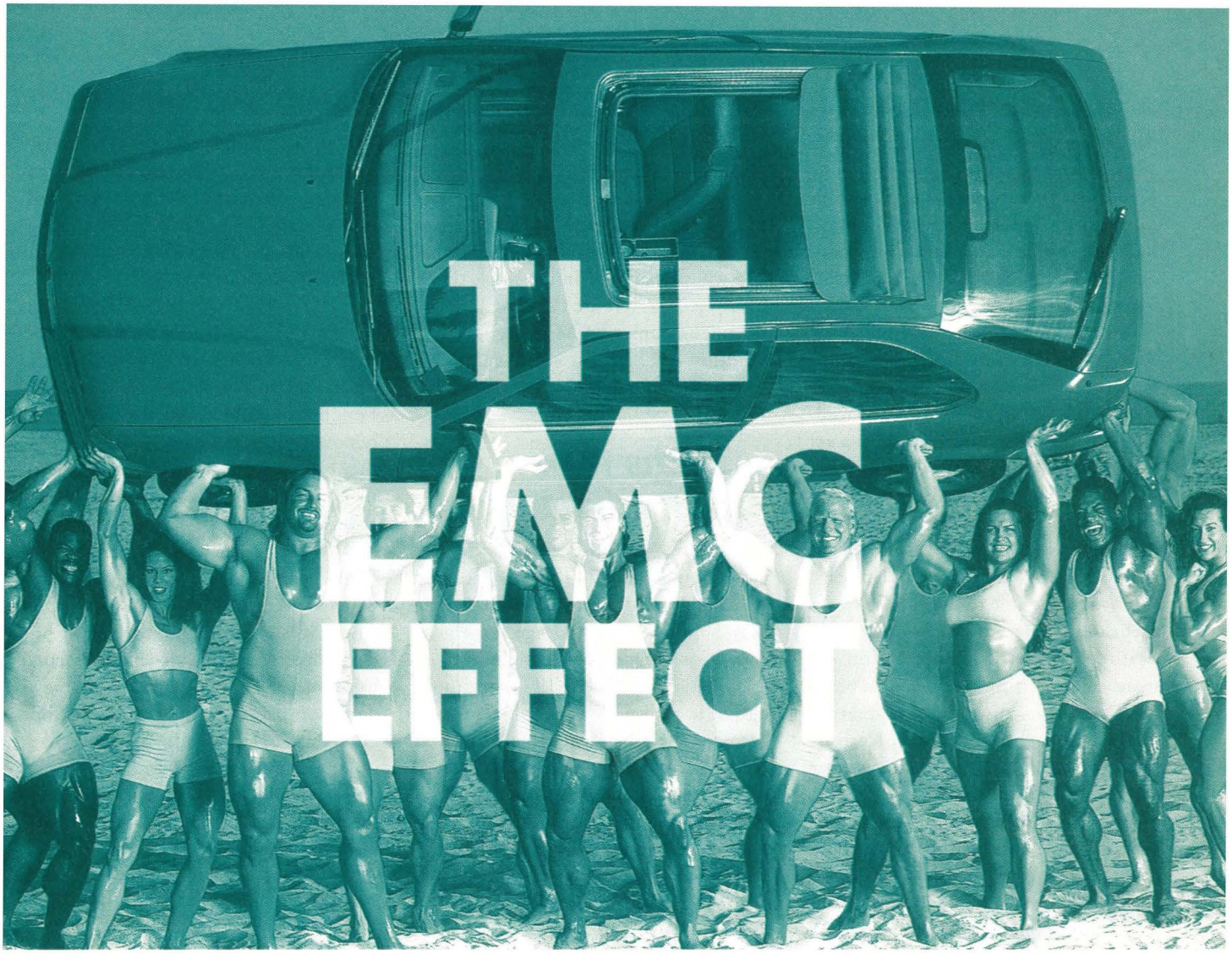
Rather than expecting UNIX to be phased out, it seems that Microsoft Corp. has accepted that it must enable corporations to leverage their existing systems by integrating Windows NT systems with UNIX systems. The company recently announced a set of utilities, the Windows NT Services for UNIX Add-On Pack, that will reportedly offer those features and benefits most often requested by UNIX and Windows NT users.

One such feature is resource sharing. Windows NT Workstation 4.0 users will be able to access files on UNIX systems and vice versa, Microsoft says. To provide these capabilities, Microsoft has licensed Network File System (NFS) client/server software from Intergraph Corp, Huntsville, AL.

Also, Windows NT Services for UNIX Add-On Pack will provide the capability for common scripting across platforms. The software will allow users to run many existing UNIX scripts on Windows NT-based systems. Microsoft will license a subset of UNIX utilities from the MKS Toolkit, a collection of 200 or more Windows and UNIX tools from Mortice Kern Systems Inc., Waterloo, Ontario, a provider of Windows NT scripting and migration tools and software configuration management products. The Korn shell has also been licensed from Mortice Kern, giving users the ability to automate common processes and administrative tasks across both UNIX and NT platforms.

Another new addition is a one-way password synchronization feature that will allow customers to maintain a common password between their Windows NT and UNIX machines. It will reportedly provide a seamless environment, so users can work with data on NT servers and UNIX systems without having to enter their password multiple times.

Remote administration capabilities have been integrated with the UNIX Add-On Pack. Using Telnet, remote users will be able to log into and execute commands on NT or UNIX systems. Microsoft says a beta version of Windows NT Services for UNIX Add-On Pack will be available this summer for Intel Corp. and Digital Equipment Corp. Alpha platforms. Final availability will be based on feedback received from beta testers.–*mm*



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pended mode after a set time period. In addition, a Resource Configuration Management feature makes it possible for an end user to modify a resource, such as a printer, and have the change take place immediately, without having to restart the application.

A more significant addition to the X Window specification is the new colormap utilization protocol, which makes it easier for applications to share read-only colors stored in a colormap–a set of entries defining color.

"An X server has limited colormap capability. If multiple applications are running, it has to share. If you're running CAD or visualization applications, you need to be able to display the colors accurately. The colormap utilization protocol will enable applications to share colormaps more efficiently," says Peter Auditore, director of marketing for Hummingbird Communications Ltd., Toronto, Ontario, a leading maker of PC X server software.

Another new feature, called Xinerama, makes it possible for two or more screens to be combined into one large display. While Xinerama isn't a feature most X Window users will need, it does have value in niche applications, such as network management or mission control at oil fields, where it's advantageous to spread the display of a large schema or graph over several screens.

According to Dave Knorr, business area manager for The Open Group, the specification will be available for public review until September (see `http://www.camb.opengroup.org/x`), and the final version will be released in October or November.

Version 6.4, however, is not as significant as the last upgrade, 6.3, announced in 1995. That release, dubbed Broadway, added some significant capabilities to the X Window System; including support for HTTP, so Web browsers could access UNIX via Web pages with embedded UNIX/X applications, and Low Bandwidth Extension (LBX), to compress the X protocol stream for easier transmission over low-bandwidth, dial-up lines. Shipments of PC X server software is projected to grow 10% in 1998, from just over 855,450 units to 941,000, according to figures from International Data Corp., Framingham, MA.

Eileen O'Brien, director of the NC Program for IDC, says the growth rate for the X server market is slowing down and will probably be in the single digits by 1999. X servers are being replaced in many companies by Microsoft Corp.'s Windows NT or, in some cases, by Network Computers (NCs).–*sjh*

LTO, the New Tape Technology

In April, Hewlett-Packard Co., IBM Corp. and Seagate Technology Inc. unveiled an open tape architecture, which they hope will set the stage for a new generation of tape storage products.

Linear Tape-Open (LTO) technology, as it's called, is expected to surpass current tape capacity and performance benchmarks while maintaining data integrity. LTO is offered in two distinctive formats, Ultrium and Accelis, to address both read-intensive and write-intensive applications–Ultrium for high-capacity needs and Accelis for fast-access requirements.

The Ultrium format, is a high-capacity, single-reel implementation that offers up to 200 GB of capacity assuming a 2:1 compression ratio (100-GB native). Transfer rates are expected to be in the 20- to 40-MB/s range. This format is aimed at users requiring high-capacity backup, restore and archive capabilities. Ultrium is designed to enable future tape products with compressed capacities of up to 1.6-TB on a single cartridge, according to the companies.

The second format, Accelis, is a fast-access, dual-reel implementation that offers data retrieval in under 10 seconds. It is designed for applications that require exceptionally fast access times, such as online data inquiry and retrieval, and is expected to debut with capacities of up to 50-GB (compressed) and deliver transfer rates from 20- to 40-MB/s (compressed). Products developed using the Accelis technology can expect access times under seven seconds, capacities of up to 400-GB (compressed) and transfer rates ranging from 160- to 320-MB (compressed), the companies say.

"The technology itself will have a lot of scalability so users can have drives that are 100-MB or 40-GB and the media will be interchangeable," says Jim Leal, media relations specialist for IBM's removable media storage solutions. "So they can scale up and down according to their needs and applications. They won't have to worry about things like I need a DLT [drive] for this, but I need an 8mm [drive] for that."

LTO technology combines the advantages of linear multichannel, bi-directional formats with enhancements in servo (or drive motor) technology, data compression, track layout and error correction code to maximize capacity, performance and reliability, the companies say. Accelis and Ultrium formats use LTO media, channel and servo technology.

LTO technology, setting the stage for a new generation of tape storage products, comes in two formats: a high-capactiy, single-reel version, called Ultrium (above), and a fast-access, dual-reel format, dubbed Accelis.

Licenses are now available to manufacturers for the two formats based on LTO technology. Typically, products based on new storage technology specifications begin to emerge 12 to 18 months after technology licenses become available. More information on LTO technology can be found at `http://www.lto-technology.com`.–*mm*

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Trade up your current tape drive and get over $1000 in value from Sun Microsystems, Inc. Upgrading your data backup technology to meet the enormous storage demands of the future is a big step to take. To make it easier for you, Sun is offering a $575-$750* discount off the regular list price of a Sun™ StorEdge™ 20-40 GB tape drive (Exabyte Mammoth technology) when you trade in your current 4mm, 8mm or DLT™ tape drive. You'll also receive Advanced Metal Evaporated AME-170m cartridges plus a Mammoth Cleaning Cartridge worth over $500**. Yours for moving up to a high performance Sun StorEdge system. The Sun StorEdge system is built for automation, so you can scale performance and capacity as your data storage needs increase. That's why now is the time to take that Mammoth leap into the backup system of the next century. Your data is mission critical. Our storage solution is Mammoth. Let Sun and Exabyte take you into the future. Call us at 800-873-7869 or visit our website at www.sun.com/8mmpromo or contact your local authorized Sun reseller for more information.

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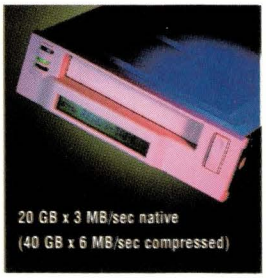

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IBM and HP Fight for Balance

IBM Corp. and Hewlett-Packard Co. have both set their proverbial sites on the intelligence load-balancing market by declaring their plans to offer commercial products to manage multiple Web servers. On May 5, IBM officially announced WebSphere Performance Pack, a load-balancing application formerly known as Nagano, which is targeted at Internet service providers (ISPs) and large corporations. A week later, on May 11, HP announced a similar product called HP Domain Commerce.

The WebSphere Performance Pack is an integrated product that incorporates existing technologies, including IBM's Interactive Network Dispatcher load-balancing server, IBM's Web Traffic Express caching proxy server and Transarc Corp.'s AFS enterprise file system. WebSphere is available on AIX, Solaris and Windows NT platforms.

HP Domain Commerce is an e-commerce server platform. The underlying technology, HP Web Quality of Service (QoS), is designed to manage peak loads, prioritize users based on a predetermined criteria and ensure the availability of crucial business applications.

"What Hewlett-Packard introduced is a totally different dimension to the [load-balancing] equation, which is a class of service differentiation for Web applications," says Martin Marshall, industry analyst with Zona Research Inc., Redwood City, CA.

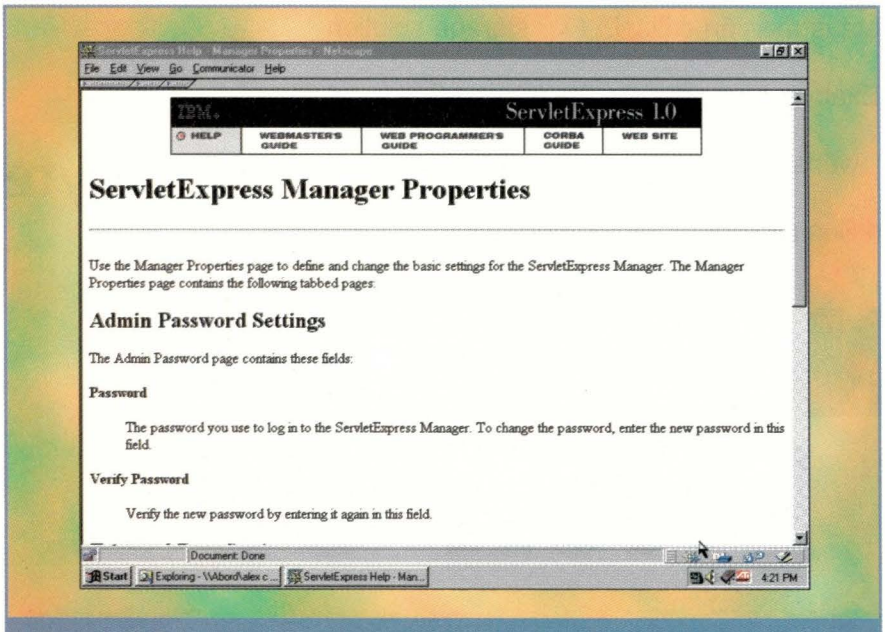
HP is pushing the notion that not all Web requests are created equal. Its new system attempts to prioritize business customers by importance–the notion being, the person most likely to make a purchase should have priority over someone who's just browsing.

IBM, on the other hand, is stressing availability with its product line. "Maybe we can't yet differentiate on quality of service that HP is promising, but they can't do it yet either. It's just a promise," says Chris Gage, senior software engineer at IBM. "Right now, we can do quality of service fairly effectively based on planned IP addresses. We are aware that quality of service is going to be an issue, but it is certainly not nearly as important as fundamentals of scalability, throughput, performance, low latency and general high availability of applications. Those are the things that we are focusing on," Gage says.

HP's new system attempts to prioritize business customers by importance–the notion being, the person most likely to make a purchase should have priority over someone who's just browsing.

The first product to be shipped by HP based on the Web QoS technology is a portion of the HP Domain Commerce platform suite, HP ServiceControl. Available for $800, HP ServiceControl is also integrated with several other technologies, including Admission Control, a policy-based system that prioritizes and manages load on the Web server; Persistent Connections, an implementation of HTTP 1.1 that prevents server overload; HP Domain Management, a management system for Web application servers that includes HP OpenView; and DLD Control load-balancing technology that works with Cisco Systems Inc.'s LocalDirector (an Internet appliance that load balances TCP/IP traffic). HP ServiceControl is only available on HP-UX and HP 9000 Precision Architecture servers.

IBM has also announced WebSphere Application Server software, designed to enable customers to build, deploy and manage Java-based enterprise applications. A Java run-time environment for Java servlets is included, called ServletExpress 1.0, that is said to integrate with common database formats and object request brokers and middleware. Down the road, IBM plans to offer an integrated toolset for building dynamic Java applications. Jeff Reser, product manager of e-business solutions for IBM, says the WebSphere Application Server software costs under $500. It was scheduled to be available at the end of June. An enterprise Java server is due out by the end of the year.–*ptc*



IBM's WebSphere Application Server software includes ServletExpress 1.0, a Java run-time environment for Java servlets.

Affordable High Availability

IBM Corp. has introduced a new RS/6000 clustered server package that aims to offer high-availability computing at a price small to mid-size com-

New Products

Sun compatible workstations from Tatung

Tatung now offers Ultra-10 and Ultra-60 Sun compatible workstations featuring PCI I/O busses. Also available are the Ultra-1 and Ultra-2 Sun Compatible systems. The workstations all run on Sun Solaris 2.x and utilize Sun Processors. These units are the cost-effective solution that every Systems Administrator should seriously consider.

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Dataram, a leading provider of Gigabyte memory upgrades for UNIX workstations, now offers memory upgrades for the Sun Ultra-5 and Ultra-10 workstations. Upgrades are available from 64mb to 512mb and carry a lifetime express-ship replacement warranty.

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The newest generation of RDI products features mid-level workstation processors, large high-resolution color displays, removable hard disk storage and a low price premium over comparable desktop workstations. This combination of features enables technical users to easily bring their workstations anywhere, so they're more versatile, more flexible and more productive in their work. It's a new way of working.support and service.

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With its RS/6000 HA50, IBM offers low-cost, high-availability computing.

panies can afford. The RS/6000 HA50 comes with two RS/6000 H50 servers bundled with IBM's High Availability Cluster Multi-Processing (HACMP) software for AIX. Pricing for the hardware/software package starts at $70,000.

"These clustered servers make big company high availability simple and affordable," says Bill Zeitler, general manager of server brand marketing at IBM. "Not just in high-end firms but in small and medium-size businesses and in departments of larger firms."

The need for high availability has grown as more companies deploy applications crucial to business operations such as electronic commerce, corporate databases and enterprise resource planning (ERP). This type of high availability, especially in terms of IBM's HACMP, has traditionally been a luxury for large organizations.

"People perceive HACMP as the expensive choice," says Dan Kusnetzky, director of the Client/Server Operating Environments Program at Framingham, MA-based market research firm International Data Corp. (IDC). "That same high value is now being offered at a lower cost."

Each RS/6000 H50 comes with a 332-MHz PowerPC 604e processor, 256 MB of memory, dual integrated Fast/Wide SCSI-2 controllers and redundant 4.5-GB SCSI IPL boot disks. The maximum configuration for the server is four 332-MHz processors, 3 GB of memory and 109.2-GB disk. "HACMP allows you to add capacity in a rather linear fashion and get the availability attributes," says Rich Michos, director of clustered solutions for the IBM server group.

Analysts are impressed with IBM's new pricing model, but in terms of technology, very little new ground has been broken. "The interesting thing is the pricing," says Harvey Hindin, director of High Availability and Cluster Services for D.H. Brown Associates Inc., Port Chester, NY. "It's neat technology but it's not like 'Wow I never saw that before.'"

IDC's Kusnetzky adds, "The issue in my mind is that IBM and everyone else that wants to sell a complex multiserver solution into a small and medium-size company is going to have to do a lot of education and show them that this is as simple as any other solution. If it isn't, they are not going to adopt it."

IBM also announced its plans to introduce technology to cluster UNIX with NT by the end of this year, or early next year. Over the next 12 months, IBM will enable its Netfinity NT cluster to be attatched to an RS/6000 SP. This will allow both the SP cluster and an NT cluster to be managed from a single point of control. Then, early next year IBM plans to attach both clusters to its fast switch.

"The first phase will be the ability to do all the system management," says Michos. "The second phase will be the ability to have very fast application integration because you have the high-speed connection."–*ptc*

DB2 Blitzes Sun

IBM Corp. has cozied up with Sun Microsystems Inc. to help push its DB2 Universal Database software onto the Solaris operating system. The two companies have agreed to work together to optimize DB2 for Sun's high-end server and to allow Merisel Open Computing Alliance (MOCA), a master reseller for Sun based in El Segundo, CA, to distribute a bundle consisting of a Sun server and the IBM database software. Furthermore, IBM has promised to provide data management tools that run on Sun platforms.

The agreement calls for a cooperative effort between the two companies to optimize the DB2 database software on the Sun Enterprise 10000 server. The companies say they will work to make cluster capabilities available on the Enterprise 10000 as well as nonclustered SMP parallel configurations.

"This [agreement] is a great lead for us to further penetrate the data center," says Chris Kruell, marketing programs manager at Sun. "There is obviously a lot of data out there on DB2 and we're just eager for the opportunity to bring Sun's high-end focus to the data center."

The release date for a tuned version of DB2 for Enterprise 10000 has not been announced, but a new bundle of Sun servers and the IBM database software is now available.

Described as a first-of-its-kind arrangement for IBM and Sun, MOCA will be responsible for distributing the Sun Enterprise 450 workgroup server preloaded with DB2 and InfoSpace Inc.'s SpaceSQL, a 100% Pure Java query and reporting analysis tool. "We're recognizing the demand in the Sun customer base for this kind of capability and we believe that DB2, InfoSpace and Sun servers represent a wonderful bundle to get this capability to those customers," says Jeff Jones, program manager of data management marketing at IBM software solutions.

IBM certainly has recognized a demand in the Sun customer base. In March, the company started shipping a version of DB2 Universal Database Enterprise Extended Edition that supports clustering capabilities for Sun servers. In addition to the Enterprise 10000 and bundling news, Big Blue has also launched a beta program for two of its data management products, DB2 OLAP Server and Intelligent

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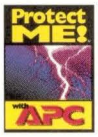

If you've ever installed a 6-20kVA, non-redundant, legacy UPS system in a datacenter, you know the challenges: installation is a struggle, maintenance is a challenge, power upgrades are unheard of, and hardware tends to be unreliable. In fact, most legacy UPSs were designed for electrical and manufacturing applications and not with the needs of today's sensitive datacenters in mind. Worst of all, with a single point of failure, the legacy system is all too interruptible.

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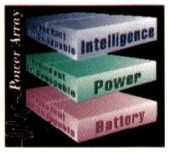

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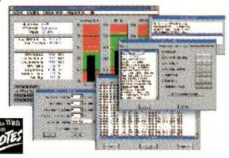

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Minor for Data, for Solaris. The DB2 OLAP Server is the result of the partnership with Arbor Software Corp. that takes its OLAP engine and Essbase OLAP server and integrates it with DB2, while Intelligent Minor is a business intelligence tool for analyzing data trends and relationships.

This trend of targeting Sun systems is being praised by analysts. IBM has long had the reputation of concerning itself with only selling its software on its own hardware. "It reflects the really incredible aggressiveness of IBM on getting into the open systems market beyond its own platforms," says Merv Adrian, analyst with Giga Information Group, Norwell, MA. "There was a lot of skepticism about IBM's commitment to selling software on non-IBM platforms."

The commitment is so strong that IBM has organized a dedicated sales force to push DB2 on Solaris. "[IBM] is only doing about 5% of their DB2 business on non-IBM platforms at this point," says Adrian. "They expect to do a lot better."

While IBM is targeting Sun customers, some analysts believe the new products will benefit organizations already using DB2. "It will be attractive for current DB2 shops to use," says Doug Lynn, program director for Meta Group Inc., Stamford CT. "They've got this familiar skill set on the other platforms."

This was the case with Draper Laboratories, an applied research laboratory based in Cambridge, MA. The company had experience with DB2 on its in-house IBM MVS mainframe. When Draper Laboratories decided to create an extranet that shares project data among nine engineering corporations, it needed a relational database that ran on Solaris. The company has been using an early release of DB2 on Solaris since 1996 and the product has worked extremely well. "We've been very pleased with DB2's performance," says Paul Aithkenhea\d, database architect for Draper Laboratories. "It has delivered as promised."

Aitkenhead says he is looking forward to future enhancements to the product and the tools that the IBM and Sun agreement should yield.–*ptc*

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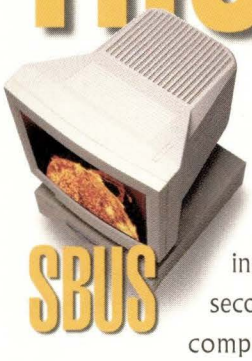

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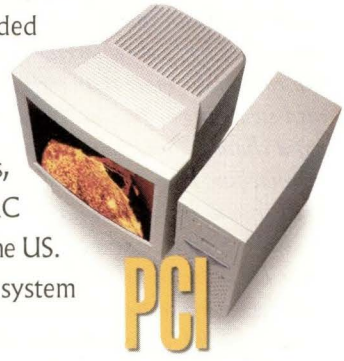

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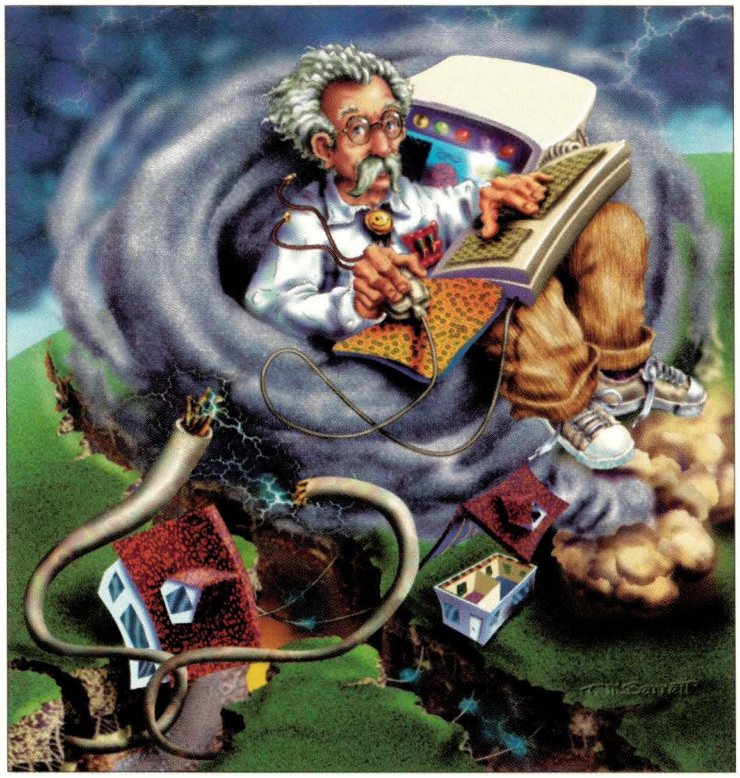
Circle No. 10

Ask Mr. Protocol

by Michael O'Brien



TOM BARRETT

"Then the LORD rained on Sodom and Gomorrah brimstone and fire from the LORD out of heaven"
– Genesis 19:24

"After having been around two hundred million years, it's hard to get excited about a dirty ball of ice."
– The dinosaurs

"I think this wire goes here."
– Internet emergency field repair

The Internet in Adversity

Q: *Well, I've had a wonderful month. My computer blew up and spent two weeks in the shop. You'd think that in an industry whose service is dominated by card replacement, no problem could take more than half a day of card-swapping to fix, but NoooOOoo, not a chance. Then, when I finally got the machine home I found out they'd fixed it so well that I couldn't read any of my backup tapes, or even make any new ones. Then the plumbing failed outright and my backyard became a federally-protected wetland, a sweet little 4.5 tectonic wake-me-up rearranged all my books and my cacti have all developed scale carried by an extremely robust population of ants who don't seem to be deterred by anything short of a tactical nuclear weapon.*

The only thing I've got that still works is the Internet.

Makes me sort of wish I'd kept my backups on that Datacomputer you were moaning about the other month. Just how useful is the Internet in times of disaster, anyway?

A: Mr. Protocol is glad you asked. He's glad mainly because he regards anything not on the Internet as a disaster waiting to happen, or occasionally, a disaster in progress. His peculiar species of irreality strengthens this attitude. To him, the Internet seems the most reliable thing in existence because whenever it disappears, he does too. This results in certain lacunae in his perception of time, which sometimes makes me think that Chez Protocol is actually some sort of prototype of Escher's Castrovalva. He gets me marching in enough circles, certainly.

On its face, the question of the Internet's potential in a disaster is a simple one. The Internet is so hard to get working, even at the best of times, that it seems plain silly to think of its even being in existence, let alone useful existence, in conditions which are far less than optimal. Life is contrary. When examined, the territory seems unexpectedly rich.

Jecon Gregory, a man who claimed to remember so little of his childhood that he could not even remember in what country he had been born, once wrote a fascinating volume entitled, *History Of a Nation Of One*. No man is an island, but nevertheless the smallest-scale disaster, which seems convenient to treat, is a disaster that affects a single individual.

The Bandwidth Problem

The Internet is beginning to be of real value in remote medical applications. The only problem with this is many medical indicators are pictorial: nuclear and magnetic scans of various sorts, good old X-rays, etc. Further, detail is important: the images can withstand little or no degradation before they lose critical diagnostic value.

This spells bandwidth. Wide-area Asynchronous Transfer Mode (ATM) networks–and there are getting to be a fair number of them under various rubrics–almost invariably play host to one or several remote medical telepresence experiments of one sort or another. The only problem with these

For secure LDAP directory products, don't be fooled by a wolf in sheep's clothing

Many of the new directory product offerings have LDAP glued onto a proprietary architecture. With this comes a lack of coexistence within multi-platform environments, control over public access to internal LDAP servers, and expertise in enterprise directory technologies.

Innosoft International has always believed that to provide the highest quality in both product and support, vendors must possess a superb knowledge of the technologies they offer. The skills required to effectively assess customer problems and develop needed solutions are best gained from building software products from the ground up.

Continuing its leadership role in the development of Internet messaging standards such as MIME, IMAP and ESMTP, Innosoft has extended this thrust to include LDAP directories. This commitment to standards demands that all products be designed using Internet technologies down to their core.

For over ten years, Innosoft has been delivering its PMDF line of enterprise messaging solutions based on internet standards to more than 2,400 installed sites worldwide. Innosoft's co-founder and chief development officer, who was also co-author of the MIME RFCs, helped bring to market the first commercial implementation of MIME in 1992. Innosoft's directory product architect, who co-authored the LDAPv3 RFCs, now brings this same level of expertise to a new line of enterprise directory solutions.

Offering enhanced scalability and performance, the Innosoft Distributed Directory Server is designed to interoperate with other LDAP servers—making it well suited for distributed, multi-platform directory environments. For added security on the firewall, the highly configurable Innosoft LDAP Proxy Server is the ideal solution for restricting search types made by outside clients and filtering responses from internal LDAP directories. Together with the X.500 Connector and LDAP Client SDK, the IDS product set provides a complete solution for the enterprise-wide deployment of LDAP-based directory services.

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Circle No. 11

experiments is they generally permit a top medical expert in one city to view all sorts of detailed medical images in another city, which might be presumed to be stuffed with top medical experts of its own–top medical experts being primarily urban creatures. Once you get further out into the sticks–say, rural Alaska–not only do top medical experts get a little thin on the ground, so does ATM. Also scarce in such places is the money to pay for long-haul, high-speed ATM virtual circuits, which presumably cost much more than the virtual circuits on the inter-city fibers carrying the Internet packets between the two cities mentioned above.

Enter the wonderful world of satellite communications.

Mr. Protocol doesn't give a rodent's derriere about the cost of communications. He thinks "cost" is the name of a field in a routing table. Most people wouldn't care much about the cost of communications in a medical emergency, either. The notion of saving a life makes them go all noble on you. Well-known Internaut Phil Karn once remarked that "'National Security' is the root password to the Constitution." It doesn't take a lot of observation to note that "saving a life" is the root password to the public wallet. Nevertheless, there are very real costs involved with satellite communications, and they aren't going down very fast, either.

The result is an amalgam of special-purpose services and individual projects, rather than the more usual (and more effective) suite of commercial applications sharing a common infrastructure that make up the bulk of the Internet. Not every Eskimo (Inuit, Aleut, take your pick) child with a brain tumor is lucky enough to have an imager backed up by a high-speed data service.

But the infrastructure is growing, even if all of the companies involved in its expansion are taking a flyer into the economic unknown as they build their systems. Iridium is far enough along to have generated its own minor, unanticipated intrusions into everyday life. We knew it was going to support satellite telephones. We could have figured out, but didn't, that the presence of 66 satellites with large, flat, aluminized antennae in 400-mile orbits would lead to the phenomenon of the "Iridium flare," in which an Iridium satellite whose antenna panels catch the Sun at just the right angle suddenly becomes a stellar object of magnitude -7 for a few seconds, dominating the night sky.

Such services will gradually spawn special-purpose, secondary services devoted to medical, search and rescue, and other emergency, disaster-of-one applications. It is not difficult to find park rangers who believe that one's encounter with the wilderness should not be cushioned by such shock absorbers as cellular phones, transponders or other high-tech links with the rest of civilization. To which one can say, fine and dandy. As someone who lost two good friends to an avalanche in a remote part of a national park, I prefer that such aids be available. One can also remark that when one finds their friends' names in the national media, it is almost never a good thing. Bunch of storm crows.

Be that as it may, let us scale up some in disaster size. In particular, let us consider the Loma Prieta earthquake of October 1989, perhaps better known as the Santa Cruz (or San Francisco) quake. Now, this quake was large enough to rewrite the map of San Francisco as San Franciscans took advantage of the inadvertent urban renewal to eliminate for good certain broken freeways, which had lost a critical mass of political support. San Franciscans have never been big on freeways–at least, not freeways leading downtown.

Santa Cruz itself lost a good portion of its downtown. People now tell stories of having walked out of a store just before the quake hit and, after picking themselves up off the ground, turning around and seeing only a pile of rubble behind them where the store used to be. So great was the damage that some of those rubble piles lasted for months.

Telephone service was interrupted. Some of the loss was due to phones being knocked off the hook and tying up central offices, some to damage to switching equipment, some to downed lines and some was deliberate, as some lines were reserved for emergency services.

The Internet, most of which was carried by leased lines at that time, continued uninterrupted, because the leased lines did not share most of the vulnerabilities of the switched telephone network. They did not happen to run through any of the switching centers that were damaged by the quake and they were immune to the other vulnerabilities.

The result was an ad hoc messaging service centered at the University of California at Santa Cruz and supported by the network operations centers of the other UC campuses. Students and others in and around the university were able to exchange electronic mail with people throughout the state and the rest of the world, even though no other communications services were available except for the ubiquitous ham radio. Network operations centers at the other campuses acted as human-powered relays, accepting incoming email sent by network administrators in Santa Cruz on behalf of local residents. These messages contained information on how to contact friends and relatives of the Santa Cruz residents, allowing the operations staff at the remote campuses to phone those people and pass health and welfare information back and forth. This operation was ad hoc and certainly not preplanned, but it fell together very quickly and worked very well.

As a result of this and other similar scenarios, which have played out at small and mid-level disaster sites, some efforts are now underway to formalize the use of the Internet in emergency management. It, like the phone system, is becoming an infrastructure that is heavily used in the aftermath of a disaster–at least in those cases where enough of the communications infrastructure is left to route packets.

And this is interesting. The telephone system uses a sort of hybrid of static and dynamic routing, which does not adapt very readily to severe outages. The designers of the Internet routing architecture, on the other hand, have gone to ridiculous lengths to allow the Internet to reconfigure itself dynamically and route around damaged areas. Of course, in a disaster, routing around the damage is secondary to actually moving packets into the heart of the damaged area, but as long as one router and one wire are left alive to provide routing updates, the packets will flow.

Of course, the infrastructure may not survive at all. There are

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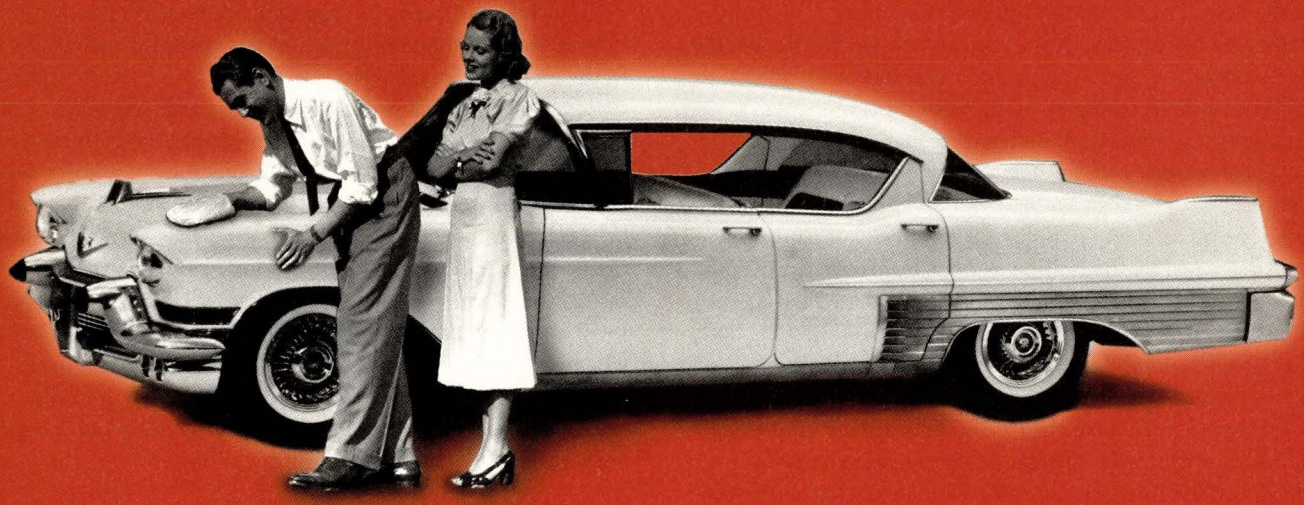

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cases where people have made some startling design decisions. The state of California, for instance, just installed a fiber-optic network specifically for emergency management. The fibers are mostly underground and are made of glass. They can't stand much sideways shearing force at all. California's most common natural disaster is the earthquake, which moves the ground with sideways shearing force. Go figure. The Internet can withstand almost anything except silly planning.

This leaves the really big disasters. Well, surprise surprise, we haven't had one since the Internet was invented, at least, not in any area already served by the Internet.

P. J. O'Rourke has been claiming loudly of late that these are the best of times, and he's pretty much right. Certainly, it's guaranteed better than most of the previous centuries, because large parts of the world's population can go from day's end to day's end without seeing pustules. Such parts of the world that are undergoing misery are undergoing that misery for local, not global reasons and, in most cases, not even for regional reasons. It's not hard to find populations in extremis, but there are not nearly as many populations in imminent danger of being decreased by the million as there have been during any other period of history. All the really big bad guys have gone away. If the worst thing we have to worry about is being barked at by an Internal Revenue Service gone amuck, we're definitely not living in evil times.

The result, as far as our survey is concerned, is gratifying in a rueful sort of way: There is no theater likely to test the behavior of the Internet in dealing with a truly large-scale disaster in the immediate future. We are left to do what survey types do in such situations: We get to make stuff up.

In terms of disrupting and ending the lives of people who would prefer to have nothing to do with the goings-on, by far the biggest potential disaster is war. This disaster goes on for long stretches, instead of being a sudden one-shot like most natural disasters, and noncombatants always get the short end of the stick no matter who's in charge.

Relief efforts become most noticeable after the cessation of hostilities. During the actual campaign, people more or less get by however they can. All resources are of uncertain availability, including most especially communications, which are generally under the tight control of whoever's in charge of the territory on that particular day. At the end of war, relief efforts go to rebuilding infrastructure, the Internet, presumably, along with the rest. This makes it difficult to predict what would happen in wartime, except for one special case: insurrection.

Periods of insurrection in high-tech countries are rare. The only one in modern times surrounded the dissolution of the Soviet Union. Almost everyone who was on the Net in the early '90s will remember the gripping postings to the Usenet from the Soviet research center, describing hour-by-hour the activities surrounding Boris Yeltsin's White House. For all the garbage that has moved over the Usenet throughout the years, that shining hour made it all worthwhile. The Internet proved that it could, in such conditions, provide a degree of visibility and access to the rest of the world previously available only through news media.

Speaking realistically, it seems highly unlikely the world will ever see another ground war of the size and scope of the two World Wars. This is not due to lack of interested parties, but rather due to the deterrent effect of nuclear weaponry. Again speaking realistically, it seems likely that the next century will probably see a bush-league war sprout a nuclear element.

Playing that card seems likely, at least for the foreseeable future, to force the world powers to take whatever steps may be necessary to prevent that war, with its nuclear element, from spreading to planetary destruction. The Internet will work till it glows (along with everything else) but not past that point.

That being the case, it seems difficult to assess the impact, or even the continued existence, of any part of the Internet in the arena of a continental war. What we can say, though, is the TCP/IP suite was originally designed with attention to its performance in battlefield situations, where any given station can disappear at any time. This is peachy for the soldiers, who have the right routing protocols and the right radios to allow the packets to move without all the wires that have been blown up, burned, bulldozed or just plain lost. However, the military tactical Internets, though they may use the same network protocol as the Internet at large, might as well be nonexistent where the noncombatant is concerned. Ordinary folk would do as they have always done in wartime: make do. Luckily, the Internet protocol suite is robust enough to survive a large amount of "making do."

The Big One

However, there are, at least occasionally, truly large-scale natural disasters, perhaps once in a thousand years. The eruption of Krakatoa would have been one such disaster, had it occurred within shouting distance of Europe. Another example, to pick one at random, is the Yellowstone caldera. This hot spot, which sort of wanders along under the continental plate, last cut loose about 600,000 years ago. The geologic record shows that it typically blows up with some regularity every 600,000 years, so we're due. We can expect to see a volcanic explosion from a crater 20 miles in diameter, resulting in an ash plume that extends to the Atlantic.

Another current favorite, at least in movie theaters, is cometary impact. This one crossed the horizon of our collective attention so recently that we're still making hefty guesses as to the distribution of impacts according to severity and frequency. The problem is the erosive forces at work are so great that even gigantic meteor craters are invisible–unless you're six years old and look at a map, in which case the Gulf of Mexico and Santa Monica Bay get pretty obvious.

Then again there's the massive solar flare scenario, viz., Larry Niven's *Inconstant Moon*.

The notion of a disaster relief effort that must encompass recovery from the complete destruction of several states boggles the mind. One imagines that a successful effort would require the complete reworking of the political and economic foundation of the country. A mild case of the strains involved may be seen in today's united Germany, in which the highly industrialized and successful (read: rich) western half is being forced to

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rebuild the entire infrastructure of the economically ruined (read: poor) eastern half. The strain is telling, and besides, all those people aren't dead.

In the wake of a truly large-scale disaster where the activities amount to recovery as opposed to resettlement, the Internet would be sure to play a part, as it is a natural medium not only for organizing the relief effort but also for allowing the remainder of the country to experience, at a personal level, conditions in the affected area. This reminder must be continuous and continual if the immense cost of relief efforts are to be borne by the remaining population.

Such an "emergency Internet" could not be carried by wires and fiber alone. In any large area whose infrastructure has been destroyed, the demands on the Net would be greater than could be borne by satellite resources alone. The Internet would have to be at least partially based on terrestrial wireless technology.

Such wireless technology comes in two flavors. The first, with which we are all familiar, cellular technology, does well in urban environments and supports arbitrary roaming. However, cellular technology depends on an installed infrastructure of interconnected cell sites.

The other flavor is point-to-point. This architecture resembles the regular wired Internet, in that connections run from one node to another. There is no "umpire node" in such an architecture, as there is with cellular technology. Packets are passed on a store-and-forward basis and the network topology is established by means of routing protocols somewhat different from those used in the hardwired Internet. These routing protocols are better able to keep up with changing topology in the network, and can also deal with unidirectional routes, because it is not at all uncommon in wireless applications to have a one-way communications path between stations. Point-to-point wireless Internet systems are not at all common, but both Metricom Inc. and Rooftop Systems Inc., for two examples, are doing work in this area.

It seems strange to think of the Internet as a lifesaver, or a front-line emergency communications medium. It depends on so much high-tech hardware working correctly. What is startling is how often the hardware does continue to work and how robust the protocols are at routing around damaged segments. It seems the Internet may be with us in adversity after all. ⊸

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

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

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

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Device Independence

Computers were once deeply expensive objects, ensconced in their own cathedrals in which their users worshipped. Well, I suppose the users didn't actually get into the cathedral often. Your deck of cards was conveyed to the appropriate entry device by a machine-servant–a priest known as an operator–whose job was to tend to the needs of the machine. The operator returned to you a wad of large pieces of paper containing your results (more likely they stuffed it into an oversize pigeonhole somewhere). If you were lucky, you could move onto the next problem; if not, you needed to edit the cards and try again.

Many of these early batch operating systems were designed to enable their programs to be run without any knowledge of their actual input or output devices. The programs were "device independent." This was important in busy machine rooms where the card readers and printers were bottlenecks. You wanted to be able to feed cards into any reader that had space, and take output from any printer. This became more important with later systems when cards and output were spooled to disk. Even though the program was receiving 80-column card images, or printing formatted output, the actual data was stored on some disk on the system until it was needed.

UNIX was designed with this legacy, the notion that programs should be device independent. Device independence is achieved by making assumptions about how programs behave. The most basic assumption is that all programs read and write streams of data. It's generally true to say programs that manipulate information will read some information, do some work and output the answer. We make the generalization that when you read from any device you're returned a stream of bytes, and, when you want to output to a peripheral or file, we also make the program write a stream of bytes. We assume nothing about the data itself, it is just moved, byte by byte, from one place to another.

So streams of data are typeless, and UNIX makes no assumptions about their contents. Actually this is true about files too. The system doesn't *know* which files on its disks contain binary data and which contain text. It doesn't know that `file.gif` contains a bitmap picture. File names are only used as tags for humans. Typeless files are generally a good thing because the programmer is not constrained to a set of operations the system designer thought were appropriate for that particular file type. It's proved to be an inconvenience when we want to display different icons for different files in visual file manager programs.

Data Streams

Any program that reads or writes data streams makes assumptions about how the streams will behave. The program is at liberty to read as much or as little of its input stream as it likes. However, the program also has to know that when reading data, it may be supplied with less information than it requested. An output data stream means that the program is

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free to write data in huge chunks or in single bytes. The operating system kernel will cope with converting that erratic output into some suitable form for sending to the target device.

Of course, real-world devices rarely deal in data streams. When you write a file to disk, you typically expect to write 512 byte blocks of data. If a program is writing a data stream to a disk, it's allowed to send irregular-size chunks. We must arrange for the kernel to retain the data until it has a filled block that can be written to the disk. We need to provide some code in the kernel that presents a data stream interface to the program.

Similar actions are needed to provide the program with the illusion it is reading a data stream. If the program is reading from a disk file, then it can ask to be sent small amounts of information and the operating system needs to store the remaining data until it is needed. Conversely, if the program asks for huge amounts of data, then the operating system needs to read several blocks from the disk before it can return control to the calling program having satisfied the read request.

At some point the file will end and the program needs to be told the stream has finished. UNIX tells programs they have reached the end of a file by returning zero in response to a read request. Typically, a UNIX program will process a file by using a loop to read a fixed-size block of data. When taking data from the disk file, the kernel will return exactly the number of bytes requested until the end of the file is reached. The program is always told how many bytes have been read on any successful request. The last read from the file may return some number of bytes that partially fill the fixed-size block. Thus, in the loop that processes the data, the program can never assume it has received the number of bytes it requested. The last block is likely to be smaller and the program must always examine the byte count supplied by the kernel. The next read request will return zero, which the program will recognize as the end of the file.

Serial Devices

The data stream model used for disk files also needs to map onto other peripherals. Many output devices, such as printers or terminal screens, already expect to be sent a stream of bytes. All devices are very slow in comparison to CPU speeds, and any program writing to the device will generate bytes much faster than they can be sent to the peripheral. The kernel will never have enough buffer space to store masses of data. So when the program writes a huge amount of data, the kernel will arrange for the program to wait until some bytes have drained out of the system and onto the peripheral. The trick is to wake the program before the kernel buffers have completely emptied so there is always data ready to be sent to the output device.

Also, the operating system may need to do some work to translate internal sequences used in UNIX into other characters the device may need. For example, the device may not support tab characters, so the kernel will need to translate a tab character into an appropriate number of spaces. More commonly, there is the problem of new lines. In disk files, UNIX uses a single character (line feed) to represent the "end of a line." When the output driver sees the end-of-line indicator, it will typically need to translate it into two characters: carriage return and line feed. For a physical printing device, carriage return makes the printing head return to the start of the current line, and line feed moves the paper up one line. Splitting the new line action into its components allows for overprinting and also gives time for the printing mechanism to settle down. Electronic devices like VDUs with no printing head or paper mimic this behavior.

Incidentally, there is no representation standard for the end of a line. MS-DOS descendants store both a carriage return and a line feed character at the end of each line, while Macintosh operating systems use a single carriage return. These differences may cause problems if you copy files between systems without doing the correct conversion.

Terminals, Keyboards and Screens

The most common serial device is a keyboard attached to a terminal–and terminals present a more complex set of problems. We need to map somewhat erratic human typing behavior into a stream of data that is sent to a running program (a *process*) when it asks for data with read request. At the same time, we will be presenting the user with output from processes. Of course, these days, you're typing into a window on a screen, but the mechanisms you're using are largely unchanged from the original interfaces designed to support terminals attached by a serial line to the computer.

To get a handle on the complexity, let's start at the beginning and look at normal behavior. We'll assume that a process has decided to read information from your keyboard, has issued a read request and is waiting for something to happen. When you type a single character on the keyboard, it will be echoed on the screen. The character has left your keyboard, traveled into the machine and been sent automatically by the kernel into the code that transmits data to your screen. Note that the process waiting for some characters might want to inhibit the echoing of characters and we need to provide it with the ability to do that. There's instant complexity here. When typing something into the machine, you are expecting to see the character coming back out to you. The input and output halves of the terminal interface are inextricably linked.

We now have the character you typed sitting in the kernel. We could decide to return the character to the waiting process immediately, telling it that it's got one character from you. In fact, a process can set up the terminal interface to send every character as it is received. This mode of operation is called "raw," and is used by visual editors, and these days, by shells, too. Normal working is usually called "cooked" mode, because it's not raw. If you are running a program that doesn't want to have fine control over the terminal interface and uses cooked mode, then the kernel will retain all your characters until you hit the return key. The kernel will also perform line editing, allowing your chosen delete key to remove characters from the stored data (which again is more complex than it seems–consider erasing a tab character that has installed a variable number of spaces on the screen). Meanwhile the program is doing nothing. It won't wake up until you have completed a line and hit return.

On early machines that ran UNIX, cooked mode was an

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important part of making the system appear to work quickly. Most input was done in cooked mode and most of the time the machine was waiting for a user to hit return. Each user received a fast response to their typing because each single character was echoed back quickly by the kernel.

Raw mode means the system has to do much more work, waking up processes and passing single characters in both directions between the processes and their terminals.

When you hit a return in cooked mode, the kernel will send all the stored bytes to the process, waking it up and supplying it with a complete line of pre-edited data. The process will start to run and deal with the information that you have typed. What happens then? It would be possible to implement the interaction so that the kernel will only accept characters when a process has issued a read request and is waiting for some input. Users of PCs will know that this is very annoying. The machine appears dead while data processing takes place. Control is finally returned to the user who is able to type more text.

On UNIX, the terminal interface will continue to accept characters even if there is no process ready to take the data from the kernel buffers. If the kernel input buffers get full and still no process has appeared to read the data, then the kernel will "beep" at the user and refuse to store any more characters. Incidentally, in cooked mode, the kernel continues to return a line of data to any calling process, even if it's got more than a line stored in its buffers.

The keyboard interface also supports a great many configuration options. First, it understands a set of control characters mapping onto UNIX signals that are sent to processes, which are talking to the terminal. Second, you can force the terminal interface to send an end-of-file indicator, which you will recall is a read request that returns zero bytes. Control-D is usually used to mean this. I still use this character to exit from shells rather that typing "logout" or "exit." When I type Control-D, my shell sees an end-of-file indicator and knows that it's time to exit.

UNIX also has support for delays that can be automatically inserted by the terminal device driver for certain character sequences. These delays are of less importance these days because we all use fast electronic devices to see the output from our computers. But the delays are there to provide support for devices that take time to settle when the printing head zooms back across the paper and the platen moves it up one line.

Finally, you can make the terminal interface react to a pair of characters that control data flow, known as the XON/XOFF protocol. The output interface will stop sending characters when the input side receives a Control-S character, and will restart when a Control-Q arrives. The input side can also use the protocol to control its own buffers, sending a Control-S when they are getting full and a Control-Q when they have drained to an acceptable level.

A flow-control protocol is needed because terminal lines have become a common way of connecting random serial devices to a computer. Serial devices will range in complexity from other computers down to the humble mouse. Serial lines were often used to connect computers together in the days before local area networks were invented. Of course, using serial lines to carry network packets is still done and many people use serial lines connected to modems to carry Internet traffic today.

I've managed to stray a long way from the simple data stream model that I talked about above. Data streams are used by naive programs that will not change any settings on the terminal interface. Programs that use the configurable options of the interface know they are dealing with a bidirectional serial line and are programmed appropriately. Such programs are not seeking device independence. The real trick is that the terminal device interfaces `\fIcan\fP` support data streams, and do so in the default case.

The File System

When Ken Thompson designed the UNIX file system in the early 1970s, he created "special files"–names in the file system address space that map onto physical devices. This completes the illusion of device independence on UNIX. All devices are addressed as if they were files. If you want to save the output of a program on disk, you simply point the output channel of the program to the file. If you want to print the output, then you point the output channel of the program to a special file that connects to a device driver for the printer. The device driver supports the data stream model and prints any data it is sent.

The key here is all programs are coded with the same set of system calls that read or write data streams. If you change the output destination of the program to point to a printer's special file, then the same system call in the same compiled binary will send output to that peripheral. The kernel recognizes the output file is special and calls the appropriate device driver routines when the process asks to write some data.

Also, tying a device to name in the file system makes it easier for programs that are not device independent to acquire access to the device. Such programs use the same set of system calls that are normally employed to deal with regular files, except they will use some extra system calls to configure the device interface.

Of course, special files are also subject to the same access control rules that apply everywhere else on the file system. By setting permissions appropriately on the files themselves, we can permit or deny access by individuals or groups on the machine. So, for example, it's possible for a user to use a standard data stream copy command like `cat` to send data to a printer. However, if we have a line printer spooler, we don't want users to circumvent the order of print jobs in the spooler queue. Rather than allowing anyone to write to the printer, we ensure that only the spooler system has access. We make use of the standard UNIX ideas of ownership and set appropriate file access permissions on the printer special file.

Should we need to, we can give known programs access to files using the UNIX notion of the `setuid` program. A `setuid` program has a bit set in its file description information. The bit tells the kernel that when the program is run, it should have the same access rights as the owner of the file in which the command lives. Thus, we can give a particular program special rights to access a file. A normal program will be run with the access rights set to the user who is running the command. Placing a `setuid` on a program's executable file is often used

to allow that program to access devices that wouldn't normally be accessible. For example, the `df` command tells you how much free space there is on a disk. To return accurate results, the program needs to delve into the special device used to address the disk. However, having the disk device open to all would circumvent system security, so the `df` command is `setuid` to permit it to look at the parts of the disk structure, obtaining the information that it needs.

The UNIX file system model means that "everything" on the computer can be addressed and accessed as a name in the file system address space. The model has been extended by successive sets of programmers. For example on Solaris, we have the `/proc` file system that places a name in the file system for every process that's running on the machine. Each running process is represented as a directory, while files within the directory supply information about the process.

The `/proc` file system provides a simple mechanism for one process to inspect the memory of another. It's not unusual to wish to have this ability. In fact, we normally want to prohibit any process from accessing another's address space for both security and program safety reasons. Before the invention of the `/proc` file system, processes used several ad hoc methods to look at the address space of other processes. The methods employed a special file that mapped onto the virtual memory maintained by the kernel and meant that the programs doing the work of accessing information needed operation system and processor specific knowledge.

So when `ps` prints the command name or other information about processes on the system, it does so by accessing the `/proc` file system and not by delving messily into the memory of another running process. Incidentally, the ownership of files in `/proc` is also used to prevent the file system from being used as a back door by me to look at your programs.

Finally...

One of the reasons UNIX is surviving is because it implements simple models of how computing should be done. The models are easily understood and make it easy to write UNIX programs. Because the models are simple and coherent, it's also easy to see why and where you need to break away from the model and do something special. I suspect that UNIX is also surviving because it's had a tradition of adapting to whatever needs are thrown at it. "Never having to say no" is actually a good recommendation for anything.

PS. I must apologize to my readers (and also the brace of Jeffs Copeland and Haemer–see Page 57) for failing to make any mention of "bazaar" in this article. I did try, honest. But, I did manage to get a "cathedral" or two into the text. ⊸

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

by Richard Morin, **Technical Editor**

KEN CONDON

Conference Calendar

If you're getting tired of staring at flickering phosphors, why not visit Boston, Monterey, New Orleans, or Seattle? Or, for an international twist, how about Maastricht, Stockholm, or Vienna? There are lots of interesting and useful conferences on the calendar. If your company is serious about keeping up with current technology, it should be sending folks to at least some of these.

Here's a rundown of some of the events taking place between now and the end of the century; why not pass a copy on to your boss?

July 1998

- **International Conference on Computer Graphics and Interactive Techniques (Siggraph '98)**
  July 19-24, Orlando, FL
  `http://www.siggraph.org/s98/s98main.html`

Siggraph is the computer graphics world's biggest "dog and pony show." If you want to know what's happening, don't miss this show!

August 1998

- **USENIX Windows NT Symposium**
  August 3-5, Seattle, WA
  `http://www.usenix.org/events/event_calendar.html`
- **Large Installation System Administration (LISA) of Windows NT Conference**
  August 5-8, Seattle, WA
  `http://www.usenix.org/events/event_calendar.html`

If you're working with Microsoft Corp.'s Windows NT, you should really make an effort to attend these two events.

- **Perl Conference**
  August 17-20, San Jose, CA
  `http://conference.perl.com/`

O'Reilly & Associates Inc. put together last year's Perl Conference in about three months. It drew more than 1,000 attendees and was a great success.

This year promises to be even better. If names like Christiansen, Friedl, Salzenberg, Schwartz, Stein and Wall don't catch your eye, stay at home; you're not really using Perl yet.

- **International Federation for Information Processing (IFIP) World Computer Congress**
  August 31-September 4,
  Vienna, Austria and Budapest, Hungary
  `http://www.ocg.or.at/ifip98.html`
- **USENIX Workshop on Electronic Commerce**
  August 31-September 3,
  Boston, MA
  `http://www.usenix.org/events/event_calendar.html`

September 1998

- **Annual Tcl/Tk Conference**
  September 14-18, San Diego, CA
  `http://www.usenix.org/events/event_calendar.html`

Tcl/Tk is a portable, lightweight and extremely flexible language that excels at GUI and other programming tasks. If you're using Tcl/Tk, then this is the conference to attend.

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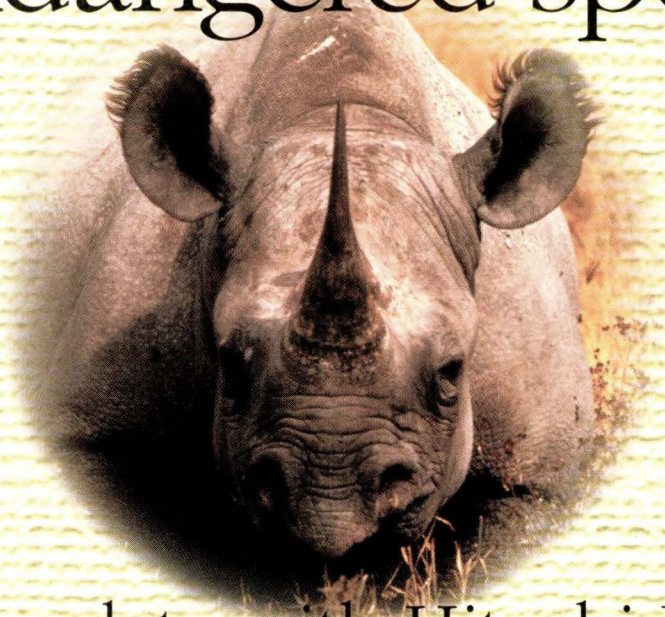

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Circle No. 19

October 1998

- Annual Association for Computing Machinery (ACM) Conference on Object-Oriented Programming Systems, Languages and Applications
  October 18-22, Vancouver, British Columbia, Canada
  http://www.acm.org/sigplan/oopsla/

November 1998

- International Python Conference
  November 10-13, Houston, TX
  http://www.python.org/workshops/1998-11/

  Python is an elegant and powerful programming language that's starting to give Perl a run for its money at administrative and CGI scripting. If you're using Python, then this is a conference you won't want to miss.
- International System Administration and Networking Conference (SANE '98)
  November 18-20, Maastricht, The Netherlands
  http://www.usenix.org/events/event_calendar.html

December 1998

- System Administration Conference (LISA '98)
  December 6-11, Boston, MA
  http://www.usenix.org/events/event_calendar.html
- Annual Computer Security Applications Conference
  December 7-11, Scottsdale, AZ
  http://www.acsac.org

February 1999

- Nordic EurOpen/USENIX Conference (NordU99)
  February 9-12, Stockholm, Sweden
  http://www.usenix.org/events/event_calendar.html

  Sweden in February? Brrrrr! On the other hand, Stockholm is beautiful, the ferry to Helsinki is a glorious trip and the conference itself is likely to be a fun and informative event.
- Symposium on Operating Systems Design and Implementation
  February 22-25, New Orleans, LA
  http://www.usenix.org/events/event_calendar.html

May 1999

- Conference on Object-Oriented Technologies and Systems (COOTS)
  May 3-7, San Diego, CA
  http://www.usenix.org/events/event_calendar.html

June 1999

- USENIX Annual Technical Conference
  June 7-11, Monterey, CA
  http://www.usenix.org/events/event_calendar.html

  Even if you missed the 1998 USENIX Conference, you don't have to miss this one. Besides, the Monterey Aquarium alone is worth the trip!

August 1999

- USENIX Security Symposium
  August 23-26, Washington, DC
  http://www.usenix.org/events/event_calendar.html

October 1999

- Conference on Domain-Specific Languages
  October 3-6, Austin, TX
  http://www.usenix.org/events/event_calendar.html

November 1999

- System Administration Conference (LISA '99)
  November 7-12, Seattle, WA
  http://www.usenix.org/events/event_calendar.html

Most of the events listed above were taken from the online calendar of the USENIX Association. The UniForum Association's online calendar also has some useful nuggets (http://www.uniforum.org/news/html/calendar).

For location- and topic-specific information on upcoming events, try the Internet Conference Calendar (http://conferences.calendar.com). For a full listing of academic computer-related events, try the ACM's Events and Conferences page (http://www.acm.org/coe/index.html). Finally, the COMDEX Calendar of Events (http://www.comdex.com/comdex/owa/all_events) lists a plethora of computer-related trade shows around the world. ➸

Richard Morin *operates Prime Time Freeware (info@ptf.com), which publishes mixed-media (book/CD-ROM) freeware collections. He also consults and writes on UNIX-related topics. He may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at* rdm@cfcl.com.

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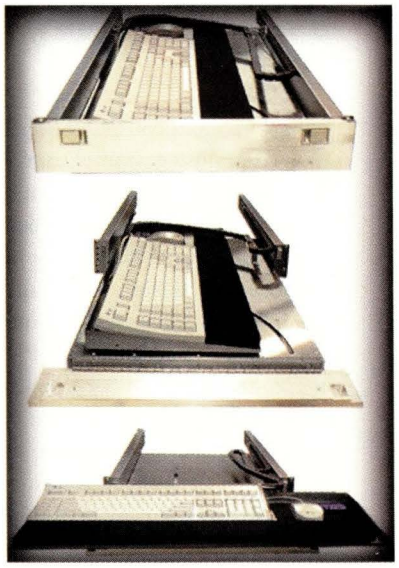

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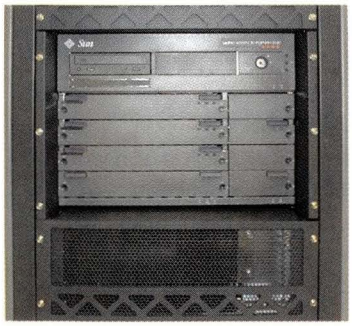

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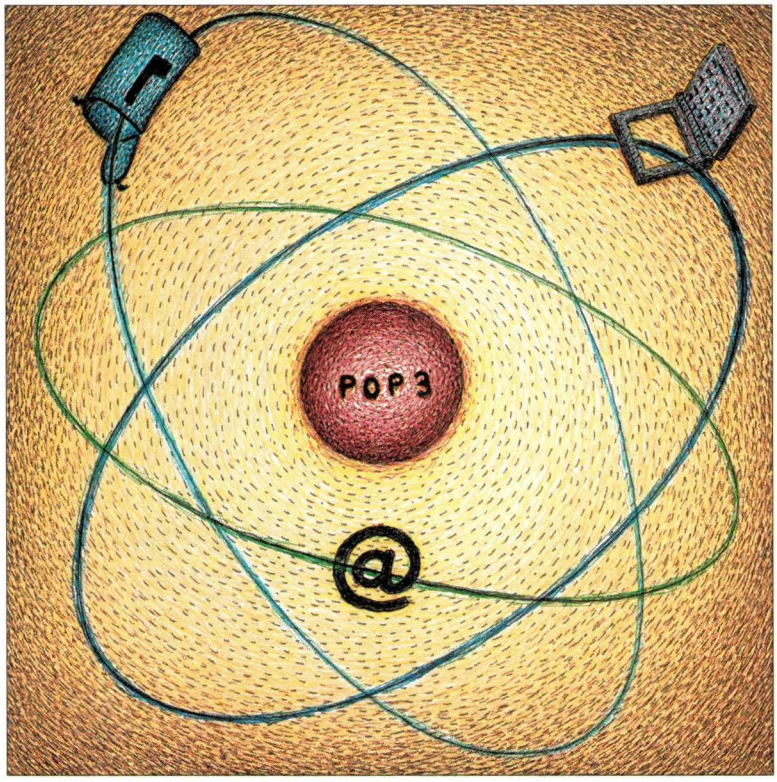

DAVE RIDLEY

How Do You Talk to a POP Server?

For modern computer users with computers at home, computers at work and computers that travel, keeping track of where particular email messages are stored would be a major headache and consumer of brain cycles were it not for some simple protocols. The Post Office Protocol (POP), now most commonly POP3, offers users the option of leaving their mail on the server and fetching the same messages from any of a number of systems. Your more nomadic staff may already be using POP to fetch mail through mail clients such as Sun Microsystems Inc.'s mailtool, QualComm Inc.'s Eudora and Microsoft Corp.'s Outlook Express.

A Little Background

The newer POP3 and earlier POP2 servers can coexist on a system. Each uses its own port–109 for POP2 and 110 for POP3. Defined in RFC 1725, POP3 is now considered "old." RFC 1725 dates back to November 1994–almost four years ago. The newer and more fully featured Internet Message Access Protocol (IMAP) is gaining ground and putting some POP3 servers out to pasture.

Though you probably won't find a POP3 server in your Solaris box, it's easy enough to find and add to your system. Don't spend a lot of money if you don't get IMAP4 support as well–you might as well be ready to meet the demand. POP3 was primarily designed to act as a "store-and-forward" mail system; it works well in this mode, downloading and subsequently deleting stored messages from the server (known as "offline" mode). For many sites, simply grabbing, and then deleting (from the server), incoming mail may be all that is required. The server acts as a holding tank that stores mail only until the client requests it.

Nomadic users will prefer to use POP3 in "online" mode. For these users, the ability to display and track the same messages from multiple email packages or multiple computers may be the only thing that separates them from complete chaos. Online mode–in which client systems leave the mail on the server and keep track of what they've "seen" and what they haven't–works better for these folks, but may not prove as rugged in performing this role as the more simple offline mode.

POP3 Vocabulary

If you have a POP3 server and would like to see the protocol in action, you can `telnet` to it and talk to it in it's own language. Keep in mind that users don't enter any of these commands; the mail client software they use sends the commands to the POP3 server when it retrieves new mail.

POP3 works in three phases: authorization, transaction and update. These are easy to understand. The first, authorization, is when the client software sends the user name and password to the server to authenticate the user fetching his mail. The second, transaction, is the phase in which messages are retrieved, messages are marked for deletion, deletion marks are removed, mail statistics (number of

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Table 1. POP3 Commands and Phases

Authorization	Transaction	Update
user *<user name>*	stat	quit
pass *<password>*	list [msg#]	
apop *<name> <digest>*	retr [msg#]	
quit	dele [msg#]	
	noop	
	rset	
	top [msg#] n	
	uidl [msg#]	
	quit	

messages and overall size) are displayed or message identifiers are listed. The third and last phase, update, occurs after the client has issued the `quit` command ending the session; messages marked for deletion are deleted and the POP3 session is ended.

Before we demonstrate the pleasant conversations possible with POP3, let's take a quick look at POP3's limited vocabulary in each of the three phases. POP3 understands all of the commands shown in Table 1, but knows only three basic answers: `+OK`, `-ERR` and lists followed by a "." (end-of-list indicator).

Talking to POP

To initiate a conversation with your POP3 server, `telnet` to the system running POP3, specifying the POP3 port (110) like this:

```
telnet mailserver 110
+OK POP3 server ready
user temptress
+OK
pass imsocool
+OK User successfully logged on
```

If you misspell a command or type something POP3 doesn't understand, it will simply respond with an error message:

```
OK, gimme some mail
-ERR Protocol Error
```

The `stat` command will display the number of email messages on the server along with the overall size of the inbox. The `list` command will list the size of each message. The `uidl` command will list the unique message identifiers that distinguish the messages from each other.

These identifiers are never used again, even if the associated message is deleted. They play a key role in allowing the client software to keep track of what messages it has already retrieved for display. For example:

```
stat
+OK 15 22047
list
1  507
2  856
3  985
4  409
5  1810
6  4717
7  1203
8  3092
9  2138
10 618
11 514
12 1581
13 823
14 494
15 2300
.

uidl
1  AAAvVJAAAAARzF9rgAwg0GR0KpXpVzQo
2  AAQvVJAAAAARzF9rgAwg0GR0KpXpVzQo
3  AAgvVJAAAAARzF9rgAwg0GR0KpXpVzQo
4  AAwvVJAAAAARzF9rgAwg0GR0KpXpVzQo
5  AAAwVJAAAAARzF9rgAwg0GR0KpXpVzQo
6  AAQwVJAAAAARzF9rgAwg0GR0KpXpVzQo
7  AAgwVJAAAAARzF9rgAwg0GR0KpXpVzQo
8  AAwwVJAAAAARzF9rgAwg0GR0KpXpVzQo
9  AAAxVJAAAAARzF9rgAwg0GR0KpXpVzQo
10 AAQxVJAAAAARzF9rgAwg0GR0KpXpVzQo
11 AAgxVJAAAAARzF9rgAwg0GR0KpXpVzQo
12 AAwxVJAAAAARzF9rgAwg0GR0KpXpVzQo
13 AAAyVJAAAAARzF9rgAwg0GR0KpXpVzQo
14 AAQyVJAAAAARzF9rgAwg0GR0KpXpVzQo
.
```

The `retr` command retrieves a message from the server. If you use this command during your `telnet` session with POP3, you will see the text of that particular message. The `dele` command is used to delete a message. The message is only marked for deletion and isn't deleted until after you issue a `quit` command to end your conversation with POP3. If you change your mind before typing `quit`, you can use the `rset` command to remove the deletion mark. You must use the `dele` command for each message you want to delete, but you can issue the `rset` command without an argument to remove the deletion mark from all marked messages. You can see how this works from the conversation below:

```
dele 2
+ok
dele 9
+ok
stat
+OK 13 19053
rset
+OK
stat
+OK 15 22047
quit
+OK pop3 server signing off
```

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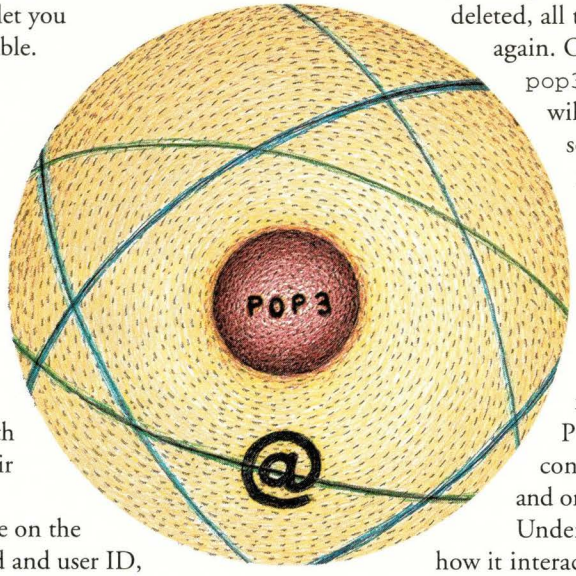
POP3 doesn't like empty lines (carriage return only), but you can issue a `noop` (no operation) command. POP3 will respond with a favorable `+OK` to let you know that doing nothing was acceptable.



Why Would You Want to Talk to POP3?

Admittedly, talking to POP3 is not quite as exciting as I've made it out to be. However, if you're not sure whether or not your POP3 server is running, here's a quick way to check: The "POP3 server ready" message displayed when you first connect tells you the server is running.

If someone is having problems with email and you want to verify that their mail is arriving, you can gather some statistics on how much mail they have on the server (you have to use their password and user ID, so have them on hand to enter this for you).

If your users are the nomadic type with computers at work, computers at home and laptops that follow them around, a good deal of information about the messages to be downloaded isn't on the POP3 server at all, but in the files the client uses to track which messages it has seen. For Eudora users, `lmos.dat` is the file that holds server information. It tells Eudora which messages it has already read so they don't get downloaded again. If this file is deleted, all the messages will be downloaded again. Outlook Express uses a file called `pop3uidl.dat`. Every POP3 client will store this information in a file somewhere if it supports online mode–leaving the email on the server.

Although IMAP provides many features that POP3 does not–for example, hierarchical folders and user-defined message status flags–support for IMAP is not yet as ubiquitous as it is for POP3, and your users may need a configuration that works on your LAN and on the road.

Understanding how POP3 works and how it interacts with mail client software might help you through some trying times. ⊸

***S. Lee Henry** has at least half-a-dozen email addresses and works in the office and at home, on the road and on the water. She lives 50 feet from the shore in Marin County, CA, and keeps track of software and systems at InCap Corp. You can send email to* `slee@cpg.com`.

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WESTERN SCIENTIFIC

by Æleen Frisch

LYNNE CANNOY

Automating Network Configuration

Suppose you get into work tomorrow morning and find that you have to add a new subnet to your company's network consisting of 200 or more new Windows NT workstations. The operating system is preloaded by the hardware vendor and you're going to let users choose their own host names. Wouldn't it be nice if all you had to do is physically connect each system to the network, hook up the router and be done?

The Dynamic Host Configuration Protocol (DHCP) is designed to address situations like this. Its goal is to minimize the amount of manual configuration needed to set up networking on typical client systems. Using DHCP, workstations receive TCP/IP configuration data–their IP address, subnet mask and other related settings–from a server rather than having them set and stored locally. DHCP is designed to automate network configuration for large numbers of essentially interchangeable systems that function purely as network clients, as well as for systems that change location frequently, such as laptops.

Although this column will consider DHCP on Windows NT systems, there are implementations available for UNIX systems as well.

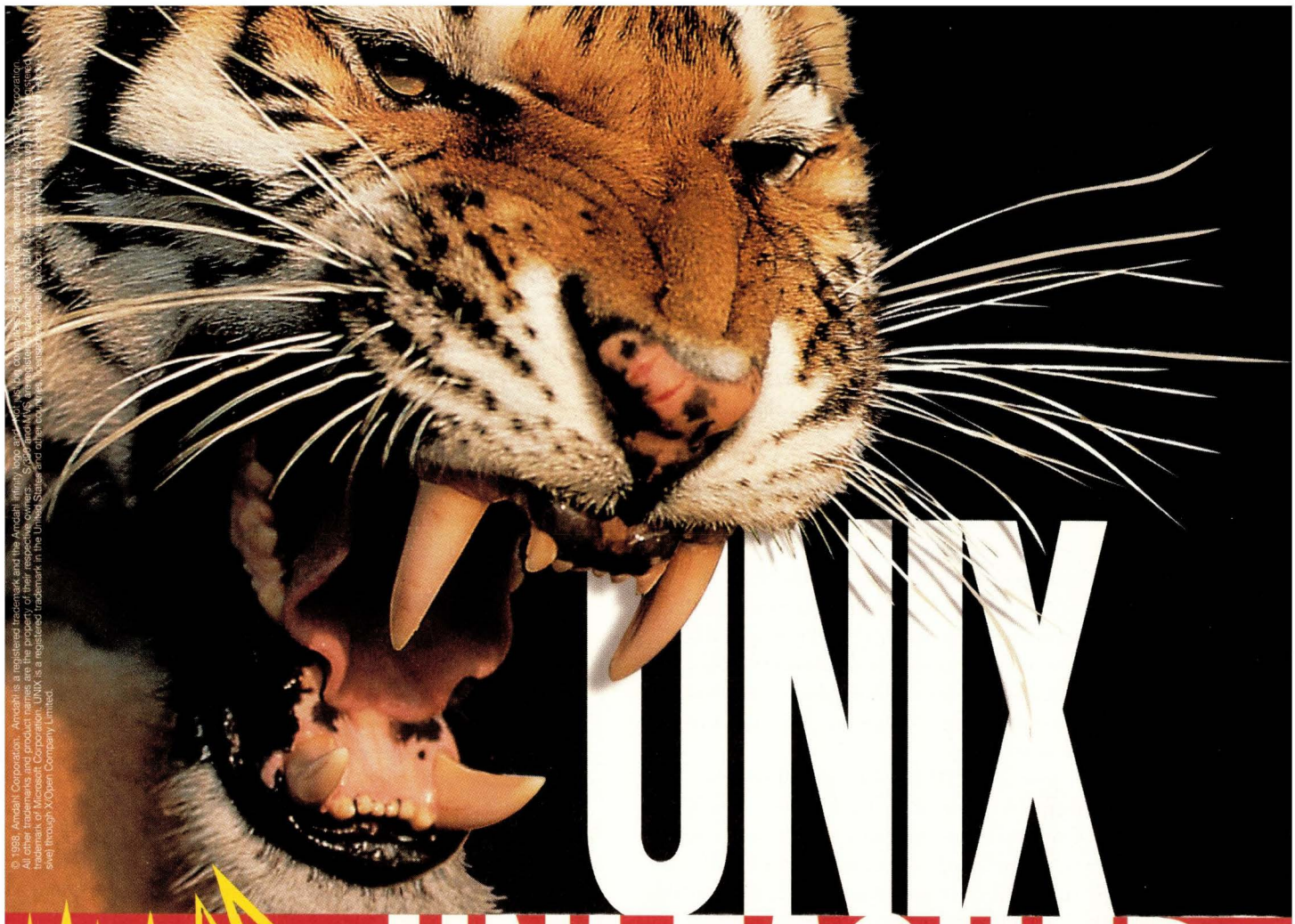
How DHCP Works

When a DHCP client needs an IP address and other configuration settings, it goes through the following process. First, it broadcasts a request for this data, called a DHCP Discover packet. All DHCP servers that receive it, and have an address available for assignment, respond by broadcasting a DHCP Offer packet. This packet contains the offered IP address, subnet mask and other configuration data needed by the DHCP client, as well as the IP address of the server and the duration of the lease (the amount of time the client can use the address before it must be renewed or returned). The client accepts one of the offers, usually the first one it receives, and broadcasts a DHCP Request packet indicating its selection. The corresponding server then broadcasts a DHCP Acknowledge packet, indicating that the address has been assigned and the other servers can return the addresses they offered to the client pool of available addresses.

When the lease is 50% gone, the client will attempt to renew it with the server. If it's successful, a new lease period will begin; otherwise, it will try again when the lease is 87.5% expired. If it fails, the client will obtain a new address from a different server.

As this description indicates, DHCP relies heavily on broadcast messages. A very busy network, combined with a short lease time, can result in DHCP producing a significant load on network resources. However, in most cases, the broadcast traffic has no profound impact on network performance because the messages are both small and infrequent.

You set up DHCP under Windows NT via the IP Address tab of the TCP/



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IP Properties menu path, Network Properties=>Protocols=> TCP/IP Protocol=>Properties. This is the default setting when Windows NT TCP/IP networking is first installed.

Note that DHCP should not be used to configure a system that functions as any type of server (whether or not it is an official Windows NT server system). Never use dynamic IP addressing for any sort of resource server–file servers of all sorts (including via Windows NT shares), print servers, providers of network services (DHCP, DNS, WINS, RAS) and so on–because it will significantly degrade the server's performance.

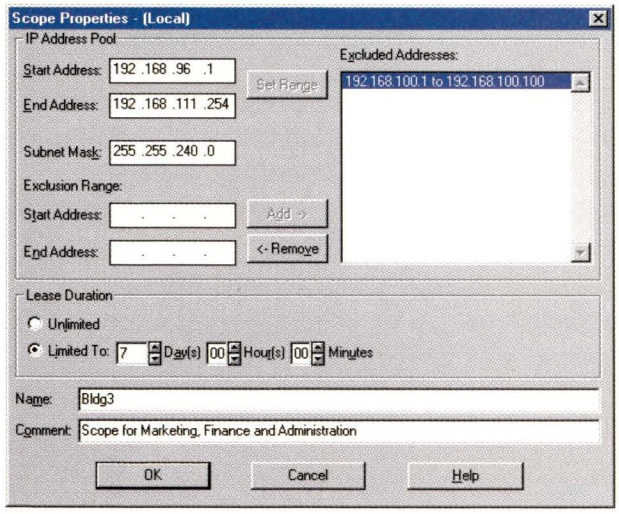
Installing and Configuring a DHCP Server

Windows NT server systems can function as DHCP servers. You will need to install this facility however, because it is not included by default when TCP/IP is installed via Network Properties=>Services=>Add. Once installed, use the DHCP Manager administrative tool to configure and manage DHCP servers (the corresponding command is `dhcpadmn`). This tool allows you to manage DHCP servers throughout the network, not just the one running on the local system. We'll use it to set up a server for the new subnet.

The main window of the DHCP Manager shows the servers that it currently knows about (adding new ones with Server=>Add). Once you have selected a DHCP server system, you must create and assign a scope to it. A DHCP scope is simply the range of IP addresses a server has available for assignment. This range must be a contiguous block of addresses within a single subnet. You create a scope via the Scope=>Create menu path, which results in the dialog box shown in Figure 1.

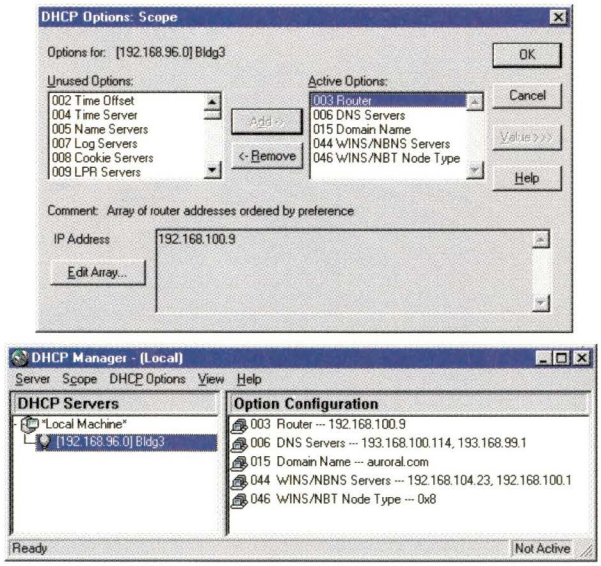
In this example, we are creating a scope named `Bldg3` that comprises the address range `192.168.96.1` through `192.168.111.254`, all of which are on the same subnet

Figure 1. Creating a DHCP Scope



Create a DHCP scope (the range of IP addresses that a server has available for assignment) via the DHCP Manager tool.

Figure 2. Setting DHCP Options



Three types of DHCP options can be assigned: global, scope-specific and default. All three are accessed via the DHCP Options menu.

(the subnet mask is `255.255.240.0`). Within this range, the addresses `193.168.100.1-100` are excluded, meaning they are removed from the pool of available addresses. The lease length for this server is seven days. The lease time should be based on how often computers enter and leave the network, as well as the ratio of available addresses to requesting clients. When there are plenty of addresses available and not much volatility, a lease length of weeks or months is appropriate. On the other hand, if computers are constantly contending for a small pool of available IP addresses, then a lease length of just a few days may be more suitable. The default length is three days.

Many additional settings can be associated with a scope and thereby automatically assigned to client systems via DHCP options. There are three types of options: global options, which apply to all scopes, scope-specific options and default options, which are assigned automatically to newly-created scopes. All three are accessed via the DHCP Options menu.

The upper illustration Figure 2 shows the dialog box for setting options for the new scope we are defining. Available DHCP options appear in the left list box and ones which have already been set appear on the right. In this example, we are specifying the setting for the Router option, which sets the default gateway for DHCP clients. The other listed options are appropriate for scopes in which DHCP clients will be using DNS and WINS facilities for TCP/IP and NetBIOS name resolution.

Specific IP addresses can also be reserved for individual client systems via the Scope=>Add Reservation menu path. It requires you to specify the desired IP address, MAC address (for the Unique Identifier field) and client host name. A trivia

question: How do you determine the MAC address for a network adapter on a Windows NT system? (Answer below.)

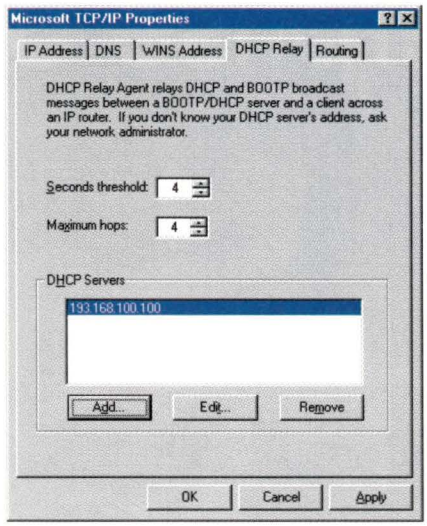
Once scope definition is complete, the scope can be activated using Scope=>Activate, which places it into use.

Service Pack 2 added a feature to the DHCP facility, which allows multiple scopes, each with their own IP address ranges and set of options and reservations, to be combined into a single entity. This facility is called a *superscope*. It can be managed by an individual DHCP server and is accessed via the Scope=>Superscopes menu path.

If your network contains multiple subnets, you have three options with respect to DHCP server placement. First, you can locate a DHCP server on every subnet, allowing all DHCP requests to be answered locally. If you choose not to place a DHCP server on a subnet, then you must provide a way for the DHCP clients' broadcast messages to reach a server on another subnet–by default, routers do not forward broadcast messages. There are two ways to accomplish this: you can use a router that supports RFC 1542 and allows it to forward DHCP/Bootp broadcast packets or you can configure a system on the subnet as a DHCP Relay Agent. In the latter case, the designated system listens for DHCP-related broadcasts and forwards them to a designated DHCP server on another subnet.

Figure 3 illustrates the configuration dialog associated with this facility. When installed, it is accessed via the DHCP Relay tab of the TCP/IP Properties menu.

Figure 3. The DHCP Relay Agent



A system on the subnet can be configured as a DHCP Relay Agent to listen for DHCP-related broadcasts and forward them to the designated server.

Managing the DHCP Database Files

DHCP uses several database files stored in `%SystemRoot%\System32\dhcp`: `dhcp.mdb`, `Dhcp.tmp`, `j50.chk` and `j*.log`. These files are copied automatically to the backup folder in the same directory once every hour. You should also ensure that the backup folder is included in all regular system backups. If necessary, you can restore the DHCP database files from a backup, either to the same server or to the same location on a different system.

There are several DHCP-related registry keys of which you should be aware (all located under `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\DHCP Server\Parameters`):

- **BackupDatabasePath:** Specifies the location of the DHCP database backup folder. For additional protection in the event of a disk failure, you can move this to a location on a different disk than the primary files.
- **RestoreFlag:** Set this to one to force the DHCP server to rebuild the active database from the backup copies at the next server restart. Then stop and restart the server to complete the process.
- **BackupInterval:** You can change the default backup interval by specifying the desired time period in minutes (the default is 60).
- **DatabaseCleanupInterval:** Specifies how long an expired client record remains in the database in minutes. The default value corresponds to 24 hours.

In unusual circumstances, you may want to alter the values of the final two registry keys. ⊸

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

Answer: You can view the MAC address for the network adapters on a system using the Windows NT Diagnostics tool via Start=>Programs=>Administrative Tools (Common)=>Windows NT Diagnostics=>Network tab=>Transports.

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by Jim Fox

▲ *wizard's apprentice*
▲▲ *super user*
▲▲▲ *wizard*

Keeping an Eye on Those Daemons

Q: I am trying to write a simple client/server application using `inetd` to start the server. I can debug the client part with `dbx print` print statements, but how do I debug the server when I don't have control over it? ▲

Judy Mills
Merris Consulting

A: Building an unattended service is one of the joys of programming, but life can be difficult when server programs fail to perform as expected. Fortunately, there are many ways to watch your daemons. Maybe one of these will work for you.

syslog – A Popular Choice

Most programmers would use `syslog` in this situation. `syslog` is a service provided by all UNIX systems. You write log messages much like you format `printf` statements. A daemon, `syslogd`, appends those messages to a file, writes them to the console or sends them to a remote system. It's very convenient. System daemons often write status messages to the system log even when they're working perfectly; this is a good way to keep track of them. All programmers should learn to use `syslog`.

First you configure the `syslog` system. Look at `/etc/syslog.conf`. Entries in this file tell `syslog` where to send each type of message. Lines starting with a pound sign (#) are comments, others identify a type of message and describe what `syslog` should do with it. A typical line looks like this:

facility.priority TAB action

Note: All the white space in this file must be filled with tabs, not blank space.

Facility is an indication of the source of the message. The source can be one of the following:

`kern`	Kernel messages
`user`	Random user-level messages
`mail`	Mail system
`daemon`	System daemons
`auth`	Security/authorization messages
`syslog`	Messages generated internally by *syslogd*
`lpr`	Line printer subsystem
`news`	News subsystem
`uucp`	*uucp* subsystem
`cron`	Clock daemon
`local0`	Local use
...	...
`local7`	Local use

The first group, except for `user`, is generally reserved for system tasks. Looking at the entries in `syslog.conf` you will see that many of these are already assigned actions. The eight local use facilities (`local0` to `local7`) are for your use.

Priority indicates the relative importance of the message. The following is a list of priority items:

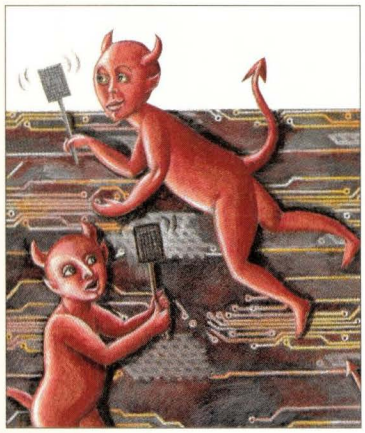
`emerg`	Emergency
`alert`	Action needed
`crit`	Critical condition
`err`	Error

`warning`	Warning
`notice`	Expected event
`info`	Information
`debug`	Debug

Note: All messages of the indicated priority and higher will be acted upon. The selection `lpr.err`, for example, selects all print system emergency, alert, critical or error messages.

The action field is usually the full path name of a disk file. Selected messages will be appended to that file. It can also be a list of users. Messages will be sent to all terminals owned by these users. Finally, the action can be a host name (preceded by an asterisk). Selected messages will be sent to the `syslog` daemon on that system.

You have to be the root user to edit syslog.conf and to signal the deamon.



It's usually more convenient to write messages to a file and watch that file using `tail -f` than it is to have the messages printed on your terminal–the latter can be annoying. You can configure multiple actions for each selection, or multiple selections for an event (see the `syslogd` man page for details).

If you want to send all your messages to a local file, then `/tmp/zzz` is a good choice. Let's choose the `local1` facility. The following command will work:

```
local1.debug /tmp/zzz
```

Remember, that's a tab separating the two fields.

Send a hang-up signal to the `syslog` daemon to reread the configuration and your ready to use `syslog`:

```
kill -HUP `cat /etc/syslog.pid`
```

Note that you have to be the root user to edit `syslog.conf` and to signal the daemon.

Using syslog in Your Program

Now you're ready to add `syslog` messages to your program. Begin by including the necessary definitions:

```
#include <syslog.h>
```

Then at the start of your main program, open the log. A typical call looks like this:

```
openlog(name, LOG_PID, LOG_LOCAL1);
```

where *name* is any name you choose–usually, it's the name of your program. The name will be attached to all logged messages. It allows you to distinguish your daemon's messages from the others.

The second field contains some options. `LOG_PID` tells `syslog` to include your process PID in each message. This is always useful information. The third field is the facility code, which tells `syslog` where to send your log messages. Choose one of the local ones: `LOG_LOCAL0`, `LOG_LOCAL1`, and so on.

Now your server program can write log messages. They look a lot like `printf` statements. For example,

```
syslog(priority,message,...);
```

where *priority* is the indication of how important you think the message is. *Priority* is one of the following, listed in order of decreasing alarm:

`LOG_EMERG`	Emergency
`LOG_ALERT`	Action needed
`LOG_CRIT`	Critical condition
`LOG_ERR`	Error
`LOG_WARNING`	Warning
`LOG_NOTICE`	Expected event
`LOG_INFO`	Information
`LOG_DEBUG`	Debug

Note the association with the `syslog` configuration priority codes.

Message resembles arguments to `printf`, for example,

```
syslog(LOG_INFO,"User %s connected", usr_name);
```

You can also use `%m` to include the text of the current error number (`usr/include/sys/errno.h`) in your message. For example, the statement

```
syslog(LOG_ERR,"Opening %s: %m", fname);
```

might send the following message to the log file:

```
Opening /tmp/xxx: No such file or directory
```

There are a couple of problems with the `syslog` approach. First, everyone shares the same pool of log facilities. On busy systems, several daemons may be logging to the same files. Second, if you try to log a lot of information at once, some data will be lost because `syslog` uses UDP datagrams to communicate between your program and the logging daemon. If there's no buffer space, the excess datagrams are dropped.

Logging to a File

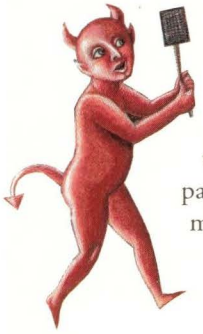
Your next choice for debugging that daemon is to manually write logging information to a file. The advantage here is that it's only your own daemons that use the file and all your messages are guaranteed to be written even if they're big. The disadvantage is that file writes can block. Blocking will make your program unresponsive. This shouldn't be a problem if the file is on a local disk.

Logging to a file is especially useful if you happen to have a Web server on the system. Simply include some HTML code in your output, put the file where the Web server can find it and you can debug your program from a Web browser!

Using dbx

If those print statements and `syslogs` still don't solve your problems, you can use `dbx` on that daemon. The trick is making your daemon wait for you.

`dbx` allows you to attach to a running process. Once attached, you can step through your program, just as if you had started it on your terminal.

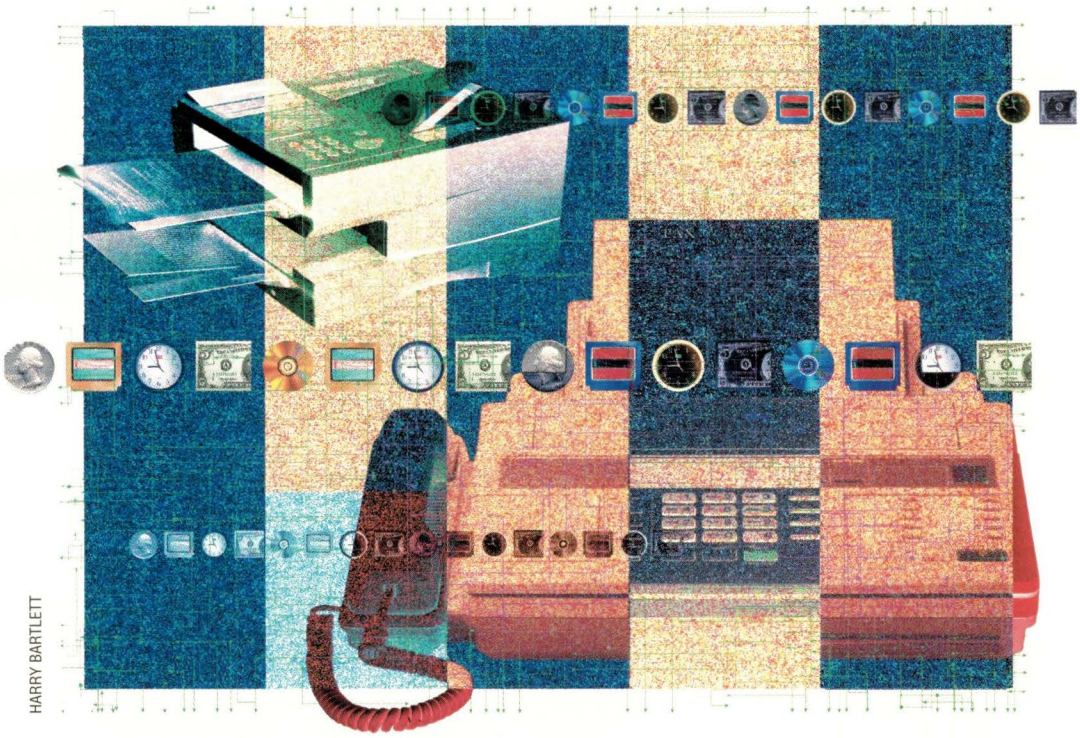


Have your server open the `syslog` with the `LOG_PID` parameter, write a short message and sleep for about 20 seconds. This gives you enough time to see the log entry, note the PID and run `dbx` using the `-a` *`pid`* option. Now you've taken control of that server program. Remember to detach before exiting `dbx` if you want the program to continue running.

You should become familiar with `syslog`. It is a very convenient and useful tool that will help you keep track of your background services. ⊸

Jim Fox *works as a systems programmer for the University of Washington. He writes and maintains distributed applications that run on a variety of UNIX systems –and some non-UNIX ones. He is also the deputy manager for the Interoperability Project for SHARE's Open Systems Group. Email:* `fox@cac.washington.edu`.

by John S. Quarterman



HARRY BARTLETT

Eliminating the Copier and Fax

"Fifteen cents! 15 cents!" gleefully said Alice, the building manager, standing next to the copying machine as I duplicated some documents. "So that's how you make your money!" I replied.

Now, I don't begrudge her the income. But 15 cents per sheet for copies does seem a bit steep, given the number of copies we tend to make here at Matrix Information & Directory Services (MIDS). I'm not even referring to copies of our periodicals, *Matrix News* and *Matrix Maps Quarterly,* which we have printed elsewhere. I'm just talking about general office copying. A page here, a dozen there; pretty soon you're into real money.

"We could buy a color scanner and I could install it!" said Grace, our systems administrator. "We could buy one for only a little more than $200!" said Kristi, in sales. "I could use one for the U.K. office!" said Fearghas, our chief technology officer. "I've been saying for a long time that it would save money!" added Gretchen, our treasurer.

"Oh, all right, buy it!" said John, the stingy president.

So apart from making everybody happy and stopping them from pestering me, what's a color scanner good for? Many things, it turns out.

We already have a fast printer. We had a scanner too, but it was slow and required lifting the lid every time we scanned a single sheet. The new scanner permits feeding sheets through it; you put one edge in, and the scanner handles the rest. This is much more convenient. Suddenly, we have a combination of scanner and printer that's as easy to use as a photocopier. Not only that, but the printer is much faster and has a higher resolution than the photocopier down the hall. So, the result is our copies are produced faster and look better. It's true our printer doesn't sort or group, but we can scan a set of pages and simply print them repeatedly.

We have people working in more than one state and country, and paper is not the ideal format for internal MIDS communications; yet we often get paper documents we need to examine. With a good scanner, we can just scan such a document and save it where any one of us can pick it up using `ssh`, FTP or WWW.

MIDS gets mentioned in the press a lot (see `http://www.mids.org/weather/iwrabout/news.html`) and so we like to have a press package ready to send to reporters, customers, venture capitalists, relatives and the like. We could photocopy a bunch of them and have them take up space in the office, or we could do what we're doing now, which is to scan them once, keep them in an online directory and print them as needed. This also permits us to put small versions up on the Web–being careful about copyright, of course.

If in the future we decide to print a larger set of press packets, it will be easy enough to take the online copies of the press articles, arrange them using a tool such as Adobe Systems Inc.'s PhotoShop

and send the result somewhere like Kinko's for printing via the Internet or onto a ZIP disk.

The scanner also helps eliminate the fax machine down the hall, for which Alice charges $2 per page (outgoing). We just scan a document and then use HylaFAX to send it. HylaFAX is a software package that spools outgoing faxes, sending them one by one through a fax modem, handling retries if necessary. We've had it installed for years. It saves a lot of staff time that would otherwise be wasted to the tune of about five minutes to send one fax. We use HylaFAX routinely to send items such as proposals or invoices.

HylaFAX also handles incoming faxes. This allows any one of us to see a faxed message from anywhere in the world, as long as we have Internet access to our home machines. It turns faxing into a modern means of communication (almost).

The one missing piece was a way to handle documents that originated on paper, such as signatures. With the scanner, we're now completely released from the tyranny of the old-fashioned fax machine.

Revamping the Office

Here are the main pieces of hardware and software you'll need to eliminate the fax machine and the photocopier:

• **A printer:** We bought a Lexmark International Inc. Optra 1620 (`http://www.lexmark.com`). This was the most expensive item, at around $1,600. You could make do with a less expensive printer, but for speed, resolution and the ability to handle multiple paper sizes, we think the one we bought was well worth the price. That last point is important if people send you letter-size faxes.

• **A scanner:** We chose the PaperPort Strobe from Visioneer, which is a color scanner available with interfaces and software for the Macintosh and PC (`http://www.visioneer.com`). It includes PaperPort Desktop software that can save scans in various formats, including TIFF, multipage TIFF, PostScript and GIF. It costs about $250.

There is scanner software for Windows, but we chose a scanner with software for the Mac because we're using a PowerMac 6100 running Mac OS 8.1. We already had this machine, so we used it; if you have a Windows machine you'd prefer to use, that will work, too.

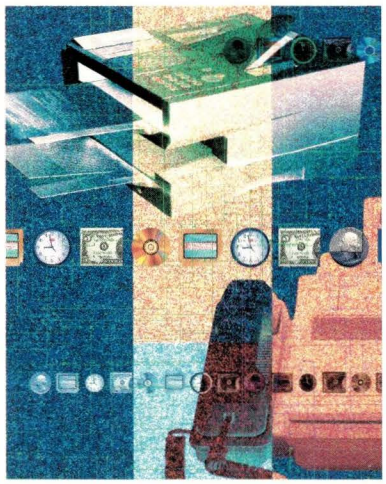
• **A computer running UNIX:** Presumably you have one or more UNIX machines or you wouldn't be reading this column. It doesn't matter which flavor of UNIX you're using. We're using Solaris on Sun Microsystems Inc. SPARC machines.

• **HylaFAX software:** HylaFAX software is available from `http://www.vix.com/hylaFAX/`. It was written by Sam Leffler (yes, *the* Sam Leffler who ran the Berkeley UNIX group for several years). It's pretty easy to compile (except possibly for the modem parts) and there are quite a few support pages available. The software includes tkhylaFAX, which is a front end to HylaFAX.

HylaFAX comes with conversion programs for converting native fax format, TIFF, to various other formats, particularly PostScript. From PostScript, you can get to GIF, JPEG or others using ImageMagick, `xv` or various other conversion packages. You can even use PhotoShop for such conversions. We use the other programs for most conversions because they can be called automatically.

In addition, there is a beta Mac client, MacFlex, which is available from `http://www.eats.com/MacFlex/` or `ftp://ftp.eats.com/pub/MacFlex-15b1.sea.hqx`. This is very convenient because it permits us to fax directly from the PowerMac that has the scanner attached, using the same outgoing fax queue and modems that we use when we send faxes from the UNIX systems. We've had no problems with it. Both HylaFAX and MacFlex are free.

• **PostScript previewer, ghostview:** Once you've scanned a document or received it via HylaFAX–as mentioned HylaFAX can convert it into PostScript–you can readily print it, using the UNIX `lp` or `lpr` commands, or you can preview it online, saving some trees. A good, free PostScript previewer is `ghostview`, which is available from `ftp://prep.ai.mit.edu/pub/gnu/`. There are Windows and Mac versions (and a VMS version, for that matter) available via the Ghostscript home page, `http://www.cs.wisc.edu/~ghost/`. Sun's `pageview` PostScript previewer also works for text–although it isn't very good for anything with a lot of colors.



Also, you'll need something to move files between Macintosh and other machines. The easiest tool to use is Fetch, which is an FTP client for the Macintosh. It's shareware and is available at any Mac archive.

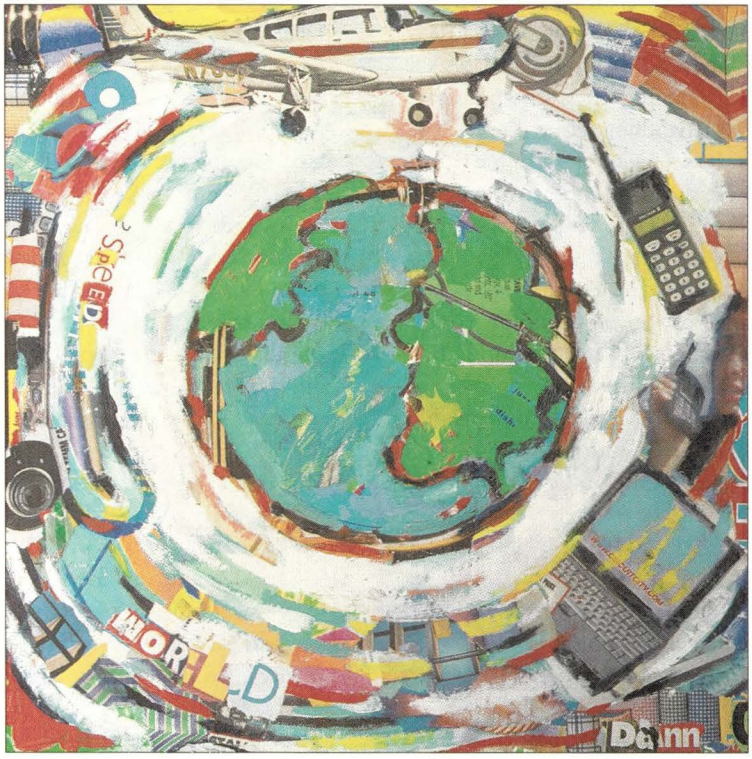
• **UNIX instructor:** If you have people who are used to using Windows or Macintosh, then you will need to show them a few things about UNIX, such as how to transfer files with FTP, how to use `sendfax` (the HylaFAX send command) and how to use the `lpr` command. The learning curve for this is neither steep nor long.

In Summary

And there you have it, for less than $2,000 (much less if you buy a less expensive printer or you already have one lying around the office), you can not only replace the fax machine and the photocopier, but you can also open up what those devices previously did and gain access to the images they would otherwise have been hoarding. Now that you have those images online, you can use them in remote offices over the Internet, put parts of them on the Web or save them for easy reprinting. No doubt there are many other uses you can think of. ⊸

John S. Quarterman *is president of Matrix Information & Directory Services Inc. (MIDS), which publishes* Matrix Maps Quarterly, Matrix News *(monthly) and the* MIDS Internet Weather Report *(daily). John has written or co-authored seven books, but the best known one is still* The Matrix. *For more information, see* `http://www.mids.org`. *He can be reached by email at* `jsq@mids.org`, *by voice at (512) 451-7602 or by fax at (512) 452-0127.*

by Jim DeRoest



DANIEL C. O'CONNOR

Ubiquitous Mobile Computing

It wasn't that long ago when most of us only had access to one mainframe computer with which to do all our data and number crunching. This was largely because these computers were big, expensive and generally not something you'd find in someone's living room next to the sofa.

Then networks came along. Computers shrank in size and, before you knew it, you had computers, files and accounts all over the place. Today, it's very likely there's a computer next to your sofa and one in your pocket too.

The ubiquitous availability of computing and network resources is rapidly changing our expectations as to how the global Internet should operate. Phrases used by the popular media such as "cyberspace," "netizen" and "the network is the computer" carry with them the assumption that there's some uniformity in access to resources and that individuals are uniquely identified. I don't know about you, but my network navigation experiences haven't been smooth or uniform.

Breakneck advances in technology, and high market demand for services, have resulted in a somewhat hasty cut-and-paste infrastructure. The blurring of boundaries between applications, machines and networks is making it difficult to pin down where particular resources reside.

This is especially true of credential and preference information that identifies your persona to the network. You know the resource, but does it know you? The difficulty is although hardware connectivity is usually available, the software required to ensure seamless mobility and interoperability between network services is still playing catch-up.

Most network applications still make the assumption that you always access network resources from a single workstation. This is no longer true. One moment you're using your office desktop. Next, you're jacked in from a laptop DHCP port in the conference room. It's lunchtime and you're doing a quick email check from the cyber café down the block. At home, you're burning the midnight oil working from your PC, which is dialed into the network via an Internet service provider. It's the weekend and time to relax by attending the Super Bowl. Alas, there's a seat-side computer there too. You can't get away from them.

Platform Synchronization

The challenge for the mobile computer user is maintaining consistent views of email folders, address books, digital certificates and other application configuration and profile information across a plethora of platforms. These platforms include everything from pagers and hybrid cell phones to notebooks, palmtops, laptops and workstations. This task is often complicated by variations in the operating system architecture and application profiles that exist on each system used. Palmtops and personal digital assistants (PDAs) often run stream-lined operating systems tailored to the small set of applications they provide.

Differentiation in the supported set of protocols and data formats can complicate synchronizing application state. In the case of email, one platform might use the IMAP protocol to access the mail server and use Tenex format to store mail folders on the server. Another device might use POP to communicate with the server and store folders in Berkeley format.

One might think the interoperable nature of Web applications would make them immune to this type of environment fragmentation. Unfortunately, the Web comes with its own set of consistency issues. The most noticeable to the end user is how to keep a common copy of browser bookmarks across multiple computers. Another is how one carries along personal certificates and cookies as they move between machines.

A variation on the problem of maintaining individual state between many computers is how to manage state on a single computer used by many people. Consider the public computers located in airports, libraries, university labs and cyber cafés. How much of the environment must be wiped clean and reloaded with each subsequent use to ensure the previous user's privacy and security is not compromised? There may also be reason to limit the extent of personalization while the device is being used.

Connectivity

Ubiquitous mobile computing assumes you should be able to connect from almost anywhere. This presumption is not far from becoming reality as advances in transport technologies push the outer edge of the network closer to the end user. The most promising of these technologies either capitalize on existing wiring infrastructure or are based on wireless technologies.

For wired connections in the United States, the quest for higher bandwidth is seeing traditional dial-up access replaced by higher speed Asymmetric Digital Subscriber Line (ADSL) and cable modem systems. ADSL uses existing phone lines but provides throughput orders of magnitude higher. Cable modems offer similar increases in bandwidth by using broadband coaxial television connections already in place in most homes.

Another possibility being explored is to use the electrical power grid as a network conduit. This service requires the use of special bypass devices to skirt substation transformers, which would otherwise block data transmission. This service may become cost-competitive in Europe, where hundreds of homes are served by a single substation as compared with the average six to eight homes served per substation in the United States.

Wireless transmission technology is the key to true global mobile access. Depending on area, coverage and bandwidth requirements, remote access can be provided by everything from short-haul infrared to wider access pack radio, digital cellular and satellite personal communication services (PCSs). Cellular and PCS have garnered the most public attention due to the widespread use of wireless phones. Cellular networks evolved from "first-generation" analog systems like the Advanced Mobile Phone Services (AMPS) developed by Bell Labs in the 1960s, to second-generation digital cellular services such as the Global System for Mobile Communications (GSM) widely used in Europe, the Personal Digital Cellular (PDC) service used in Japan and the North American Digital Cellular (NADC) service. Unfortunately, these second-generation services are based on incompatible spectrum and modulation standards. However, the International Telecommunications Union (ITU) is attempting to converge second-generation implementations into a global third-generation digital service called the Universal Mobile Telecommunications System (UMTS) under its International Mobile Telecommunications 2000 (IMT-2000) Project (see Table 1).

How Far Can You Wander?

Given the prevalent availability of computing devices and network access, just how global is cyberspace? The last count I saw for countries with Internet access was around 170, or 94%. It shouldn't be surprising that access and availability vary from country to country according to land mass, population,

Table 1. Mobile Computing Information

Steve Kroplas' adapter information	Citrix Systems Inc.'s WinFrame
http://www.kropla.com	*http://www.citrix.com/*
IETF Mobile IP	Insignia Solutions Inc.'s Ntrigue
http://www.ietf.org/html.charters/mobileip-charter.html	*http://www.insignia.com*
IMT-2000 Project	Microsoft Corp.'s Terminal Server (Hydra)
http://www.itu.int/imt	*http://www.microsoft.com/ntserver/info/hydra.htm*
Mobile IP RFC 2002	Olivetti & Oracle Research Lab's VNC
http://www.isi.edu/rfc-editor/rfc.html	*http://www.orl.co.uk/vnc/*
Avalan Technology Inc.'s Remotely Possible	Symantec Corp.'s pcANYWHERE
http://www.avalan.com/rp/rpindex.html	*http://www.symantec.com/pcanywhere/*

economic wealth and politics.

A lack of general standardization between countries requires that international "netizens" carry an extensive arsenal of adapters for power and telephone connections. Check out Steve Kroplas' Web page for a list of the various interfaces used in each country (see Table 1). Other helpful mobile computing amenities include laptop power adapters that accommodate multiple voltage rates and a cache of rechargeable batteries. Nickel Metal Halide (NiMH) or Lithion Ion (LiON) batteries are preferable over Nickel Cadmium (NiCad) because the former aren't as susceptible to memory effects caused by recharging batteries that haven't been fully discharged. Those who spend a good deal of time traveling by air can take heart in that most of the major U.S. airlines are experimenting with in-flight power systems for portable computers.

Along with choosing the correct telephone adapter, it's a good idea to verify whether the phone system is analog or digital. Digital Private Branch Exchange (PBX) systems, for example, can be detrimental to your analog modem. Another challenge is accommodating various dial tones and international telephone access codes. Believe me, given the current rates for international calls, you don't want to spend a lot of time experimenting with the phone system.

Mobile IP

Many of the network services we use depend on a static IP address, subnet or domain name in order to determine our location on the network. A number of TCP/IP protocol extensions are being drafted in order to support roaming systems. Examples include Mobile IP RFC 2002 (see Table 1), Mobile Network Computing Protocol (MNCP) and Mobile Network Reference Specification. A common theme among most of these proposals is the use of indirect connections via some type of roaming support gateway. The mobile system contacts this gateway box when it connects to the network, informing the gateway of its current IP address through extensions to the TCP protocol. The gateway has a static IP address and acts as an indirect link to the dynamic IP used by the mobile unit for network services. Some proposed solutions include an assigned gateway that can cache IP packets when the connection to the mobile unit is interrupted due to a faulty or slow link. This eliminates retransmission of packets, saving on overall network bandwidth.

There are a number of products and development efforts that are attempting to solve the mobile user environment synchronization problem for Microsoft Corp. Windows platforms by storing the client profile on a server. The idea is akin to some of the features exhibited by the Massachusetts Institute of Technology's X Window System and X terminals. The mobile Microsoft Windows computer is only responsible for displaying screen output generated by applications running on a central server. The server maintains all application and configuration information. Olivetti & Oracle Research Lab has built a publicly available implementation of this called Virtual Network Computing, or VNC (see Table 1). VNC is interesting in that it's not as operating system intrusive as some vendor products. VNC also has a portable client implemented in Java. Other popular vendor offerings include Microsoft's Terminal Server (Hydra), Avalan Technology Inc.'s Remotely Possible, Citrix Systems Inc.'s WinFrame, Insignia Solutions Inc.'s Ntrigue and Symantec Corp.'s pcANYWHERE (see Table 1).

Simplify

So what do we do while waiting for the vendors and standards groups to smooth the path to seamless ubiquitous mobile computing?

Begin now by simplifying your computing environment. Try to collocate address books, email folders, preference and configuration information on a central server. Use applications that support protocols designed to centralize data repositories. In some cases, you will have to carefully duplicate your environment onto each machine you use regularly. This means doing things like copying personal certificates and bookmark files. Start reducing the proliferation of accounts and credentials. Use disconnected modes of operation when they are supported. In most cases, this option will resynchronize files to the central server when you reconnect. It's not going to get any easier, so simplify now. Computers and networks, they're here, they're there, they're everywhere, so beware. ⊸

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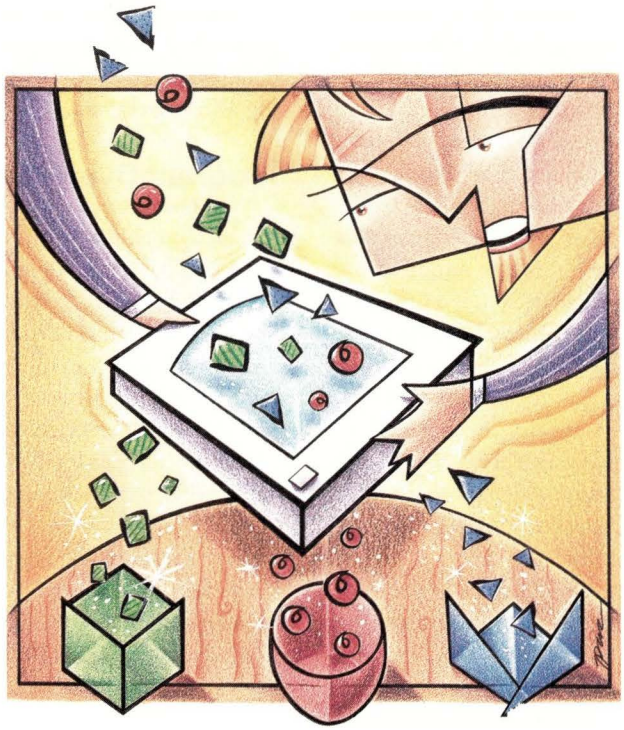
by Jeffreys Copeland and Haemer



PAUL STODDARD

Cathedrals, Bazaars, and News Readers

Since the birth of the notion, late last year, of converting *SunExpert* exclusively to columns about bazaars and cathedrals, the editors, inspired by Eric Raymond's paper on Linux development entitled "The Cathedral and the Bazaar" (see `http://www.linuxresources.com/Eric/cathedral.html`), have taken the route of releasing "early and often." The initial release, Rich Morin's "Of Cathedrals and Bazaars," January 1998, Page 32, was succeeded by Mike O'Brien's longer version, "The Cathedral, the Bazaar and Mr. Protocol," April 1998, Page 24.

Peter Collinson had been assigned responsibility for the next release, but became lost while doing research at Canterbury cathedral, which is down the street from his house.

The editors then came to us, explaining that they'd decided to reassign the task of producing an interim release to us, owing to our familiarity with the bazaar. "Homonyms," we tried to explain, "are tricky things." "Jeffs," they said, "it's either that or wander around the Canterbury catacombs looking for Peter." As squeamish as we are underground, we immediately set pen to paper.

Because Peter obviously prefers to deal with real cathedrals than metaphorical ones–and by the time you read this Mike's and Rich's columns will be as far in the past as Boulder's winter snow–let's recap.

Eric's paper is an exploration of two different team approaches to software development. In the first, more traditional method, a single architect or a small group brings a software concept to fruition (that's "small" in the special sense that requires a team of two to implement UNIX, and a team of thousands to implement Windows NT). The group madly tests the software and doesn't release it until it is reasonably certain the program is relatively bug-free ("relatively bug-free" in that same special sense). The first external customers are usually beta testers who are sworn to secrecy ("secrecy" in the special sense that allows end users to be beta testers for some manufacturers' operating systems). The development cycle parallels that of a 15th-century cathedral.

By contrast, if software is built by a loosely coupled group of developers, each of whom is also a user and tester, in close contact via the Internet, the development cycle more closely resembles a noisy bazaar. In the bazaar model, software is released early and often. Feedback is constant. The software is often better debugged because the many hands have made light work of finding, characterizing and fixing the bugs.

Which brings us to *our* current problem. About two months ago, a friend suggested that we might want to read a bunch of Usenet articles on science fiction writer Arthur C. Clarke. We didn't have time to read them then, so we grabbed all the articles into files for reading at our leisure. Unfortunately, once it was too late, we remembered that outside of a threaded reader like `trn` or `tin`, we've lost all notion of the order in which the articles need to be

read. What does this have to do with Eric's cathedral and bazaar notion? Plenty.

First, we're writing this column with Donald Knuth and Silvio Levy's literate programming tool CWEB, which combines explanatory text formatted in TeX with code in C. We can write our code independently of the order in which it needs to be presented to the compiler. CWEB came out of Knuth's work on TeX, which in turn resulted from his work on the multivolume *Art of Computer Programming* series published by Addison-Wesley (see http://www-cs-staff.stanford.edu/~knuth/). *Art of Computer Programming*, with its long development cycle and unifying notions provided by a single person, is a prime example of the cathedral development methodology. TeX itself has a number of crossover features: while it's still the brainchild of one developer, it has an army of debuggers and developers of support software. Much of that support software follows the bazaar model of development.

The task, says Knuth, is not to describe to the computer what to do, but to explain to another human being what we want the computer to do.

So listen up. This article isn't just about a program. It *is* the program. Feed the source of this article to ctangle, which extracts the code from the CWEB source, present the resulting C source to gcc and you get executable code. (The task, says Knuth, is not to describe to the computer what to do, but to explain to another human being what we want the computer to do.) Because of the process of typesetting for printing in the magazine, we lose some features like cross-references and module numbering; you can get these back by running the source through cweave and tex.

Those in the dark about CWEB shouldn't feel too much at sea, this is more or less the same approach we've used in explaining code in our columns to date–a little explanation, followed by a little code, followed by a little more explanation–but with a little more structure. If you need more background information, see our Work columns on literate programming ("An Introduction to Literate Programming," *RS/Magazine*, January 1995, Page 26, and "Literate Programming: Parts I and II," *RS/Magazine*, February and March 1995, Pages 32 and 31, respectively), Knuth and Levy's *The CWEB System of Structured Documentation* (Addison-Wesley, 1994, ISBN 0-201-57569-8), Knuth's *Literate Programming* (Cambridge University Press, 1992, ISBN 0-937073-80-6), or just pick up the CWEB software from our Web site at http://alumni.caltech.edu/~copeland/work.html.

We're going to be looking at data from one of the great examples of the bazaar model in the universe, namely Usenet news. As we develop code, we're going to be following one of the principles Eric cites in his paper: "Good programmers know what to write. Great ones know what to rewrite and reuse."

To the extent we can, we'll try to steal ideas, if not code, from the news readers. So the code you'll read below owes some ideas to trn's thread manager, a program called mthreads. Why don't we just use mthreads directly? Because it assumes a fair amount of the news database cruft is set up–remember we want to run this locally, not on our news server. It is also optimized to build onto an existing database of threads. We just want the simple case of threading a (relatively) small list of articles.

Program Overview

Our goal is to take a list of news articles and emit the list in threaded order, that is, the order in which they relate to one another. That order is almost certainly not the same as the strict order in which they were written, nor is it likely to be the order in which they arrived at our news server. We rely on two little bits of information in the header of the news article to achieve our goal: the Message-id and References headers. The first gives a unique identifier for this article and the second lists every article that preceded it. We'll also save the article subject line and date for backup information.

Our main program is very simple. We read the list of articles from stdin, open them and then relegate processing of the articles to a subroutine. When we're done, we walk the resulting article tree in another subroutine and deliver the tree to stdout. Because we're operating as a strict filter, we don't need any command-line arguments:

```
<main program>=
main( )
{
   char buf[BUFSIZ];
   FILE *artf;

   while( fgets(buf,BUFSIZ,stdin) != NULL )
   {
     chomp(buf);
     artf = fopen(buf,"r");
     if( artf == NULL)
     {
       perror(buf);
       continue;
     }
     process_art(artf,buf);
     fclose(artf);
   }
   display_tree();
}
```

We also need some data structures here. The most important is going to be the structure for holding the article data. We need to assemble these structures into a tree so each one will potentially link to both a sibling (at the same level in the tree) and a child. Notice that we keep track of a list of references and point to both the first and last in that list:

```
<data structures>=
typedef struct _article {
  struct _article *sibling;
```

```
  struct _article *child;
  char *message_file;
  char *message_id;
  char *subject;
  struct _reference *refs;
  struct _reference *end_refs;
  time_t date;
} ART;
```

Instead of storing the references as a single string, we will store them as a linked list, which will make scanning the list of references a bit easier at the cost of complicating the storing of data into that structure:

```
<data structures>=
typedef struct _reference {
  struct _reference *next, *prev;
  char *reftext;
} REF;
```

A quick word about `Message-id`s: `Message-id` strings in news articles are made unique by containing a domain part and an article part, `<31415926@gateway.opennt.com>`, for example. A lot of handwaving happens in `mthreads` to separate the article and domain parts of the `Message-id` in order to save space in memory. On a PDP-11, this was necessary, but now we're typically running machines that have more main memory than our first PDP-11 had disk, so we won't bother. (Or as the Jeffreys keep debating among themselves, when is it OK to be profligate with memory rather than CPU cycles?). We're going to assume that `References` lines grow to the right, which may result in some misplacements.

Reading the Files

Each time we open an article file, we need to read the headers and then place the article data into the tree of articles in some reasonable fashion. Like the main program, the structure of this routine is pretty simple, but the problem is in the underlying details. The `place_article()` routine is sufficiently complicated that we'll be putting it off a while.

```
<service routines>=
process_art( FILE *art_fp, char *art_name )
{
  <process_art local variables>
  <allocate and initialize an article>
  <parse the article headers>
#ifdef DEBUG
  show_headers(art);
#endif
  place_article(art);
}
```

Local variables are an interesting problem. We know before the fact that we're going to need an `article` structure and a buffer to read lines into. We'll also need some pointers into the buffer. We'll add to this list later. One of the joys of literate programming, like writing in C++, is that we can declare variables as we need them:

```
<process_art local variables>=
char buf[BUFSIZ];
ART *art;
char *s, *t;
```

Allocating the `article` is very simple. We also initialize the `message_file` entry:

```
<allocate and initialize an article>=
 art = (ART *) malloc(sizeof(ART));
 art->message_file = strdup(art_name);
 art->sibling = art->child = NULL;
 art->message_id = NULL;
 art->refs = art->end_refs = NULL;
```

Now we parse the article headers. We read from the `article` file up to a blank line–the end of the header lines. We're only interested in a few of the headers, though. We'll postulate a useful routine, `headerEQ`, which checks a case-invariant header tag. If it matches, the routine returns a pointer to the text following the header; otherwise, it returns `NULL`. On matches, it also strips the trailing new line. In the case of the date header, we'll use a variation `getdate()` parser, which Steve Bellowin wrote while he was at the University of North Carolina, and which is supplied with the `trn` code to convert the date string into a `time_t`. The `References` lines are a special case: We need to get all the continuation lines for them, so we invoke a different paragraph of code to do so. It is important that we check `References` first for reasons we explain in the next module.

```
<parse the article headers>=
while ( fgets(buf,BUFSIZ,art_fp) != NULL )
{
  if( *buf == '\n' )
      break;
  if( (s = headerEQ("references",buf)) )
    <get all references lines>
  if( (s = headerEQ("message-id",buf)) )
    art->message_id = strdup(s);
  else if( (s = headerEQ("subject",buf)) )
    art->subject = strdup(s);
  else if( (s = headerEQ("date",buf)) )
    art->date = getdate(s);
}
```

We want to collect all the continuation lines for `References` headers, so that we can have *all* the references. Continuation lines begin with a space or tab. Notice we fall out of this routine when we find a noncontinuation line, passing that line unprocessed to the main header parser in the previous module:

```
<get all references lines>=
{
```

```
  extract_refs(art, s);
  while( fgets(buf,BUFSIZ,art_fp) != NULL )
  {
    chomp(buf);
    if( *buf != ' '  &&  *buf != '\t' )
        break;
    extract_refs(art, buf);
  }
}
```

We need to talk about the routine that extracts references from the `References` line. We're given the article pointer, so we can update the first and last references. We scan for each reference on the line delimited by open and close angle brackets and add it to the linked list of `REF`s in the article:

```
<service routines>=
void
extract_refs(ART *art, char *line)
{
  REF *this;
  REF *last;
  char *s, *t;
  char save;
  s = line + strspn(line," \t");
  while( s && *s )
  {
    if( (s = strchr(s,'<')) == NULL )
        return;
    if( (t = strchr(s,'>')) == NULL )
        return;
    this = malloc(sizeof(REF));
    save = *(++t);
    *t = 0;
    this->reftext = strdup(s);
    this->next = NULL;
    this->prev = art->end_refs;
    if( this->prev )
        this->prev->next = this;
    if( art->refs == NULL )
        art->refs = this;
    art->end_refs = this;
    *t = save;
    s = t;
  }
}
```

Utility Routines

We've used a number of utility routines that we haven't defined yet. We'll start with the easy Perl analog, `chomp()`, which removes the trailing new line from a string:

```
<service routines>=
char *
chomp(char *buf)
{
  char *s;
  s = strpbrk(buf,"\r\n");
  if( s )
    *s = 0;
  return buf;
}
```

We need to define the `headerEQ()` routine, too. We do a case-insensitive comparison of the given string against the supplied buffer and return a pointer the first character of the header line's text. As a side effect, we remove the trailing new line on matching lines.

```
<service routines>=
char *
headerEQ(char *hdr, char *buf)
{
  char *s;
  if( strncasecmp(hdr,buf,strlen(hdr)) != 0)
    return NULL;
  chomp(buf);
  if( (s = strchr(buf,':')) == NULL )
    s = strchr(buf,' ');
  while( isspace(*(++s)) )  continue;
  return s;
}
```

A debugging routine:

```
<service routines>=
void
show_headers(ART *art)
{
  REF *t;
  printf("===== ");
  printf("%s: date %ld; subj %.25s\n id %s\n",
    art->message_file, art->date,
    art->subject, art->message_id);
  printf(" refs from 0x%x to 0x%x\n",
    art->refs, art->end_refs);
  for( t = art->refs;  t;  t = t->next )
    printf("  %s @ 0x%x\n", t->reftext, t);
}
```

We finish up the utilities by completing our collection of function prototypes:

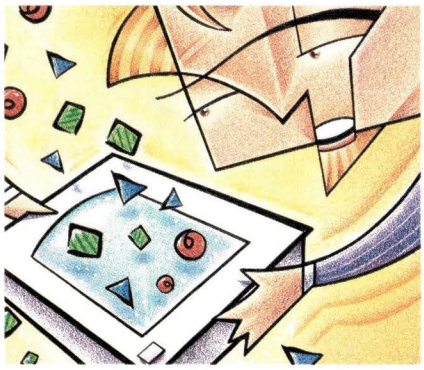
```
<function prototypes>=
char *headerEQ(char *, char *);
char *chomp(char *);
void extract_refs(ART *, char *);
void show_headers(ART *);
```

Wrapping Up

We've almost run out of space for this month, but there's one thing we need to finish. We need to outline the complete program by collecting all the source code together and wrapping it with `include` files:

```
#define _ALL_SOURCE
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
<data structures>
<function prototypes>
<main program>
<service routines>
```

We've left the playing field with a big blank space in the middle, much like that old *American Scientist* cartoon where there's a flock of equations on the left side of the blackboard, a flock of equations on the right side, and, in the



middle, the legend "and then a miracle occurs." (The caption reads, "I think you're a little vague in step two here.")

In our case, the missing miracle comes in the form of the `place_article()` routine, which drops the parsed article into the tree, and the `display_tree()` routine, which prints the final result.

We'll cover those and other stories from the bazaar next month.

Until then, happy trails.

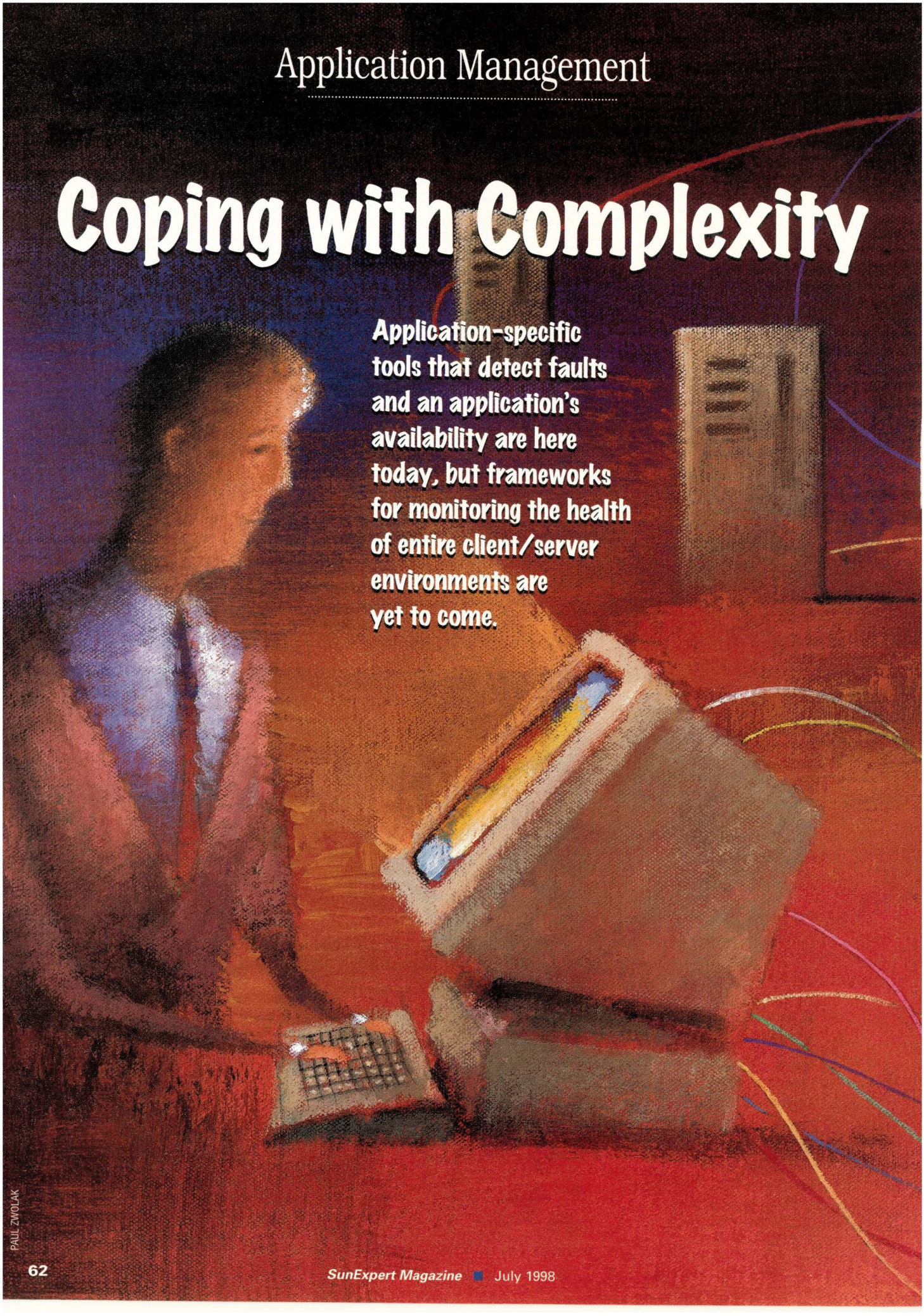
Jeffrey Copeland *(copeland@alumni.caltech.edu) lives in Boulder, CO, and works at Softway Systems Inc. on UNIX internationalization. He spends his spare time rearing children, raising cats and being a thorn in the side of his local school board.*

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

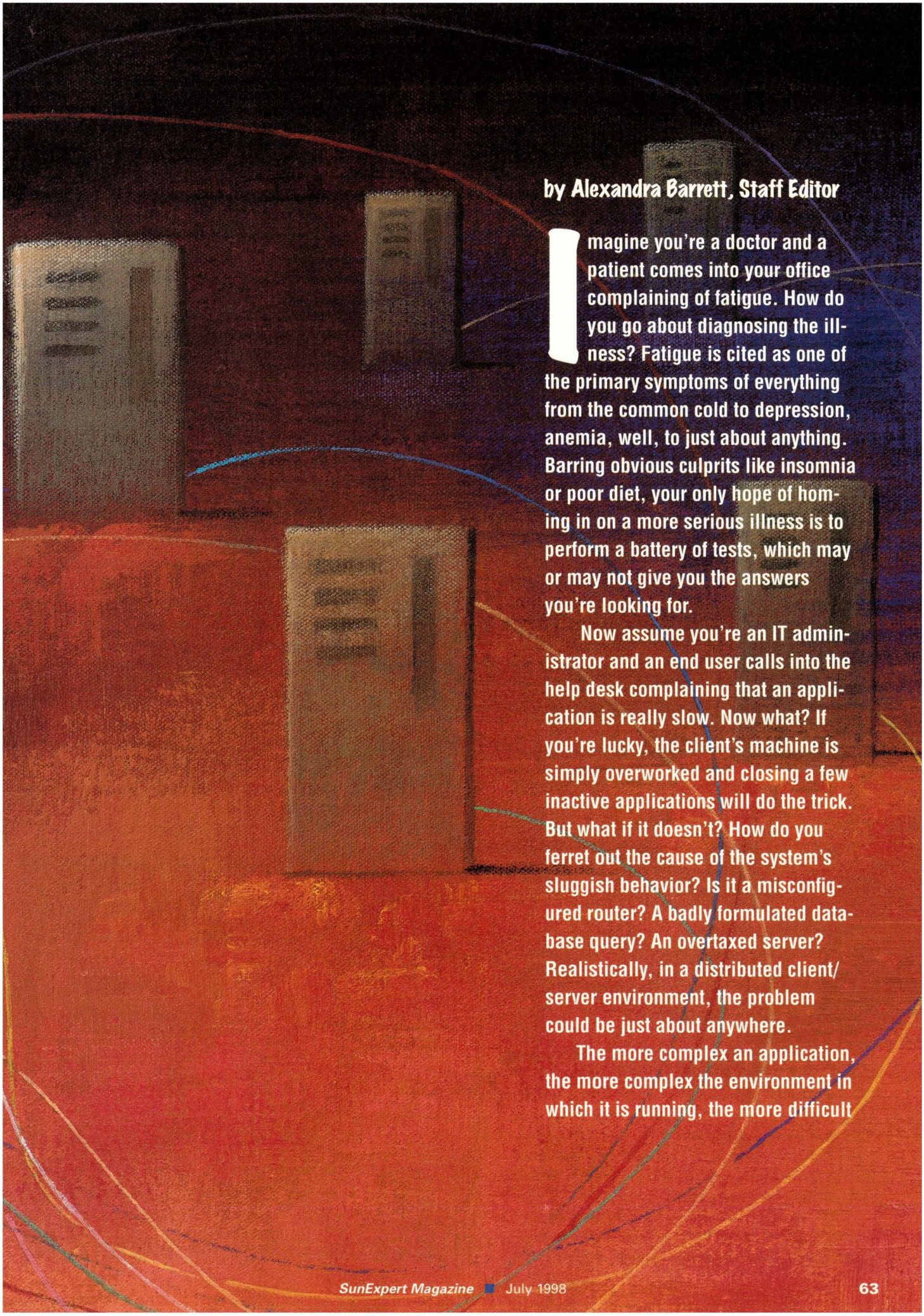
Note: The software from this and past Work columns is available at `http://alumni.caltech.edu/~copeland/work.html`.

Coping with Complexity

Application-specific tools that detect faults and an application's availability are here today, but frameworks for monitoring the health of entire client/server environments are yet to come.



PAUL ZWOLAK

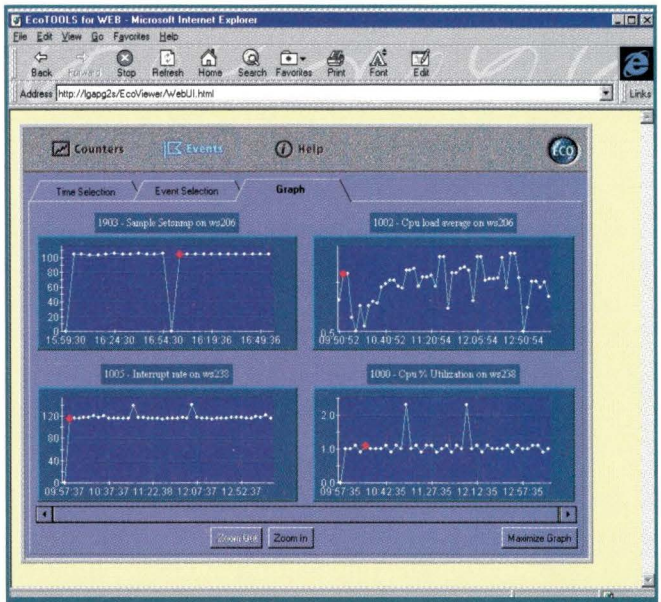


by Alexandra Barrett, Staff Editor

Imagine you're a doctor and a patient comes into your office complaining of fatigue. How do you go about diagnosing the illness? Fatigue is cited as one of the primary symptoms of everything from the common cold to depression, anemia, well, to just about anything. Barring obvious culprits like insomnia or poor diet, your only hope of homing in on a more serious illness is to perform a battery of tests, which may or may not give you the answers you're looking for.

Now assume you're an IT administrator and an end user calls into the help desk complaining that an application is really slow. Now what? If you're lucky, the client's machine is simply overworked and closing a few inactive applications will do the trick. But what if it doesn't? How do you ferret out the cause of the system's sluggish behavior? Is it a misconfigured router? A badly formulated database query? An overtaxed server? Realistically, in a distributed client/server environment, the problem could be just about anywhere.

The more complex an application, the more complex the environment in which it is running, the more difficult



EcoTOOLS, part of Compuware's EcoSYSTEMS suite of networked application management tools, provides effective real-time application component management.

it is to determine the root cause of a performance problem. And by extension, the less likely the problem will be solved in a timely manner. These are some of the more unfortunate axioms of managing large-scale networked applications in distributed client/server environments.

But as businesses come to rely more and more on the applications they deploy, IT can no longer offer up the complexity of client/server computing as an excuse for an underperforming system. "End users don't care what the problem is," says Ron Gleason, director of product planning at Compuware Corp., Farmington Hills, MI, maker of the EcoSYSTEMS application management suite. "They just want IT to know there's a problem and to fix it."

The challenge facing IT is therefore to find tools that help not only manage an application, but help them understand how the application is performing in the eyes of the end users.

IT has had the ability to manage and detect application faults for a long time now, with the help of application-specific tools that report on an application's availability. For example, managers responsible for SAP R/3–one of the leading enterprise resource planning (ERP) applications from the German firm SAP AG–can use Computing Center Management System (CCMS) to monitor a single instance of SAP R/3 running on a server. With it, SAP administrators, so-called Basis managers, can keep tabs on key metrics such as job execution times, database free space and user activity, to name a few. If CCMS detects a problem–for example, a job is aborted or a print spool delay surpasses some predetermined threshold–it alerts the Basis manager via email or pager.

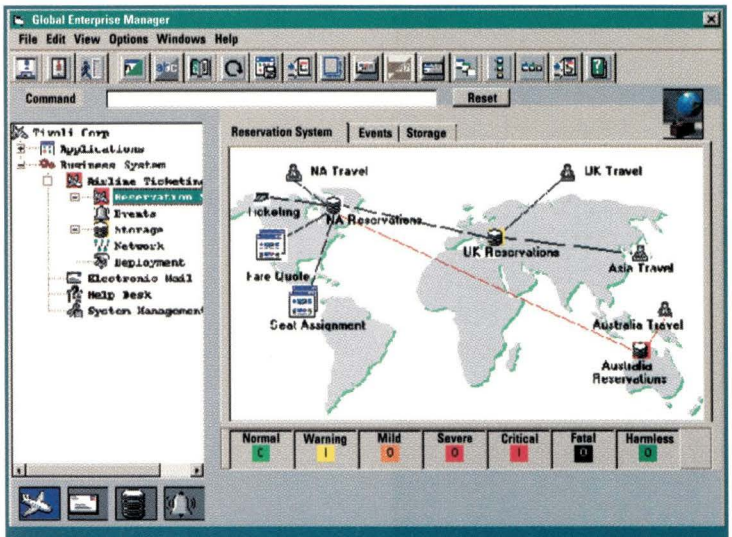
Where CCMS fails its users is in being unable to manage different instances of SAP R/3 running on different servers. Today, most mission-critical applications, and practically all SAP R/3 implementations, span several servers. In fact, a typical SAP installation usually includes 20 to 25 geographically distributed groups of servers (SIDs, in SAP parlance, for SAP IDs), says Jeffrey Peterson, senior product manager at Boole & Babbage Inc., San Jose, CA, maker of the events and alarms management product COMMAND/Post. In turn, each SID can be made up of about five to seven individual servers. In other words, an SAP installation can easily comprise anywhere between 100 an 175 servers and, in some cases, more.

Centralizing Application Management

SAP has indicated that it will address CCMS's shortcomings in SAP R/3 Version 4.0, due for release in the second half of 1998. But in the meantime, some customers are taking matters into their own hands, choosing to integrate their application management tools into a centralized network and systems management framework, such as, Unicenter TNG from Computer Associates International Inc., Islandia, NY, the Tivoli Management Environment (TME) from Tivoli Systems Inc., Austin, TX, or Palo Alto, CA-based Hewlett Packard Co.'s OpenView.

The primary incentive behind managing applications with the aid of a framework is one of simple logistics: We've already established that a typical SAP installation can easily comprise hundreds of servers. Experts recommend that each and every SAP instance be monitored at all times. "If you don't have a physical human being sitting in front of each one of those servers 24 hours a day, it can really affect your bottom line," says Peterson. Now assuming you take the experts' advice, your department is going to be very hard pressed to find–not to mention pay for–the hordes of SAP professionals required to continuously staff all those CCMS consoles.

So if for no other reason, centralizing application management endeavors can help cut down on the number of IT staff needed to monitor applications, freeing them up to do more



Tivoli's Global Enterprise Manager (GEM) is a unified software solution for managing large, cross-platform business applications that is said to improve availability and performance.

productive tasks. Relegating the task of monitoring key business systems to a computer can also help put your mind at ease. The nice thing about replacing human administrators with server-based agents, says Ken Vanderweel, senior product manager for Boole & Babbage's client/server products division, is that agents never get bored, never slack off; they are "ever-vigilant virtual administrators."

Frameworks as we know them today tend to focus on delivering network and systems management capabilities. "In a way, frameworks can be thought of as an extension of the operating system," says Compuware's Gleason. Services that a framework might offer include job scheduling, backup and recovery, event management and software distribution.

Application management is a relative newcomer to the list of services offered by a management framework. That said, vendors in this space have been quick to recognize its potential and are usually all too happy to sell you application-specific modules designed to plug into their wares.

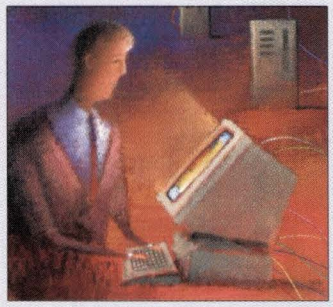
The specific application modules available will largely depend on the framework your organization has chosen to adopt. In general, though, vendors in the application management space have offerings covering four major application types: ERP products from companies such as Baan Co., Oracle Corp. PeopleSoft Inc. and the above-mentioned SAP AG; databases; groupware applications such as Lotus Development Corp.'s Notes; and middleware, such as IBM Corp.'s MQSeries and BEA Systems Inc.'s Tuxedo. In addition, modules for managing Internet services such as Netscape Communication Corp.'s SuiteSpot are cropping up.

But assuming that a framework will be able to take care of all your application management needs can be a mistake. For starters, if you're waiting on the implementation of a framework to perform application management, you might be stuck waiting a long time.

The fact of the matter is the folks responsible for managing applications are not usually involved in implementing

Instrumenting the Applications with Standards

Competing in the application management market isn't easy. There are hundreds of applications for which users would like management support, but for which vendors cannot provide. At the heart of the problem is the fact that, from a management standpoint, independent software vendors (ISVs) don't have an easy way to make their applications compatible with third-party management tools. Any applications a vendor does support have been added painstakingly, on a case-by-case basis.



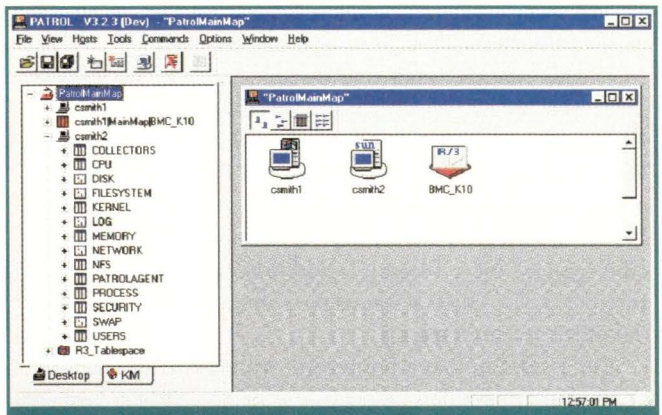
Not surprisingly, interested parties have rallied behind standards as a way to bring applications under the management umbrella. Under the auspice of the Desktop Management Task Force, or DMTF (`http://www.dmtf.org`), Tivoli Systems Inc. has submitted its Application Management System (AMS) for inclusion in the Common Information Model (CIM) specification. Described by Mike Turner, vice president of Tivoli's Application Management Solutions group, as a definition language for describing the components of an application and how to deploy them, applications that come with AMS information should be easy to install. Key information such as which files make up the client, what version of the operating system you need or what changes need to be made to directory services. At the same time, all that information is codified with AMS and can be interpreted by a software distribution tool.

Microsoft Corp. and partners BMC Software Inc., Cabletron Systems Inc., Cisco Systems Inc. and Compaq Computer Corp. have come out in support of another complementary standard, Web-Based Enterprise Management (WBEM). At its heart a data repository, WBEM calls for the data to be stored in the Microsoft Object Format (MOF) versus CIM's Management Information Format (MIF). But despite their differences, Turner says analysts are giving both proposed standards a good chance for success, if only because they are not competing for exactly the same space, and because of the number of vendors behind them.

Management vendors are also hoping that the adoption of a more ambitious standard, Application Response Management (ARM) will take place. Pioneered by Tivoli and Hewlett-Packard Co., ARM comprises a set of six APIs that, when implemented within an application, allow management applications to diagnose "sub-transactions," Turner says. For example, with ARM, you can determine not just the end-to-end response time of a transaction, but where in the stack–the network, database, middleware–problems occur.

While ARM represents a terrific opportunity for application management vendors, it has been slow to catch on with ISVs. Opponents complain that ARM is obtrusive, that it requires vendors to make source code modifications to the applications. Turner, however, is hopeful that once the larger enterprise resource planning (ERP) vendors jump on the ARM bandwagon, industry acceptance of the standard will snowball. But for now, ARM is stuck in a catch-22, waiting for trailblazing ISVs to take the lead.

Meanwhile, application management vendors can't afford to wait for ISVs to instrument their applications according to a standard. "If you're not looking for a product, implement a standard," says Murray Berkowitz, senior vice president of advanced technology for Computer Associates International Inc. The solution? For now, industry standbys such as Simple Network Management Protocol (SNMP) traps, Management Information Bases (MIBs) and plain old proprietary hacks. "We have no choice but to offer solutions based on data that is already available," says Ron Gleason, director of product planning at Compuware Corp.–*ab*



BMC plans to merge its PATROL family of management products with BGS Systems' Best/1 performance analysis tool to create Application Service Assurance (ASA).

the framework, says Compuware's Gleason. The decision of whether or not to get a framework is usually made by high-level IT management, without consulting the staff who will use it. "A lot of people come to us [and] say, 'I think we may be getting a framework, but I'm not sure,'" Gleason says.

When and if an organization finally does decide to implement the framework, application management is rarely at the top of its list of things to do. "They're looking at things like user ID admin, single sign-on, job scheduling or software distribution, which they'll spend weeks and months planning and implementing," says Gleason. "Meanwhile, the poor folks that are trying to manage the applications are still trying to address their problems, but they're way down in the queue."

New Style of Management

To counter this problem, several management vendors have set out to make applications first-class citizens in the eyes of IT, and not just a management afterthought. Applications, they argue, are the raison d'être of an IT infrastructure, providing end users with the means to do their jobs quickly and efficiently. In theory, all the IT resources you find in an organization–client desktops, servers, databases, the network, middleware and so on–should be at the service of the applications and the people who rely on them. The upshot of this philosophy is a new style of management tool, which instead of managing the IT infrastructure as a series of atomic elements–servers, databases, the network–views all traffic and transactions in light of the applications.

If you take the view, like vendors Tivoli and Compuware, that an application is made up of several components above and beyond the actual application executable, you quickly realize this approach, while it sounds simple enough, is really quite ambitious. Tivoli, for example, talks of the "management stack," where applications reside above the network, databases, middleware and operating system. If an application is to be

Companies Mentioned in this Article

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http://www.baan.com
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BEA Systems Inc.
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http://www.beasys.com
Circle 151

BMC Software Inc.
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Houston, TX 77042
http://www.bmc.com
Circle 152

Boole & Babbage Inc.
3131 Zanker Road
San Jose, CA 95134
http://www.boole.com
Circle 153

Cabletron Systems Inc.
35 Industrial Way, Bldg. 36
Rochester, NH 03866
http://www.ctron.com
Circle 154

Cisco Systems Inc.
170 W. Tasman Drive
San Jose, CA 95134
http://www.cisco.com
Circle 155

Compaq Computer Corp.
20555 State Hwy. 249
Houston, TX 77070
http://www.compaq.com
Circle 156

Computer Associates International Inc.
One Computer Associates Plaza
Islandia, NY 11788
http://www.cai.com
Circle 157

Compuware Corp.
31440 Northwestern Hwy.
P.O. Box 9080
Farmington Hills, MI 48334
http://www.compuware.com
Circle 158

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
http://www.hp.com
Circle 159

IBM Corp.
Contact local sales office
http://www.ibm.com
Circle 160

InfoVista Corp.
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Redwood City, CA 94063
http://www.infovistacorp.com
Circle 161

Lotus Development Corp.
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Circle 162

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http://www.luminate.com
Circle 163

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Circle 164

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Mountain View, CA 94043
http://www.netscape.com
Circle 165

Oracle Corp.
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Redwood Shores, CA 94065
http://www.oracle.com
Circle 166

PeopleSoft Inc.
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Pleasanton, CA 94588
http://www.peoplesoft.com
Circle 167

SAP America Inc. (a division of SAP AG)
701 Lee Road, Ste. 200
Wayne, PA 19087
http://www.sap.com
Circle 168

Tivoli Systems Inc.
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Austin, TX 78759
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Circle 169

properly managed, all the components below it on the stack must be managed as well.

BMC Software Inc., Houston, TX, is one proponent of this approach. Long known for its PATROL family of management and performance optimization products, the company announced in February it had merged with BGS Systems, Waltham, MA, maker of the BEST/1 performance analysis, visualizing and capacity planning product. Over time, BMC plans to merge the two products, arriving at a new management philosophy it calls Application Service Assurance, or ASA.

"The key difference between the framework and ASA is that the framework is associated with making the IT department more efficient and effective. Application Service Assurance is associated with making the end user and the business process more effective and efficient. The focus shifts from the people managing IT to the people actually using IT," says Steve Lesam, BMC's director of application management, about the difference between his company's new offering and the traditional framework approach.

Quantifying the end-user response time involves following application traffic all the way to the desktop, which adds a certain amount of complexity to installing these tools.

A good and popular measure of an application's performance is the response time experienced by the end user, or the "end-to-end." Much in the same way rosy cheeks are taken as a sign of good health, satisfactory response time suggests that nothing is seriously amiss in your environment. "Response time has become one of the hot buttons, perhaps because it's such an emotional factor," says Compuware's Gleason, adding that end-user response time is a key metric used to determine if service-level agreements are being met.

Quantifying the end-user response time involves following application traffic all the way to the desktop, which adds a certain amount of complexity to installing these tools. More simplistic tools look only at the application's server-level performance stats. However, for a true indication of the actual response time the end user is experiencing, desktop clients need to be equipped with agents that can capture local performance information and send it back to the central management tool.

Some vendors deem the end user's perspective so important they base entire products around it. Take for example, Luminate Software Corp., Redwood City, CA, maker of Luminate for SAP R/3. Luminate works by placing agents throughout the SAP environment to report back on end-user response times. This data is gathered into a data warehouse, which Basis managers can review to determine the kind of performance SAP is actually delivering, in the form of a historical time series.

But simply reporting on response time isn't enough, says David Burns, vice president of marketing for Luminate Software. "Our customers told us that yes, [reporting on] response time was nice, but what they really wanted to know was what was causing the response time." Luminate's solution is to place data collecting agents throughout the SAP R/3 environment, which it can then use to capture the response time of all the individual systems.

An end user's response time is, after all, the sum of its parts. By breaking it down into the individual response time of each element in the SAP system, Luminate says it can direct application managers to the exact point within SAP that is causing a problem by letting them drill down through the performance data.

For example, Hector Armandiaz, a Basis manager at the Monterrey, Mexico-based steel manufacturer Hylsa-Mex, claims that Luminate helped his organization identify the source of its SAP performance problems. "We were in the process of increasing the number of users on the system and were facing some performance problems. We didn't know if the problem was with SAP, the hardware or the LAN. With Luminate, we discovered that the problem was with some home-grown code."

This ability to home in on the source of an application's performance problems is where every application management vendor wants to go, says Mike Turner, vice president of Tivoli's Application Management Solutions group. Today, most vendors are at the point where they can reliably deliver end-user response time metrics.

But as far as going the distance and telling you where in the IT system an application is getting bogged down, "Well, no one's quite there yet. That's the Holy Grail," Turner says.

SUPPLEMENT

WebServer MAGAZINE

For Managers of World Wide Web Sites

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NC Standard Bearers Get Busy

For proponents of network computing, 1998 has been an active year so far. Besides fending off discouraging reports from analysts, who observe that Network Computer (NC) sales have been far below expectations, NC defenders have been hard at work hammering out standards and specifications that, they hope, will give NCs some much needed credibility with consumers.

Columns illustrated by STEPHEN SCHILDBACH

The most noticeable effort to bolster the public image of the Network Computer has been a campaign by The Open Group, Cambridge, MA, to create an NC brand and logo–sort of a "Good Housekeeping Seal of Approval" for NCs. The Open Group, a consortium of computer industry vendors formed in 1996 by the merger of the X/Open Company and the Open Software Foundation, took on the role of keeper of NC standards with the formation of its Network Computing Working Group in October 1997. The Open Group's work teams typically consist of a requirements group and a technical group. The requirements group defines the business needs while the technical group decides how to implement those needs in the specification. In January, major NC vendors, including IBM Corp., Sun Microsystems Inc., Network Computer Inc. and Neoware Systems Inc., agreed to work through The Open Group to set NC standards.

Since then, The Open Group has announced a number of new NC initiatives, including a testing and trademark licensing program for vendors who want products to carry The Open Group logo. In April, four NC products became the first to win that official seal of approval. Not surprisingly, those first NCs to win brand approval were IBM's Network Station Series 100, 300 and 1000, and Sun's JavaStation, which has only been commercially available since March. Both Sun and IBM have been leading proponents of NCs and deeply involved in The Open Group's NC standards creation.

"It [certification and branding] is something that we've been building towards right from the beginning," says Mark Pozefsky, a strategist with IBM's NC division.

To achieve certification, an NC product must successfully complete a number of tests designed to determine if it meets The Open Group's NC Reference Profile specifications. The tests include support of HTTP and TCP protocols, and the capability to send email and input text. The product must also have a Java Virtual Machine (JVM). If it passes the compatibility tests, and if the company is willing to pay a $10,000 fee, plus a $1,000 annual renewal fee, a product can carry The Open Group's blue "Open Network Computer" logo.

As of mid-May, approximately 10 NC products were in the pipeline for certification, according to Shane McCarron, testing research manager for The Open Group. McCarron says he expects to see many other NC products submitted for certification over the next couple of months.

What benefit will branding have for NC vendors and customers? McCarron says the branding process is designed to give the NC industry more credibility with consumers and with software developers who might be uncertain as to whether or not they should invest money in developing commercial NC applications. "One major benefit is to show application developers that there is a sufficiently large number of seats out there, and that it's worth their while to develop for them," McCarron says.

But it remains to be seen whether or not consumers care if an NC carries the official seal of approval from The Open Group. "I'm not sure if branding is a customer hot button or not," says Greg Blatnik, an NC analyst with Zona Research Inc., Redwood City, CA. He says customers are more likely to care about whether an NC has the features they

need, rather than if it's officially blessed by The Open Group.

Eileen O'Brien, director of the NC Program for International Data Corp. (IDC), Framingham, MA, does feel that branding is significant to consumers, but says it may take time before The Open Group brand becomes a consideration when buying an NC–mainly because there just aren't that many NCs to choose from right now (see "A Sampling of Network Computers, Page 72).

"I think end users are respectful of a certification that comes from a third party, rather than from a vendor," says O'Brien. "But I have to chuckle over the fact that the two vendors who have received certification are virtually the only two NC vendors on the market …It's not like they beat out a field of 13 competitors."

Another NC vendor–Network Computing Devices Inc., Mountain View, CA, the company that manufactures IBM's NCs–says it may seek to have its own Explora line of NCs receive certification, but is waiting to gauge customer demand for certification before doing so.

Along with its certification effort, The Open Group is also working to expand its set of specifications for NCs. In April, The Open Group renamed its Desktop Program Group, which was responsible for developing desktop standards for UNIX and X Window systems, the Network Client Program Group. The focus of the revamped group will be the NC client architecture. According to Jerry Kellenbenz, engineer scientist at Apple Computer Inc., the group will attempt to define standards for things such as security–how the client should verify that the correct desktop or software application has been loaded–and how data should be rendered on the screen. However, the group probably won't attempt to define a specific NC GUI, says Kellenbenz, because of the difficulty in attaining consensus among vendors, each of which has its own GUI that it would want to be represented in any NC standard.

Searching for a Common Goal

Another group, the Network Computer Management Group is working on standards for how NC clients and servers communicate. NCs from one vendor don't always work with servers from another vendor. The Sun JavaStation, for example, currently only works with Sun's Netra j server. To remedy that situation, the NC Management Group is working to develop common standards for booting, security, login security, printing and license management.

"Just like in the PC world, in the NC world there are multiple ways of doing things like security or configuration," says IBM's Pozefsky. "We want to standardize on one, base level, so that, for example, there's just one command that changes everyone's desktop to red, or which gives everyone access to an application."

Those specs are expected this month. In addition, Version 2 of The Open Group's NC Reference Profile is sched-

uled for release this month. While The Open Group is no longer releasing preliminary drafts of the new spec, an early version the group released in February indicated it would add support for HTML 4.0, JavaScript, Virtual Reality Modeling Language (VRML), Secure Sockets Layer (SSL), the Dynamic Host Configuration Protocol (DHCP) for assigning IP addresses to stations in a network, and CORBA 2.1 Object Request Broker (ORB) with Internet Inter-ORB Protocol (IIOP) Version 1. In addition, it will include support for an email client (Version 1.0 has support only for mail sent through the Sendmail function, initiated when a user clicks on an email link). NCs that have already been certified and branded by The Open Group will have to be recertified for the new specifications, McCarron says.

On the horizon are specifications for mobile NCs. A group of vendors operating under the name Mobile Network Computer Reference Specification Consortium released the first draft of its mobile NC specs in March. The group, which includes many members who have been involved in developing The Open Group NC specifications, including Sun, Network Computer Inc. (NCI)–a subsidiary of Oracle Corp.–and IBM, expects to have a final version out sometime in the fall.

While the current Open Group NC Reference Profile specs don't preclude mobile devices, they also don't address some of the unique requirements that mobile NCs have, according to the consortium. The mobile NC specs will detail things such as how NCs should communicate with servers over remote lines, power management and data synchronization. The specs also define three classes of mobile NCs: professional assistants, which can support a variety of productivity applications and can run in a disconnected mode; information access devices for Web and email access; and basic mobile NCs for paging and messaging, but with little other functionality.

According to IDC's O'Brien, it's the possible emergence of mobile NCs that could have the greatest impact on NC adoption by corporate workers. "Without that, the NC market cuts out a whole lot of workers, like myself, who have to carry around a laptop. [Microsoft Corp.] Windows-based terminals will never be able to compete on that front, because everything runs off the server [with no local storage or processing capabilities on the client]. I think if the Java NC vendors like IBM and Sun could solidify a mobile NC effort, they could really have a leg up on the Windows-based terminals."

However, O'Brien doesn't see mobile NCs flooding the market anytime soon. "I've talked to several vendors and most of them are a year or two away."

Toshiba Corp. does have a mobile NC for sale in Japan and NCI says it's working on mobile NC software that OEMs will use to develop mobile NC products. The first of those NCs will probably be available in early 1999, according to NCI spokesman Randy Brasche. ⊸

A SAMPLING OF NETWORK COMPUTERS

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

Key:
N/A = Not applicable
— = Information not available from vendor

	Acorn Acorn NC	Affinity Systems Visara NC Model 210	Affinity Systems Visara NC Model 211	Corel Netwinder 275	Dell OptiPlex N/NX
NetPC-compliant	No	No	No	No	Yes
NC-compliant	Yes	Yes	Yes	Yes	No
Min. microprocessor	ARM 7500FE	Motorola 821	Motorola 821	Digital StrongARM SA-110	Intel 166-MHz Pentium MMX Intel 233-MHz Pentium II
Terminal emulation	Yes	5250, 3270, vt320, other UNIX	5250, 3270, vt320, other UNIX	Yes	No
Operating systems supported	Native Acorn RISC OS; as terminal, Windows NT, Solaris, more	Windows, UNIX, OS/400	Windows, UNIX, OS/400	Linux/JavaOS	Windows 95/NT
X server access to UNIX applications	Yes	Yes	Yes	Yes	No
Local memory min./max. (MB)	5/256	8/64	24/64	32/64	16/384
Diskless device	Yes	Yes	Yes	Optional	Yes
Internal hard drive support for caching	No	No	No	Yes	Yes
Monitor included	No	No	No	No	No
Monochrome, grayscale or color	Monochrome, grayscale, color	N/A	N/A	Color	Color
Min. monitor resolution (pixels)	640x480	800x600	800x600	480x640	640x480
Screen size (inches)	N/A	N/A	N/A	N/A	15-21
Refresh rate (Hz)	N/A	N/A	N/A	N/A	72
"Plug-and-play" device IDs	No	No	No	N/A	Yes
Unique ID	Yes	Yes	Yes	Yes	Yes
End-user expansion slots	No	PCMCIA only	PCMCIA only	No	1 PCI
X11 release supported	4	5	5	6	None
X11 security and authority support	No	Yes	Yes	Yes	No
X remote support	Yes	Yes	Yes	Yes	No
X server location	Dependent on configuration	Download	Download	Download or local disk	—
Built-in window manager	NCD	Motif	Motif	Corel SuiteCentric	None
Built-in clients	None	Over 75	Over 75	Yes	No
Multimedia support	Yes	No	No	Yes	No
Font server support	Yes	Yes	Yes	Yes	No
Formats supported	JPEG, GIF, WAV, AU, AVI, PNG, more	—	—	JPEG, GIF, WAV, AU	JPEG, GIF, WAV, AU, more
Remote configuration and management	No	Yes	Yes	Yes	Yes
Device drive and installation meets Windows NT standard	No	Yes	Yes	No	Yes
Network management protocols supported	None	CIFS, DHCP, BootP, ARP, RARP, NFS, TFTP	CIFS, DHCP, BootP, ARP, RARP, NFS, TFTP	DCHP, BootP	SNMP, IPX/SPX
IP-based protocols supported	Dependent on user requirements	Telnet, TCP, FTP, UDP, SNMP, ICMP, RPT	Telnet, TCP, FTP, UDP, SNMP, ICMP, RPT	Telnet, TCP/IP, FTP, NFS, UDP, SNMP	TCP, FTP
Web standards supported	HTML 3.2; HTTPS (optional)	—	—	HTML, HTTP, CGI, Java	HTML, HTTP, Java, more
Mail protocols supported	SMTP, POP3, more	SMTP, POP3, plug-ins	SMTP, POP3, plug-ins	SMTP, POP3, IMAP4, MIME	SMTP, POP3, IMAP4
SLIP/PPP support	Yes	Yes	Yes	Yes	Yes
Standard interfaces	Parallel, Ethernet (twisted pair), modem	Serial, parallel, Ethernet (twisted pair), Token Ring (optional)	Serial, parallel, Ethernet (twisted pair), Token Ring (optional)	Serial, parallel, Ethernet (10BaseT, 100BaseT)	Serial, parallel, Ethernet (twisted pair)
Server extensions supported	N/A	N/A	N/A	N/A	—
Warranty	Contact vendor	12% of list for 1 year	12% of list for 1 year	1 year	3 years limited (1 year on-site, 2 years parts and delivery only)
List price ($)	Contact vendor	698	898	999	1,007/1,336 (base configuration)

	Hewlett-Packard Entria II Netstation	Hewlett-Packard Net Vectra	Hewlett-Packard Envizex II Netstation	IBM Network Station Series 100	IBM Network Station Series 300
NetPC-compliant	No	Yes	No	No	No
NC-compliant	No	No	No	Yes	Yes
Min. microprocessor	NEC R4300	Intel 166-MHz Pentium MMX	NEC R4300	PowerPC 403GA	PowerPC 403GCX
Terminal emulation	Yes	Via third-party software	Yes	Yes	Yes
Operating systems supported	HP-UX, SunOS, Solaris, AIX, Windows NT	Windows NT 4.0	HP-UX, SunOS, Solaris, AIX, Windows NT	None specified, but can support Windows 95/NT, UNIX, more	None specified, but can support Windows 95/NT, UNIX, more
X server access to UNIX applications	Yes	No	Yes	Yes	Yes
Local memory min./max. (MB)	4/96	2/64	2/64	8/64	16/64
Diskless device	Yes	No	Yes	Yes	Yes
Internal hard drive support for caching	No	Yes	No	No	No
Monitor included	No	No	No	No	No
Monochrome, grayscale or color	Color	N/A	Color	—	—
Min. monitor resolution (pixels)	1024x768	N/A	1024x768	640x480	640x480
Screen size (inches)	15-19	N/A	17-21	14-21	14-21
Refresh rate (Hz)	75	N/A	75	85	85
"Plug-and-play" device IDs	No	No	No	Yes	Yes
Unique ID	Yes	Yes	Yes	Yes	Yes
End-user expansion slots	No	No	2 PCI	No	No
X11 release supported	6	N/A	6	5	5
X11 security and authority support	Authority only	No	Authority only	Planned	Planned
X remote support	No	No	No	Yes	Yes
X server location	Download or ROM	N/A	Download or ROM	Download	Download
Built-in window manager	Motif, dtwm, twm, more	N/A	Motif, vuewm, dtwm, twm, more	Motif	Motif
Built-in clients	xclock, dtterm, hpterm, vt320, tn3270, more	N/A	xclock, dtterm, hpterm, vt320, tn3270, more	xterm, 5250, 3270, JVM, screen lock, more	xterm, 5250, 3270, JVM, screen lock, more
Multimedia support	—	Yes	—	Yes	Yes
Font server support	Yes	No	Yes	No	No
Formats supported	AU, application dependent	Application dependent	AU, application dependent	JPEG, GIF	JPEG, GIF
Remote configuration and management	Yes	No	Yes	Yes	Yes
Device drive and installation meets Windows NT standard	Yes	Yes	Yes	No installation required	No installation required
Network management protocols supported	SNMP, RSH	DMI	SNMP, RSH	SNMP, MIB2	SNMP, MIB2
IP-based protocols supported	TCP, Telnet, SNMP, NFS, UDP, SMB	Windows NT 4.0 stack	TCP, Telnet, SNMP, NFS, UDP, SMB	TCP, TFTP, DHCP, UDP, BootP, NFS, Telnet, SNMP, sockets	TCP, TFTP, DHCP, UDP, BootP, NFS, Telnet, SNMP, sockets
Web standards supported	HTML, HTTP, Java	HTML, HTTP, Java	HTML, HTTP, Java	HTML, HTTP, CGI, Java, JavaScript	HTML, HTTP, CGI, Java, JavaScript
Mail protocols supported	POP3	SMTP, POP3, IMAP4	POP3	POP3, IMAP4 (planned)	POP3, IMAP4 (planned)
SLIP/PPP support	Yes	Yes	Yes	Yes	Planned
Standard interfaces	Serial, parallel, Ethernet (twisted pair)	Serial, parallel, Ethernet (twisted pair), USB	Serial, parallel, Ethernet (twisted pair), 100 VG	Ethernet (10BaseT), Token Ring	Ethernet (10BaseT), Token Ring
Server extensions supported	SharedX, XIE, DBE, shared memory, SYNC, Xidle, XTrap, multibuf	N/A	SharedX, XIE, DBE, shared memory, SYNC, Xidle, XTrap, multibuf	None	None
Warranty	1 year, return to depot (standard), up to 24x7 (extended)	3 years parts & labor	1 year, return to depot (standard), up to 24x7 (extended)	1 year	1 year
List price ($)	1,095 (base configuration)	1,007–1,336	2,190 (base configuration)	499	629

	IBM Series 1000 Java NC	IGEL Etherminal 5J+/ Etherminal 5X+	JCC xfaceC	JCC xface20	NCD Explora 400/450
NetPC-compliant	No	No	No	No	No
NC-compliant	Yes	Yes	No	No	Yes
Min. microprocessor	PowerPC 603e	Intel Pentium or compatible	MIPS R3000	MIPS R3000	PowerPC 403
Terminal emulation	Yes	Yes	Yes	Yes	Yes
Operating systems supported	None specified, but can support Windows 95/NT, UNIX more	UNIX, Windows NT, JavaOS	UNIX	UNIX	UNIX, Windows NT, MVS
X server access to UNIX applications	Yes	Yes	Yes	Yes	Yes
Local memory min./max. (MB)	32/64	16/64	8/128	4/24	8/128
Diskless device	Yes	Yes	Yes	Yes	Yes
Internal hard drive support for caching	Optional	No	No	No	No
Monitor included	No	No	Yes	Yes	No
Monochrome, grayscale or color	—	Grayscale or color	Color	Color	Color
Min. monitor resolution (pixels)	640x480	640x480	1280x1024	1280x1024	1280x1024
Screen size (inches)	14-21	Any size	13	20	15-21
Refresh rate (Hz)	85	85	60	64	85
"Plug-and-play" device IDs	Yes	N/A	No	No	No
Unique ID	Yes	Yes	Yes	Yes	No
End-user expansion slots	No	No	No	No	1
X11 release supported	5	6	6	6	5
X11 security and authority support	Yes	Yes	Yes	Yes	Yes
X remote support	Planned	Yes	Planned	Yes	Yes
X server location	Download	Flash memory	Download and ROM	Download and ROM	Download or flash memory
Built-in window manager	Motif	Fvwm, Windows 95 look alike	Motif, Open Look, more	Motif, Open Look, more	NCD, Motif
Built-in clients	xterm, 5250, tn3270, JVM, screen lock, more	xclock, xterm, more	xclock, xterm, more	xclock, xterm, more	Standard X clients
Multimedia support	Yes	Yes	Yes	Yes	Yes
Font server support	No	Yes	Yes	Yes	Yes
Formats supported	JPEG, GIF	Any current standard	JPEG, GIF, WAV, AU, more	JPEG, GIF, WAV, AU, more	MPEG, GIF, AVI, WAV
Remote configuration and management	Yes	Yes	Yes	Yes	Yes
Device drive and installation meets Windows NT standard	No installation required	No	No	No	No
Network management protocols supported	SNMP, MIB2	Any supported by Linux	SNMP, ICMP	SNMP, ICMP	SNMP
IP-based protocols supported	TCP, TFTP, DHCP, UDP, BootP, NFS, Telnet, SNMP, sockets	TCP, NFS, SNMP	TCP, UDP, Telnet, NFS, SNMP, ICMP, ARP	TCP, UDP, Telnet, NFS, SNMP, ICMP, ARP	TCP, FTP
Web standards supported	HTML, HTTP, CGI, Java, JavaScript	HTML, HTTP, CGI, Java	Planned	Planned	HTML, HTTP, Java
Mail protocols supported	POP3, IMAP4 (planned)	POP3	Planned	Planned	Any server-side
SLIP/PPP support	Planned	No	Yes	Yes	Yes
Standard interfaces	Ethernet (10BaseT), Token Ring	Serial, parallel, Ethernet (twisted pair)	Serial, Ethernet (twisted pair, thin)	Serial, Ethernet (twisted pair, thin)	Serial, parallel, Fast Ethernet (twisted pair, thin), Token Ring (PCMCIA), wireless
Server extensions supported	None	—	—	—	PEX, DPS
Warranty	1 year	1 year (standard), optional flexible terms	1 year, extended options	1 year, extended options	3 years
List price ($)	999	499 (base configuration)	10,995	12,995	695 (base configuration)

	NCD Explora 700	NCI NC 1000	Neoware Systems NeoStation 200	Neoware Systems @workstation
NetPC-compliant	No	Yes	No	No
NC-compliant	Yes	Yes	Yes	Yes
Min. microprocessor	MIPS R4700	Intel Pentium	PowerPC 821	Intel i960
Terminal emulation	Yes	Yes	Yes	Yes
Operating systems supported	UNIX, Windows NT, MVS	NCOS	UNIX, Windows NT	UNIX, Windows NT
X server access to UNIX applications	Yes	Yes	Yes	Yes
Local memory min./max. (MB)	8/256	16/128	8/128	12/132
Diskless device	Yes	Yes	Yes	Yes
Internal hard drive support for caching	No	Planned	Yes	Yes
Monitor included	No	Yes	No	No
Monochrome, grayscale or color	Color	Color	Monochrome, grayscale, color	Monochrome, grayscale, color
Min. monitor resolution (pixels)	1600x1200	1024x768	640x480	640x480
Screen size (inches)	15-21	14	14-37	14-37
Refresh rate (Hz)	85	—	60-80	60-80
"Plug-and-play" device IDs	No	No	No	No
Unique ID	No	Yes	Yes	Yes
End-user expansion slots	1	No	Yes	2 (optional)
X11 release supported	5	6	6	6
X11 security and authority support	Yes	Yes	Yes	Yes
X remote support	Yes	Yes	Yes	Yes
X server location	Download or flash memory	ROM	Download, flash memory, hard drive	Download, flash memory, hard drive
Built-in window manager	NCD, Motif	Motif	Motif, Open Look, netOSwm	Motif, Open Look, netOSwm
Built-in clients	Standard X clients	xclock, xterm, more	xclock, text editor, terminal emultations	xclock, text editor, terminal emultations
Multimedia support	Yes	Yes	Yes	Yes
Font server support	Yes	Yes	Yes	Yes
Formats supported	MPEG, GIF, AVI, WAV	JPEG, GIF, WAV, AU, more	JPEG, FIG, AU, WAU, XPM, XBM	JPEG, FIG, AU, WAU, XPM, XBM
Remote configuration and management	Yes	Yes	Yes	Yes
Device drive and installation meets Windows NT standard	No	No	Yes	Yes
Network management protocols supported	SNMP	SNMP, MIB2	SNMP, MIB2, DHCP, BootP, ARP, RARP, RSH	SNMP, MIB2, DHCP, BootP, ARP, RARP, RSH
IP-based protocols supported	TCP, FTP	TCP, FTP, Telnet, NFS, UDP, SNMP	TCP, FTP, SNMP, MIB2, CIFS/SMB, NFS, UDP, ICMP, RTP, TFTP	TCP, FTP, SNMP, MIB2, CIFS/SMB, NFS, UDP, ICMP, RTP, TFTP
Web standards supported	HTML, HTTP, Java	HTML, HTTP, Java, CGI	HTML, HTTP, HTTPS, Java, CGI, NNTP	HTML, HTTP, HTTPS, Java, CGI, NNTP
Mail protocols supported	Any server-side	SMTP, IMAP4, POP3	SMTP, POP3	SMTP, POP3
SLIP/PPP support	Yes	Planned	Yes	Yes
Standard interfaces	Serial, parallel, Fast Ethernet (twisted pair, thin), Token Ring (PCMCIA), wireless	Serial, parallel, Ethernet (twisted pair)	Serial, parallel, Fast Ethernet, Ethernet (twisted pair, thick or thin), Token Ring (optional)	Serial, parallel, Fast Ethernet, Ethernet (twisted pair, thick or thin), Token Ring (optional)
Server extensions supported	PEX, DPS	PEX	PEX	PEX
Warranty	3 years	Contact vendor	1 year, extended options	1 year, extended options
List price ($)	1,695	500–750	649	999

	Sherwood 8000 PT NC	Sun Microsystems JavaStation	Tektronix NC200 Series Business Network Computers	UMAX NC-320
NetPC-compliant	No	No	No	No
NC-compliant	No	Yes	Yes	Yes
Min. microprocessor	Intel 486 DX2	MicroSPARC II	NEC R4300	200-MHz Pentium MMX
Terminal emulation	Yes	Yes	Yes	Yes
Operating systems supported	UNIX, Windows 95/NT, WinFrame 1.7, Novell NetWare, DOS	JavaOS	UNIX, PC	UNIX, Windows NT, NCOS
X server access to UNIX applications	Yes	Yes	Yes	Yes
Local memory min./max. (MB)	4/64	16/64	8/40	32/64
Diskless device	Yes	Yes	Yes	Yes
Internal hard drive support for caching	Yes	No	No	No
Monitor included	No	Optional	Contact vendor	No
Monochrome, grayscale or color	—	Color	Color	Grayscale or color
Min. monitor resolution (pixels)	640x480	640x480	1024x768	640x640
Screen size (inches)	User selectable	14-19	15, 17, 20, 21	User definable
Refresh rate (Hz)	60-85	60-75	70, 73	up to 120
"Plug-and-play" device IDs	No	N/A	Yes	Yes
Unique ID	No	Yes	Yes	Yes
End-user expansion slots	Yes	No	2	No
X11 release supported	5, 6	5, 6	6.1	None
X11 security and authority support	Yes	Yes	Yes	No
X remote support	Yes	—	Yes	No
X server location	Download	Download	Download, flash memory	N/A
Built-in window manager	Server-installed	HotJava Views	Optional Motif or Open Look	NCI NC Desktop
Built-in clients	Server-installed	Server-installed	xclock, launcher, Windows manager, more	NCI client
Multimedia support	Optional	Yes	Yes	Yes
Font server support	Yes	Yes	Yes	No
Formats supported	Application dependent	JPEG, GIF, AU	JPEG, GIF, WAV, MPEG, AU	JPEG, FIG WAV, AU
Remote configuration and management	Yes (flash disk)	Yes	Yes	No
Device drive and installation meets Windows NT standard	Yes	N/A	N/A	Yes
Network management protocols supported	Any	DNS, NIS, NFS, DHCP	DNS, SNMP, MIB2, ping, Boot Monitor, more	—
IP-based protocols supported	TCP, FTP, more	TCP, DNS, NIS, NFS, DHCP, FTP, Gopher, SOCKS, SSL	TCP/IP, TFTP, NFS, BootP, RARP, more	TCP, FTP, NFS, UDP, Telnet
Web standards supported	HTML, HTTP, Java	HTML, HTTP, Java (JDK 1.1)	HTML, HTTP, Java, JavaScript	HTML, HTTP, CGI, Java
Mail protocols supported	SMTP, POP3, IMAP4	SMTP, MIME, IMAP4	SMTP, POP3	SMTP, IMAP4, POP3
SLIP/PPP support	Yes	Yes	Yes, PPP	No
Standard interfaces	Serial, parallel, Ethernet (twisted pair)	Serial, Ethernet (twisted pair)	Serial, parallel, Ethernet (twisted pair, thick or thin, 100BaseTX)	Serial, parallel, Ethernet
Server extensions supported	—	N/A	Xidle, Xtest, Xblink, font caching, input extensions, more	—
Warranty	2 years	Contact vendor	1 year, return to depot	1 year
List price ($)	500	742	895	749

Companies Mentioned in this Survey

Acorn Group
Acorn House
645 Newmarket Road
Cambridge, CB5 8PB, UK
http://www.acorn.com
Circle 210

Affinity Systems
1000 N. Broad St.
Lansdale, PA 19446
http://www.affinitysys.com
Circle 211

Corel Computer Corp.
150 Isabella St., Ste. 1000
Ottawa, Ontario
Canada K1S 1V7
http://www.corelcomputer.com
Circle 212

Dell Computer Corp.
One Dell Way
Round Rock, TX 78682
http://www.dell.com
Circle 213

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
http://www.hp.com
Circle 214

IBM Corp.
Network Computer Division
Rte. 100
Somers, NY 10589
http://www.ibm.com/nc
Circle 215

IGEL LLC
31 Stonecroft Drive, Ste. 105
Palmer, PA 18045
http://www.igelusa.com
Circle 216

JCC Corp.
124 University Ave.
Palo Alto, CA 94301
http://www.jccusa.com
Circle 217

Network Computing Devices Inc. (NCD)
350 N. Bernardo Ave.
Mountain View, CA 94043
http://www.ncd.com
Circle 218

Network Computer Inc. (NCI)
1000 Bridge Pkwy.
Redwood Shores, CA 94065
http://www.nc.com
Circle 219

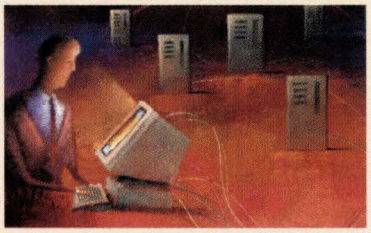
Neoware Systems Inc.
400 Feheley Drive
King of Prussia, PA 19406
http://www.neoware.com
Circle 220

Sherwood USA Corp.
Sherwood Network Division
21056 Forbes St.
Hayward, CA 94545
http://www.sherwoodterm.com
Circle 221

Sun Microsystems Computer Co.
2550 Garcia Ave.
Mountain View, CA 94043
http://www.sun.com
Circle 222

Tektronix Inc.
Video and Networking Division
P.O. Box 500
Beaverton, OR 97077
http://www.tek.com/VND
Circle 223

UMAX Technologies Inc.
3561 Gateway Blvd.
Freemont, CA 94538
http://www.umax.com
Circle 224



Balancing Network Resources

In what seems to be a desperate demand for more bandwidth, more disk space and more and faster processors, some companies are opting for alternative network connections in the form of bandwidth management and load-balancing products.

Last summer, Synopsys Corp., a Mountain View, CA-based software company, was running short on bandwidth. Specifically, Synopsys was having trouble providing adequate throughput for customers trying to download software from the company's Web site. A normal 50-minute download could, at times, take as long as two or three hours–and customers were not shy about venting their frustration at Synopsys technical support staff. Complaints were especially loud on days following the release of a new product or upgrade, when dozens of customers would simultaneously attempt to download 200-MB files. The problem was aggravated by Synopsys employees, who share an Ethernet connection with customers and often wound up competing with them for bandwidth.

"We have a 10-Mb/s connection to the Internet, which is pretty fast, but one of our employees could innocently cause a problem by starting a 500-MB download at the same time that several customers were trying to do the same," explains Habeeb Quadri, network architect for Synopsys.

The solution? No, not paying an extra $20,000 per month to upgrade the network connection to 45 Mb/s, but, rather, installing a Check Point Software Technologies Inc. FloodGate-1 bandwidth manager, for a onetime price of $19,000. By configuring it to give Synopsys customers a 7-to-3 priority in bandwidth allocation over Synopsys employees, everyone can now be accommodated on the network–with customers always getting the edge when traffic is heavy.

"We want to make sure that customers get a higher priority, because they get pretty upset if everything isn't up to their expectations," says Quadri, "The irate phone calls have pretty much gone away."

Software developers, online storefronts, Internet service providers (ISPs) and other businesses that rely heavily on IP networks, are constantly confronted with the need for additional capacity. It seems there is always a desperate demand for more bandwidth, more disk space and more and faster processors to handle everything from email traffic and software downloads, to Java-enabled Web pages and streaming video. But resources are not infinite, and IS managers are increasingly reluctant to shell out big bucks for expensive upgrades. Instead, some are beginning to look for alternatives and finding them in the form of bandwidth management and load-balancing products.

"The best way for ISPs and corporations to reduce the cost of networking is to control the usage," says Elizabeth Rainge, senior analyst for network management at International Data Corp. (IDC), Framingham, MA. "This is about making the most efficient use of the network."

Rainge estimates there are just under a dozen vendors selling bandwidth management products. Likewise, there are eight to 10 companies making load-balancing products, according to Earl Mathis, worldwide product marketing manager for IBM Corp., Armonk, NY, maker of the Interactive Network Dispatcher load-balancing tool.

Bandwidth management tools enable managers to allocate portions of the available bandwidth to different users or applications. Load balancers, on the other hand, address the server side of the equation. They route traffic to the best server available to handle a particular job, usually either the closest server

geographically to the person making the request, or to the least-busy server.

The main reasons to purchase a bandwidth manager–a hardware product or software application that runs on a server–are if you have continuously heavy traffic and don't want to upgrade your network, or if you have bursty traffic that you need to control. You may also want a bandwidth manager if your employees or customers frequently use applications that can't tolerate delays–such as streaming video–for which you need to guarantee a minimum level of bandwidth.

For ISPs, another motivation to invest in bandwidth management is to offer customers quality-of-service guarantees as well as a wider range of bandwidth options.

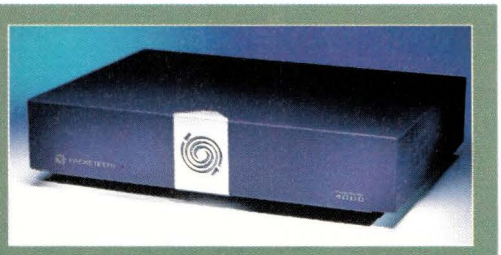
Last month, Digex, a national ISP based in Washington, D.C., installed Access Point, a bandwidth manager made by Xedia Corp., Littleton, MA, so that Digex can give its business customers more alternatives. "For example, if we have a customer who is at 10 Mb/s and needs more bandwidth, but who doesn't want to go all the way up to 100 Mb/s, this lets us allocate bandwidth for them somewhere in between," explains Lloyd Taylor, vice president of technology operations for Digex's Web Site Management Group. "I'd say 30% to 40% of the bids we're asked to make these days involve some form of bandwidth management."

Such value-added services help give ISPs an edge over their competition. "There is tremendous pent-up demand for differentiated services," says John McConnell, president of McConnell Consulting Inc., Boulder, CO. "ISPs would love to be able to differentiate themselves from their competitors."

Queuing vs. Rate Control

Bandwidth managers typically cost between $2,000 and $5,000 per server license or hardware unit and direct traffic either through end-to-end rate control–monitoring individual IP connections and signaling the senders to slow down or speed up–or through some form of queuing, in which IP packets are prioritized based on the identity of the sender or receiver, or on their contents. Queuing can be strictly priority-based–Person or Resource A always gets preference over Person or Resource B–or it can be weighted, so that even low-priority traffic always gets some small amount of bandwidth. Some bandwidth managers rely on queuing alone, while others offer both rate control and queuing; all have to provide queuing for real-time audio and video because that type of traffic can't be handled via rate control.

McConnell likens rate control and queuing to air-traffic control. "You might be on a plane, and they tell you that they're not going to take off for a while because the other airport is too busy. That's rate control. Or you can take off and end up circling the airport waiting to land. That's queuing. If you don't have rate control, you'll occasionally end up with traffic you can't handle."



Packeteer's PacketShaper lets network managers create different classes of service and establish bandwidth levels for different business applications.

However, Greg Smith, product marketing manager for Check Point Software, Redwood City, CA, is an advocate of weighted queuing–the method that Check Point's FloodGate-1 employs–over rate control. Rate control, he believes, wastes bandwidth by forcing the network to constantly increase and decrease flow rates to keep up with demand. "Rate control works well if you have a small number of connections, but otherwise you can find yourself always playing catch-up, with bandwidth sitting idle much of the time."

Devising Bandwidth Policies

Regardless of the method used by a bandwidth manager, the point is to establish policies for who, and what, gets more of the bandwidth resources. A network manager might give preference to outside customers over internal employees, as did Synopsys' Quadri, by giving requests coming from the company's own IP address a lesser percentage of the bits than requests coming from outside IP addresses–or by giving traffic coming into a particular URL precedence over other traffic. If you have a lot of remote workers, you might opt to set policy by URL rather than IP address, because remote employees who log into the corporate intranet through an ISP won't necessarily carry an identifiable corporate IP address. But by giving priority to traffic addressed to specific URLs, such as those of a departmental Web site or internal employee human resources site, a network administrator can make sure these remote workers get a guaranteed amount of bandwidth.

You might also give priority to specific types of services or applications. For example, you could allow FTP downloads preference over email traffic by configuring the bandwidth manager to give priority to the specific TCP or UDP (IP protocol used for real-time audio and video) port numbers associated with those applications. Aponet Inc., San Jose, CA, for instance, makes the Aponet Bandwidth-Manager, which can control bandwidth based on IP address or TCP port number, or both.

At least one product uses directory services to set bandwidth policy: TrafficWARE, an NT-based product from Ukiah Software Inc., Campbell, CA, relies on a network's existing Lightweight Directory Access Protocol (LDAP)-compliant directory services, such as Netscape Communications Corp.'s Directory Server or Novell Inc.'s Network Directory Services, to allocate bandwidth based on predefined users and groups.

Most bandwidth managers also offer some type of management and reporting features, such as real-time and historical graphs of traffic usage and various management options. For example, PacketShaper, from Washington, D.C.-based Packeteer Inc., comes with policy consoles that let network managers create different classes of service and establish bandwidth levels for different business applications–more, say, for customer HTTP requests to the company Web site and less for employee PointCast (PointCast Inc.'s online news service) traffic. And in January, Aponet re-

leased a free add-on to its bandwidth manager, which allows an ISP to set up different bandwidth allotments for customers based on daytime, evening and peak usage times, and to increase or decrease the customer's guaranteed bandwidth during those times.

Load Balancers: Pooling Resources

Now that Synopsys' bandwidth troubles are under control, Quadri has two other items on his network wish list. Within the year, he hopes to purchase a second server to handle the demands of the company's growing customer base and employee population. To get optimal performance from that second server, Quadri also plans to install a load-balancing product to speed response time by distributing HTTP, FTP and email traffic between the two CPUs, and to minimize downtime by having replicated servers take over for one another should one go down.

"Instead of just upgrading our server to the next biggest iron, I want to have two servers and balance the load between them. That will allow us to do maintenance on one without bringing everything down," Quadri says.

In a load-balanced network, incoming IP traffic is distributed among several replicated servers. Load balancing not only allows network managers to set up clusters of servers to share the processing load and take over when one fails, but also provides a way to speed response time for users. It comes, however, at a price: Load balancers can cost anywhere from $1,500 per Web server (for a software-only product) to $30,000 (for a complete hardware/software system capable of handling hundreds of thousands of concurrent TCP connections). Vendors in this market include Bright Tiger Technologies, Acton, MA; Cisco Systems Inc., San Jose, CA; Resonate Inc., Mountain View, CA; HydraWEB Technologies Inc., New York, NY; F5 Labs Inc., Seattle, WA; Coyote Point Systems Inc., Sunnyvale, CA; and IBM.

Many Web sites and ISPs are familiar with a primitive sort of load balancing, in which visitors to a Web site are asked to select from a list of servers. Often, they're presented with an imagemap, asked to click on their state or country, and are then connected with a server in their geographic region. Or they may be simply presented with a series of URLs and instructed to make a choice. From the point of view of the Web site visitor, this is extremely inconvenient because there is no way for them to know whether or not the server they choose is even available, much less whether it's the speediest.

You can also set up your TCP/IP Domain Name System (DNS) to do load balancing by binding, in rotation, the IP addresses of your various servers to your domain name. This round-robin approach causes each incoming request to be handed off to the next server in the pool, regardless of how many current sessions that server may or may not be handling at the time–or even whether that server is still alive. It has the disadvantage of potentially overloading an already-busy server, while another sits virtually idle.

However, true load balancing means an intelligent and transparent (to the user) distribution of incoming traffic among a pool of servers. The load balancer–either software running on a server or a hardware product (essentially a router)–acts as a gateway, screening all traffic addressed to the host's IP address and routing it to the most appropriate server.

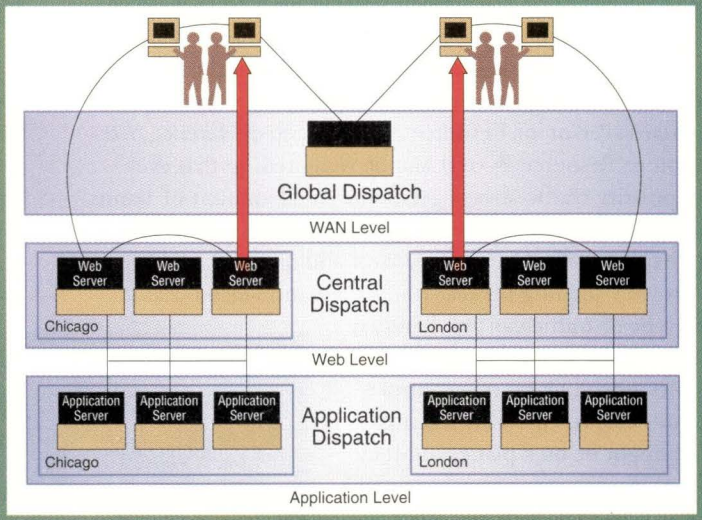
Rules of the Load

Load-balancing products typically allow the network manager to decide the rules for how traffic should be distributed, by providing a menu of performance algorithms, such as server load or response time. It might also allow a manager to decide even smaller gradations of performance, such as whether server load is defined as the number of concurrent sessions or the number of actual bits being handled per second. Response time might be measured by `ping` time (how long it takes for a single packet of data to make the round-trip to the server and back), or by the response time of the Web server application itself.

"If you just `ping` the server, it doesn't mean that the software is up and running. We try to contact the daemon to make sure it's alive. If not, the server is taken out of the pool," says Bill Kish, chief engineer for Coyote Point Systems, maker of the Equalizer load-balancing router.

Of course, you can also instruct a load balancer to distribute traffic in simple round-robin fashion–something you may want to do during the initial start-up phase, or when you've taken one server out for maintenance and now want to return it to the pool without overwhelming it with traffic.

If you have servers in different parts of the country, or around the world, you may want to initially route traffic based upon geographic proximity. Some load-balancing products offer WAN, as well as LAN, capabilities. For instance, Cisco Systems sells the Distributed Director, which looks at the



Among the load-balancer vendors is Resonate, whose Global Dispatch provides intelligent WAN-based scheduling to the optimal Point Of Presence (POP). Resonate Central Dispatch schedules all TCP services to the optimal server within a POP; and Resonate Application Dispatch schedules and prioritizes requests to the optimal application server.

domain names of the incoming packets and searches for the server or cluster of servers closest to that location. Once there, another Cisco load-balancing product–Local Director–routes the request to the most appropriate server based on several algorithms (such as number of connections or fastest response), which the network manager can specify.

Return to Sender

Load balancers don't all use the same methods for sending incoming IP requests to their ultimate destination. Some intelligent load balancers use DNS to direct incoming traffic to the appropriate server. Others may use different methods, such as Network Address Translation (NAT). NAT is an IP protocol that enables the LAN to maintain a larger set of IP addresses than is recognized by the outside world. Load balancers that use NAT must handle all address translations for incoming and outgoing packets.

Coyote's Equalizer load-balancing router distributes client requests across any number of back-end servers.

Alternatively, if only you want to load-balance your HTTP traffic–and not email, FTP or other types of IP traffic–then you might opt for a load balancer that uses HTTP-redirect, one of the methods used for distributing incoming requests. With HTTP-redirect, the load balancer selects a server and sends a message back to the client's browser with the address of that server. The client then connects to the chosen server directly. While transparent to the user, HTTP-redirect can often be slower than dedicated load balancers.

IntelliWeb Technologies, a start-up based in Berkeley, CA, offers yet another twist on load-balancing technology. Its product, IntelliWeb, uses a Java applet to push the work of load balancing onto the client. When a Web server is contacted by a browser, it sends a Java applet out to the client. That applet can then calculate which of the available servers is the most appropriate, basing the decision on geographic distance (converting the IP address of remote servers into longitude/latitude), by assessing server load via `ping` time or by looking at the number of server processes and available memory. Besides being unique in that it relies on a smart client, rather than a server, to make the decision, IntelliWeb is also unusual in terms of its price: You can download it for free at `http://www.intelliweb.net`.

Another issue to consider is whether you want the load balancer to control outgoing as well as incoming traffic. With unidirectional load-balancing products, incoming connections are handed off to a server and all future communication is between that server and the client; nothing goes back through the load balancer. Conversely, with a bidirectional approach–more commonly found in router-based load balancers–both incoming and outgoing packets flow through the gateway. Advocates of the bidirectional approach say it allows the load balancer to keep better tabs on the overall state of the traffic, both incoming and outgoing. Detractors say it has the potential to turn the load balancer into the network bottleneck, by forcing it to handle outgoing traffic, which is typically much larger in volume than incoming requests.

The early customers for load balancers and bandwidth managers are large ISPs, but analysts and vendors expect smaller ISPs as well as corporate Webmasters and intranet managers to soon become interested in these products.

"It's a process of education," says Check Point Software's Smith. "People know that they need a security solution, like a firewall, but they don't always realize that they need a bandwidth management solution. They're just now beginning to realize there are such products out there."

Eventually, however, the average Webmaster probably won't need to worry about shopping for a load balancer or bandwidth manager–not because the need for them will disappear, but because they'll simply become part and parcel of the networking infrastructure itself. While many of the current products come as software applications or stand-alone units, analysts believe that over the next few years the functions of bandwidth management and load balancing will be included in networking hardware such as routers and switches.

As IDC's Rainge predicts, "At this point, it's a discrete market. But in the future it will probably be absorbed into other network devices." ⊸

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.

Rack-Mount Enclosures for Sun Products

SharkRack has announced a new line of 19-inch rack-mount enclosures specifically designed for products from Sun Microsystems Inc. The rack-mounts fully enclose Sun products and come with hot-pluggable cooling units. The SharkRack modules can be placed within a standard 19-inch rack and mounted in any standard cabinet, the company says.

The product line includes SharkRack UniMount, SharkRack E3000, SharkRack E4000, SharkRack A5000, SharkSTOR and SharkKEY. SharkRack UniMount is designed specifically for use with Sun Ultra 1, 2, 5, 10, 30 and 60, SPARC 5, SPARC 20 and the StorEdge MultiPack. The SharkRack E3000 and E4000 are designed for use with Sun's E3000 and E4000 servers, respectively, and Sun's SPARCstorage Array 112 and 114 can use SharkSTOR. Sun's A5000 works with SharkRack A5000, while SharkKEY is designed for Sun's large keyboards.

The SharkRack enclosures are built with milled and sheet metal, which the company says provides the necessary

strength to protect Sun systems. Prices range from $792 to $6,500, depending on the model.

SharkRack Inc.
573 Maude Court
Sunnyvale, CA 94086
http://www.sharkrack.com
Circle 101

Performance Library for Small, Mid-Size LANS

ATL Products has announced PowerStor L500 DLT Library. It supports up to three DLT drives and 14 DLT cartridges in a single 7-inch high rack-mount, or 7-inch wide deskside enclosure. PowerStor L500 reportedly delivers 54 GB per hour of backup performance with a 490-GB storage capacity. An LCD control panel is provided to configure the library, manipulate the system's robotics and access status information.

PowerStor comes with several options, including a bar-code reader for inventory operations and WebAdmin software that allow systems administrators to access PowerStor locally or remotely using a Java-enabled Web browser. In addition, PowerStor L500 drives can be migrated to other higher performing, larger capacity ATL libraries.

PowerStor L500 DLT Library operates with any host platform supporting SCSI protocols, and is sold through OEMs and VARs. Contact vendor for pricing.

ATL Products Inc.
2801 Kelvin Ave.
Irvine, CA 92614
http://www.atlp.com
Circle 102

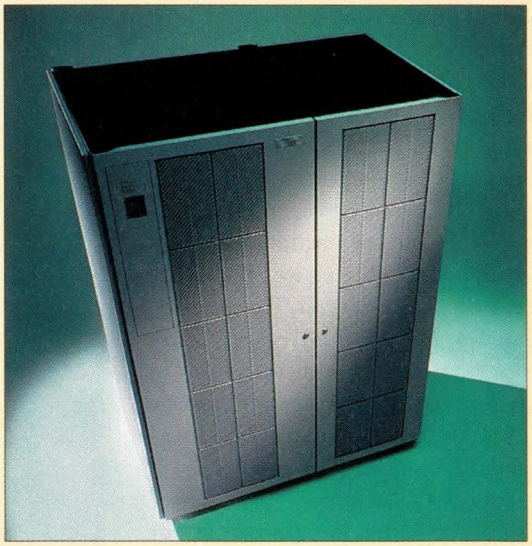
Network Analyzer for SunOS/Solaris

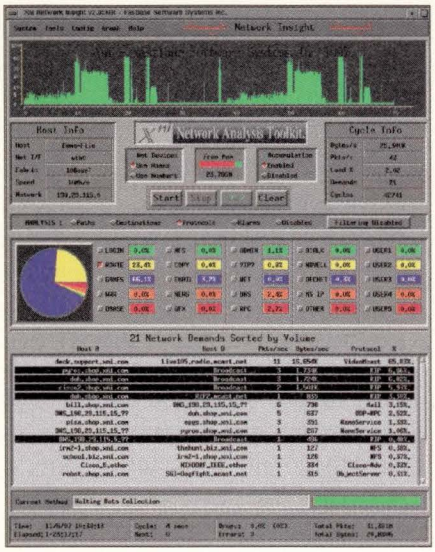
The Xni network analysis package from Fastlane Software Systems is designed to be a comprehensive, easy-to-

Hitachi Unveils High-Performance Storage System

With the capacity to execute 30,000 input/output operations per second and to store up to 3 TB of data, the Freedom 7700E storage subsystem from Hitachi Data Systems is designed to be one of the most powerful multiplatform storage subsystems on the market, the company says. The Freedom 7700E has 256 drive slots, and can be configured with any mix of three drives: 6.1-, 9.2- or 18.4-GB drives. The Freedom 7700E boasts a nonvolatile cache memory of 10 GB, as well as a FlashAccess option for binding frequently accessed data in the cache memory. It also includes a Shadow Image Copy feature, so users can duplicate production data, the company says. With the addition of Fibre Channel and Ultra SCSI support, the 7700E is now compatible with a range of connectivity options, including parallel and SCSI-2. Pricing for the Freedom 7700E starts at $135,000.

Hitachi Data Systems Corp.
750 Central Expressway
Santa Clara, CA 95050
http://www.hds.com
Circle 100





use solution for monitoring conversations between hosts in real time. It produces a graphical view of network usage and traffic flow without the heavy resource drain and limitations of SNMP/RMON tools or the dedicated hardware typically required of network analyzers, the company says.

Xni installs on any client workstation in minutes, is distributed as a single binary and requires no special configuration or user training, according to Fastlane. It records network traffic information on a continuous basis to create a complete picture of which hosts are using what network resources and how. This is said to give systems administrators the ability to easily identify high-bandwidth users, pinpoint the causes of network slowdowns, spot network intruders and collect the data needed to do chargebacks.

For administrators concerned with tracking Domain Name System (DNS) performance, Xni uses DNS to closely monitor DNS/BIND entries for hosts and reports all devices that have no DNS entry or result in a time-out. This indicates the presence of unauthorized users and makes it possible to spot the source of some network problems, Fastlane says.

Xni features on-the-fly HTML reporting that allows administrators to create reports on network traffic usage and view them from any machine using a standard browser. The software will automatically write reports on a schedule designated by the administrator and then transform them into HTML pages that can be accessed from any browser.

Additional software bundled with Xni enables a Xni-equipped workstation to function as a Web server, eliminating the need to copy report files onto a separate machine. Real-time data can be viewed from a Xni-equipped machine or from any machine running X Window System. It's priced at $4,995 per floating or node-locked license.

Fastlane Software Systems Inc.
1180 Miraloma Way, Ste. J
Sunnyvale, CA 94086
http://www.inetd.com
Circle 103

DEC Extends DLT Family

Digital Equipment Corp. has added a larger departmental tape library, the TL895 Automated DLT Tape Library, to its StorageWorks line. The TL895 supports up to 3.36 TB of storage (uncompressed), provides sustained transfer rates of up to 25 MB/s with five drives (uncompressed) and can handle up to seven drives. It features 96 data media slots and four I/O slots in a footprint of less than 0.5m^2. In addition, it comes with an integrated bar-code reader for automated media inventory and cataloging, DEC says.

The library reportedly allows users to integrate automated backup, archiving and hierarchical storage management (HSM) for departmental and enterprise operations. The TL895 DLT tape library costs $102,000.

Digital Equipment Corp.
111 Powdermill Road
Maynard, MA 01754
http://www.storage.digital.com
Circle 104

Multivendor Storage Solution

Emass has integrated storage technology from Sun Microsystems Inc. and IBM Corp. with its own to form Emass Storage Manager (EMS). Specifically, Emass has combined Sun's Ultra Enterprise Server, the IBM ADSTAR Distributed Storage Manager (ADSM) software and its own Automated Mixed-Media Libraries (AML).

Four configurations make up the ESM product line. The base configuration includes a Sun Ultra Enterprise 3000 with 72 GB of RAID storage, ADSM software and Emass AML/S library with 12 TB of native storage capacity using DLT7000 drives. All packages include a Sun server with ADSM software preinstalled, licenses for 100 ADSM clients, and the Emass library populated with four DLT7000 drives and media bays.

The ADSM software environment can be expanded by simply adding more client licenses. The Emass AML/S library is expandable to 27 TB, the company says. EMS is also available with the Emass AML/J library, a larger library that can support configurations of between 22 and 161 TB. Prices start at $299,900.

Emass Inc.
10949 E. Peakview Ave.
Englewood, CO 80111
http://www.emass.com
Circle 105

High-Speed CD-Recording for UNIX

Young Minds has announced the release of its third-generation CD-Recording system for UNIX, Mass Production Studio (MPS) 2. The MPS 2 CD-R system is designed for high-volume CD-Recording environments. Up to 100 CD-ROM disks can be premastered, recorded and printed per day,

the company says. MPS 2 comprises the MPS multiprocessor controller; premastering software, which formats the data-to-CD-R requirements; two 4x CD-Recorders; a media autoloader; and an inline printer. MPS 2 is compatible with major UNIX platforms, including Solaris, AIX, HP-UX, Digital UNIX, IRIX and SCO UNIX. Pricing starts at $47,100, depending on configuration.

Young Minds Inc.
1906 Orange Tree Lane, Ste. 240
Redlands, CA 92375
http://www.ymi.com
Circle 106

Three-Port Bridge/Routers

Zyxel Communications' Prestige 153 and 153X remote access routers are said to feature a combination of dial-in/dial-out capabilities designed for wide-area network (WAN) office applications–including LAN-to-LAN bridge/routing, Internet access routing and remote access routing for telecommuters who need to access the Internet or corporate intranet.

Prestige 153 provides remote access solutions for multiple local-area network (LAN) users by using one of three asynchronous WAN ports connected to an ISP or corporate intranet. The remaining two WAN ports can provide access for remote dial-in users. In addition, it provides PPP/MP and Bandwidth on Demand, which allows it to bundle all three asynchronous WAN ports to effectively triple the connection speed via PSTN or ISDN network dial-ups.

For leased or fractional T1/E1 lines, Prestige 153X has two V.35/RS-449 ports for asynchronous data transmission. Both models support IP and IPX multiprotocol routing and transparent bridging, and are compatible with enterprise-class routers from Ascend Communications Inc. and Cisco Systems Inc., among others.

The Prestige 153 Series WAN Bridge/Routers are managed through a menu-driven user interface that provides network management either locally or remotely via Telnet connections. Integrated Simple Network Management Protocol (SNMP) support is said to make it easy to manage with other connected SNMP devices within a corporate enterprise.

Security is ensured via Remote Authentication Dial-In User Services (RADIUS). The 153 Series also supports the password protection authentication protocol (PAP) and challenge handshake authentication protocol (CHAP). Pricing for the Prestige 153 Seriesstarts at $699.

Zyxel Communications Inc.
4920 E. La Palma Ave.
Anaheim, CA 92807
http://www.zyxel.com
Circle 107

Data Warehouse Tools

Sybase has introduced Warehouse Studio, a suite of tools for building data warehouse applications. The toolset comprises PowerDesigner Warehouse Architect, PowerStage, Adaptive Server IQ and Warehouse Control Center.

PowerDesigner Warehouse Architect offers warehouse design functionality. It supports relational, star and aggregated multidimensional schemas and can be used to create scripts to load the warehouse. PowerStage automates the extraction, transformation and cleansing of data from multiple operational sources. Adaptive Server IQ works as a decision support database and Warehouse Control Center is an English-language interface that allows database queries to be made without "complex coding," as well as a tool for capturing, synchronizing and managing metadata, the company says. It stores logical, physical and contextual metadata in a central repository, while synchronizing it with the query tools so users can access data using business terms rather than database nomenclature. Sybase Warehouse Studio is available on Solaris, AIX, HP-UX, Digital UNIX and Windows NT platforms. Contact vendor for pricing.

Sybase Inc.
6475 Christie Ave.
Emeryville, CA 94608
http://www.sybase.com
Circle 108

High-Performance Laser Printers

Lexmark International has added four monochrome printers to its Optra S printer line. The new laser printers offer four engine speeds–12, 16, 18 and 24 pages per minute. New features include a receive-only fax capability via the serial interface, an innovative TIFF Single Inline Memory Module (SIMM) for printing image files and an Optra-Image tool for copying.

To avoid printing bottlenecks, the Optra S printers include VR-4300, 64-bit MIPS RISC processor-to-high-speed PCI-bus MarkNet network adapters, advanced data management and optimized controller architecture. The Optra S printers continue to offer 1200-by-1200-dpi and a 1200 Image Quality mode.

All Optra S printers share the same optional memory, flash memory, hard drive, MarkNet network adapters, OptraImage solutions and a choice of 7,500- or 17,600-page capacity toner cartridges.

Lexmark's Optra S 1255, Optra S 1625, Optra S 1855 and Optra S 2455 cost $950, $999, $1,129 and $1,999, respectively. Network-ready printers,

which include 10BaseT/100BaseTX Ethernet adapters cost $1,240, $1,299, $1,439 and $2,350, respectively.

Lexmark International Inc.
740 New Circle Road N. W.
Lexington, KY 40511
http://www.lexmark.com
Circle 109

12,000-RPM Hard Drive

Hitachi America has designed a new 9.2-GB drive with an average read/seek time of 5 msec. Hitachi says the DK3E1 is well suited for disk array and server systems used to store and manage large amounts of information for online transaction processing, data mining and high-end audio/visual applications.

Hitachi claims the new drive delivers 50% greater performance (12,000 RPM) than conventional disk drives. The fast performance is achieved using 2.5-inch media, which allows designers to easily incorporate the DK3E1 in systems designed for earlier generation drives without any changes to the cabinet or power supply, the company says. The drive offers an internal data transfer rate of 27.3 MB/s and a choice of available external interface technologies, ranging from data rates of 10/20 MB/s for Fast SCSI 2 to 100 MB/s for Fibre Channel. System performance can be further improved with increased disk-to-system cache sizes from 512-KB to 2-MB with SCSI systems and from 1- to 4-MB with Fibre Channel drives, Hitachi says.

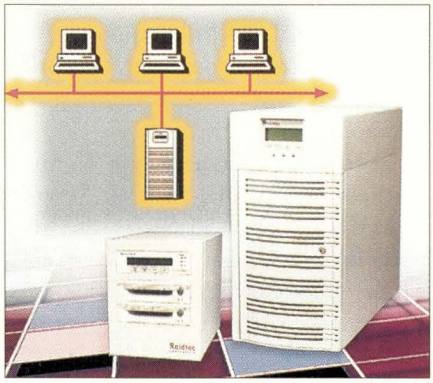
The first model to be released is the DK3E1T-91, which is a Wide Ultra 2 SCSI model. Pricing starts at $1,395. A Fibre Channel model will be available in October.

Hitachi America Ltd.
2000 Sierra Point Pkwy.
Brisbane, CA 94005
http://www.hitachi.com
Circle 110

Network-Attached RAID Storage

Raidtec has introduced a family of network-attached storage products based on "thin server" technology. Raidtec's RAIDserver is a high-performance direct network-attached fault tolerant storage solution that is compatible with all networks and accommodates both UNIX and Windows clients simultaneously on a LAN. RAIDserver is host independent and controlled in the background by a hardware-based RAID controller. It can be added to any 100-BaseTX or 10BaseT LAN.

Autoselection between Ethernet speeds is standard. Other features include support for RAID levels 0, 1 and 3/5, TCP/IP with SNMP management, Windows 95/NT client support with SMB and UNIX clients with NFS.



RAIDserver is available in three models: TFX, a tower configuration for up to 72 GB of usable storage which supports RAID 0, 1, 3/5; RDFX, an industry-standard 19-inch, rack-mount version expandable to hundreds of gigabytes which supports RAID 0, 1, 3/5; and RAIDserver M, a mini tower configuration for 4-, 9- or 18-GB requirements that supports RAID 0 and 1.

Pricing for RAIDserver starts at $3,195. RAIDserver is designed as a plug-and-play box that can be placed anywhere on the LAN. No additional network operating system license is required. Device management and configuration is possible via the Internet or intranet from a Web browser on either a UNIX or Windows client.

Raidtec Corp.
400 Overlook Business Park, Bldg. 12
1360 Union Hill Road
Alpharetta, GA 30004
http://www.raidtec.com
Circle 111

Console Manager Software Unveiled

Aurora Technologies' new ControlTower software is said to enable a single Sun Microsystems Inc. SPARC server to function as a common console (monitor and keyboard) for up to 128 managed systems. Any function that can be performed from a keyboard and display attached directly to a server can be performed from the console manager server, including monitoring log files, running diagnostics and rebooting a system, Aurora says. In addition, a time-stamped log of system messages from each managed system is maintained via the console manager to assist in monitoring and analyzing system problems.

Using ControlTower viewer software (included with the product), the console manager server can be accessed via a TCP/IP network or modem link. This enables managed systems in one or more physical locations to be monitored and administered from a remote location. The viewer software can be installed on more than one system to facilitate access from multiple locations, the company says.

ControlTower console manager software operates on a Sun SPARC (or compatible) server running Solaris 2.5+. Managed systems can be SPARC Solaris-compatible servers or any UNIX servers that support a serial-line console. Managed systems are connected to the host server via an RS-232 serial interface from the console port. The software must be used with an Aurora multiport serial controller to assure optimum performance and reliability.

Aurora ControlTower console manager software is sold under a host-ID license agreement. The User Edition supports up to 16 managed systems from one host system and is priced at $5,000, while the Standard Edition, which supports up to 128 managed systems from one host, costs $7,500.

Aurora Technologies Inc.
176 Second Ave.
Waltham, MA 02154
http://www.auratek.com
Circle 112

N-PLEX Global for Solaris

Isocor has announced the availability of N-Plex Global Version 2.0 for Solaris, a scalable, high-performance messaging server based on Internet standards. The server is Year 2000-compliant and capable of handling millions of users on the Sun Microsystems Inc. Solaris operating

system, Isocor says. It reportedly offers a distributed architecture for multiple server environments, extensive remote management capabilities, antispamming features, ease of administration and APIs for value-added applications.

N-Plex Global's distributed architecture supports millions of POP accounts and IMAP4 message store users over multiple servers, the company says. The message store allows for load balancing as well as distributed message processing and storage among multiple servers with single-domain addressing. Antispamming features offer full support for antirelay and access control features to secure against spam and "unfriendly" domains, as well as address verification using reverse DNS lookup via the Simple Mail Transfer Protocol (SMTP) to prevent SMTP spoofing. It also includes an extension mechanism to allow for customized spam filters.

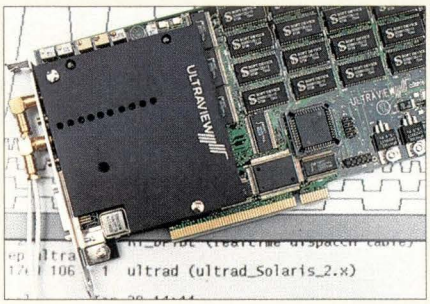
The product offers ease of management, centralized administration and Web-based management (Java applets) with features that include message store management facilities, performance monitoring, built-in security and remote administration of user accounts. N-Plex Global 2.0 is targeted at Internet service providers and large organizations with high-end messaging requirements. It runs on Solaris 2.5, Windows NT 3.51 and 4.0. Pricing starts at $35,000.

Isocor
3420 Ocean Park Blvd.
Santa Monica, CA 90405
http://www.isocor.com
Circle 113

PCI Boards for Sun SPARCstations

Ultraview has released a line of PCI bus data acquisition boards that are capable of operating in Sun Microsystems Inc.'s new PCI bus-based SPARCstations.

The ULTRAD-1280 series boards have been designed for high-speed, low-jitter operation in scientific, industrial, medical and defense applications. In addition to on-board analog-to-digital (A/D) and digital-to-analog (D/A) converters, all ULTRAD-1280 series boards have eight parallel TTL inputs, which can acquire digital data at the same rate,



and concurrent with, the A/D samples. Each board also has four TTL outputs, which can provide a high-speed stream of digital data vectors at the same rate as the D/A samples. Incoming A/D samples are automatically stored in the board's dual-ported 4 MB of RAM and D/A samples are automatically outputted from the same RAM software. The software, which is supplied with the ULTRAD-1280, allows waveforms to be displayed in Xview or to be continuously stored or retrieved from disk.

Also unique to the ULTRAD boards is their selective sampling and time-stamp function, in which a 31-bit time-stamp counter records the relative time positions of discontinuous A/D converter samples. A special TTL "Event" input allows a condition external to the ULTRAD board to start and stop the recording process.

The ULTRAD-1280 series boards run on PCI-based Suns, including the Ultra 5, 10, 30 and 60, as well as PCs running Solaris 2.6/Intel Corp. Platform Edition. Pricing starts at $3,695 for the AD1280DX (dual 12-bit 40-MHz A/D) and $4,395 for the ADDA1280DX (dual 12-bit 40-MHz A/D plus dual 12-bit D/A) and includes drivers for both Solaris 2.6 SPARC Edition and Intel Platform Edition.

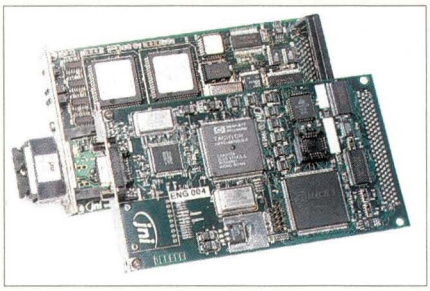
Ultraview Corp.
34 Canyon View
Orinda, CA 94563
http://www.ultraviewcorp.com
Circle 114

SBus-to-Fibre Channel Adapter Out

A new, 64-bit SBus-to-Fibre Channel adapter from Jaycor Networks offers data transmission speeds of up to 1.063 Gb/s, the company says. FibreStar is a single-slot card for workstations and file servers using the SBus internal bus architecture. The new 64-bit version offers twice the throughput of the existing 32-bit FibreStar adapter.

Jaycor offers two 64-bit FibreStar adapter models: FC64-1063-C1 and FC64-1063-NOI. The Model FC64-1063-CI has a built-in interface for copper cables and the Model FC64-1063-NOI has a built-in interface for fiber-optic cables. These interfaces take the place of removable modules, making the adapter easier to install, Jaycor says.

The 64-bit FibreStar comes with software that enables the SBus adapter to support Fibre Channel fabrics (switches) as well as network and data storage equipment using the Fibre Channel Class 2 connection mode. The fabric support allows the SBus adapter to work with switches from all leading manufacturers, and ensures that data moves at full speed between CPU and network-attached devices such as RAID systems.



FibreStar supports all Fibre Channel connection modes, including Class 1, Class 2, Class 3 and Intermix. It can handle data over point-to-point, arbitrated loop and switched network topologies. FibreStar supports Solaris 2.4, 2.5 and 2.6. FibreStar Model FC64-1063-CI costs $3,150 and FibreStar Model FC64-1063-NOI costs $3,675.

Jaycor Networks Inc.
9775 Towne Centre Drive
San Diego, CA 92121
http://www.jni.com
Circle 115

Memory Kits for Sun Ultra 5, 10

Kingston Technology has introduced high-capacity memory kits for Sun Microsystems Inc.'s Ultra 5 and Ultra 10 workstations. While most workstations typically ship with only 64 MB of

removable memory installed, both the Ultra 5 and Ultra 10 workstations have four sockets (two banks of two modules each) and with the correct combination of Kingston memory, may be powered up to 1 GB for the Ultra 10 and 512 MB for the Ultra 5, the company says.

The 64-, 128-, 256- and 512-MB kits are guaranteed to be 100% compatible with Sun's Ultra 5/10 hardware, software and diagnostics. All products include a lifetime warranty.

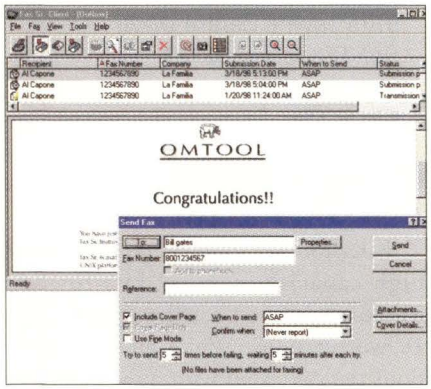
Pricing starts at $330 for the 64-MB memory upgrade kit, at $715 for the 128-MB kit, at $1,415 for the 256-MB kit and at $2,785 for the 512-MB kit (available for Ultra 10 systems only).

Kingston Technology Co.
17600 Newhope St.
Fountain Valley, CA 92708
http://www.kingston.com
Circle 116

Low-Cost, Long-Distance Faxes with Fax Sr.

Omtool has introduced Fax Sr., a network and Internet faxing tool for Solaris. Fax Sr.'s client/server design makes it possible for any desktop client, including those running Windows or Mac OS, to send a fax. An unlimited number of users and modems can be supported from a single SPARC machine, the company says. Additional users, servers and lines can be added to Fax Sr., which automatically performs outbound load balancing.

Because the product integrates with SMTP email, users can send and receive faxes and email from a universal inbox, such as Netscape Communications Corp. Mail, Qualcomm Inc. Eudora, Lotus Development Corp. Notes and Sun Microsystems Inc. Mail.



The software routes faxes between servers over a private WAN or the Internet, making long-distance faxes cost as little as a local phone call. Pricing for Fax Sr. starts at $1,995.

Omtool Ltd.
8 Industrial Way
Salem, NH 03079
http://www.omtool.com
Circle 117

Conferencing Software for Solaris

White Pine Software has introduced MeetingPoint Conference Server for Sun Microsystems Inc.'s Solaris. MeetingPoint reportedly enables multipoint group conferences between users of the International Telecommunications Union (ITU) H.323 standard for conferencing over packet networks. It works with H.323 clients such as Microsoft Corp. NetMeeting, Intel Corp. ProShare, PictureTel Corp. LiveLAN and White Pine's CU-SeeMe.

MeetingPoint allows users to communicate via video, audio, whiteboard and text chat. Its Web-based GUI allows network administrators to manage multiple simultaneous servers and conferences and to limit how much bandwidth is being consumed by conferencing services, the company says. MeetingPoint can handle small videoconferences to large-scale interactive cybercasts, and is also capable of handling multicast broadcasts. MeetingPoint for Solaris is priced at $5,995 for a 10-user license. A Windows NT version is also available at $3,995 for a 10-user license.

White Pine Software Inc.
542 Amherst St.
Nashua, NH 03063
http://www.wpine.com
Circle 118

Multiplatform Development Environment

Passport's IntRprise 1.2 is an object-oriented application development environment for creating multitier client/server applications that can be deployed on UNIX (including Solaris), Windows and Java platforms.

IntRprise includes various tools for developing and deploying applications, including a Visual Logic Editor, which enables developers to view and modify the logic of any object, and the RapidApp RAD (Rapid Application Development) tool, which enables a developer to generate applications without needing to write code, the company says. Passport's IntRprise is said to make it possible for corporate developers to reuse code from existing C, C++ or COBOL programs by linking those applications to the new target environment, whether it's Solaris 2.6, Windows NT or some other platform. Because IntRprise allows for a wide range of granularity for components, an entire COBOL application or a single message passed between objects can be treated as a single component, the company says.

Clients equipped with a Java-enabled browser can access an IntRprise application by downloading the Passport Java Presentation Applet, which provides the user interface and handles communication with the application running on the server. IntRprise does not over-tax network bandwidth, according to Passport, because communication between client and server involves only small messages required to project the application to the desktop, with the processing actually done on the server.

Version 1.2 includes new features such as the addition of a network monitor and manager for conducting automatic load balancing and failover, and tools for version control and application distribution. IntRprise's open middleware interface is designed to work with third-party middleware products such as Momentum Software Corp.'s XIPC, BEA Systems Inc.'s Tuxedo or any Remote Procedure Call (RPC) interface. Pricing for IntRprise 1.2 starts at $8,995.

Passport Corp.
Mack Centre III
140 E. Ridgewood Ave.
Paramus, NJ 07652
http://www.passportcorp.com
Circle 119

CORRECTION

In "High Toll for Internet Traffic," Page 46, April 1998, the correct URL for NetReality is *http://www.nreality.com,* and the correct address for NetScout Systems Inc. is 4 Technology Park Drive, Westford, MA 01886.

Upgrades, Enhancements, Additions...

■ Open Systems Management has launched Version 2.0 of COSbatch, its UNIX batch scheduler and background job management software. New features include networkwide job submission and control, high availability and comprehensive calendar facilities. COSbatch does not rely on `cron` and makes job submission straightforward using a simple queuing concept using variables such as priority, execution time limit or user notification on completion, the company says. Using the command-line interface, batch job scheduling can be integrated with applications such as database applications. Users can submit and control jobs from any machine running COSbatch anywhere on the network. COSbatch 2.0 is part of COSMOS, the company's suite of systems management applications. It can function either as a stand-alone product or can be seamlessly integrated with other COSMOS modules. COSbatch 2.0 runs on most major UNIX flavors; pricing starts at $750. **Open Systems Management Inc.**, 1111 Third Ave., Ste. 2500, Seattle, WA 98101, *http://www.cosbatch.com.* **Circle 120**

■ RTS Software has introduced Release 3.0 of RTS Service Suite, formerly known as Business First. This latest release adds four new applications: RTS Remote, RTS Mobile, RTS Support and RTS Report. RTS Remote and RTS Mobile improve field communication. Remote is a Web-enabled extension of the company's RTS Call dispatching software, and Mobile extends to a wireless environment, the company says. RTS Support is said to deliver a call management solution designed to address the needs of an external support organization. RTS Report includes a set of predefined field service reports along with a set of Business Objects database schemas that allow users to develop ad hoc reports. RTS Service Suite runs on Microsoft Corp. SQL Server and Oracle Corp. Oracle RDBMSs and supports Solaris and Windows NT/95/3.11 clients. Pricing starts at $200,000 per individual application. **RTS Software Inc.**, 1601 Trapelo Road, Waltham, MA 02154, *http://www.rtssoftware.com.* **Circle 121**

■ GraphOn has released a new version of its thin-client X server for Java-enabled displays. GO-Joe 2.0 provides access to UNIX/X applications without requiring software rewrites or a fat X server on the desktop. This new version, which is now shipping on Sun Microsystems Inc.'s latest Netra j CD-ROM distribution, reportedly employs GraphOn's unified server, which drives all GraphOn thin clients. It supports SunOS, Solaris, HP-UX and OpenServer. In addition, support for AIX and Digital UNIX machines has been added with this release. GO-Joe is built on a multitier thin client/server architecture with application processing on the UNIX host and graphics displayed via a small applet (under 300 KB) on the display. Using GraphOn's RapidX protocol, GO-Joe fits into existing environments that can include all types of communication pathways and computer environments. GO-Joe's server software is multiuser, fully scalable and centrally managed. Pricing for GO-Joe 2.0 starts at $295 per seat. **GraphOn Corp.**, 150 Harrison Ave., Campbell, CA 95008, *http://www.graphon.com.* **Circle 122**

■ SoftTech Solutions continues to enhance its On-Line! Detective for Sun. Release 8.0 for workstations, and 5.0 for servers, includes a new module for troubleshooting techniques that includes information on using a dumb terminal or laptop, troubleshooting a blank screen and troubleshooting Ethernet problems. On-Line! Detective helps determine whether a system problem is hardware-, software- or network-related. On-Line! Detective runs on Solaris and Windows 95, 97 and NT. It will load on Sun Microsystems Inc. workstations, servers, PCs and laptops. The tool is sold individually or in multiple-user packs. A single unit investment begins at $1,995 with a $495 annual subscription fee. A demo of the the product can be ordered from SoftTech's Web site. **SoftTech Solutions Inc.**, 3525 Elizabeth Lake Road, Ste. A, Waterford, MI 48328, *http://www.stsolutions.com.* **Circle 123**

■ JVC Professional Computer Products Division has announced it has enhanced its 200- and 600-disk capacity CD-ROM libraries to produce sustained data transfer speeds that are four times faster than earlier versions. Models MC-1200 (200 disks) and MC-1600 (600 disks) now feature a 32x speed CD-ROM reader, an improvement on the 8x speed reader previously available with these systems. This is said to enable the libraries to transfer data at 4.8 MB/s. In addition, the new readers reduce average data access time from 115 to 85 msec . Buffer capacity is also doubled to 512 KB. Model MC-1200 costs $10,395 and Model MC-1600 costs $16,095. **JVC Professional Computer Products Division,** 5665 Corporate Ave., Cypress, CA 90630, *http://www.jvc.net.* **Circle 124**

■ Netect has announced Netective, a scanning application that searches for vulnerabilities in a network's security. Netective scans a network for potential trouble areas and produces a report offering either patches or corrective actions for any problem areas, the company says. Netective is designed to identify and resolve security problems at both the operating system and network level, and monitors system files for unauthorized changes. Netect reportedly provides ongoing security updates over the Internet to ensure that users are protected from the latest known threats. Netective is free from the company's Web site. **Netect Inc.**, 212 Northern Ave., West 1, Ste. 300, Boston, MA 02210, *http://www.netect.com.* **Circle 125**

■ Netscape Communications Corp. has added Netscape BuyerXpert 1.0 software to its CommerceXpert product family. BuyerXpert is an Internet application that automates the process of purchasing goods and services for businesses. With BuyerXpert, businesses can manage supplier catalogs, and employees can order supplies via a Web browser as well as manage internal approvals for purchases, the company says. Netscape BuyerXpert enables customers to use and extend their existing business systems, such as Oracle Corp. SAP R/3, for order-entry, price updates and similar tasks. It provides mapping tools for translation to most enterprise resource planning (ERP) or electronic data interchange (EDI) systems. Also, it conforms to the Open Buying on the Internet (OBI) standard and EDI Internet Integration standard. It is available on Solaris and costs $250,000 for a two-CPU system. **Netscape Communications Corp.**, 501 E. Middlefield Road, Mountain View, CA 94043, *http://www.netscape.com.* **Circle 126**

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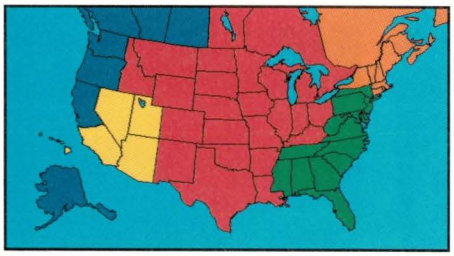

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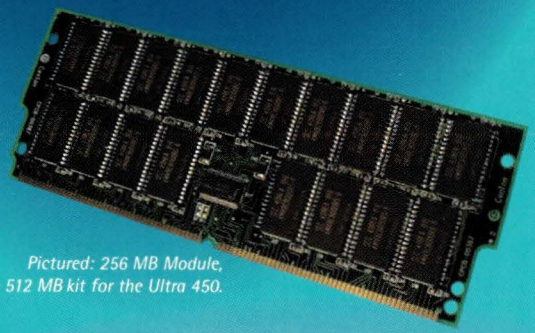

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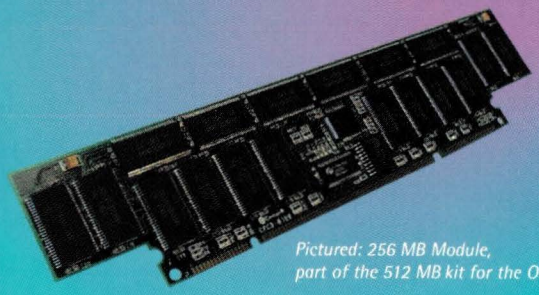

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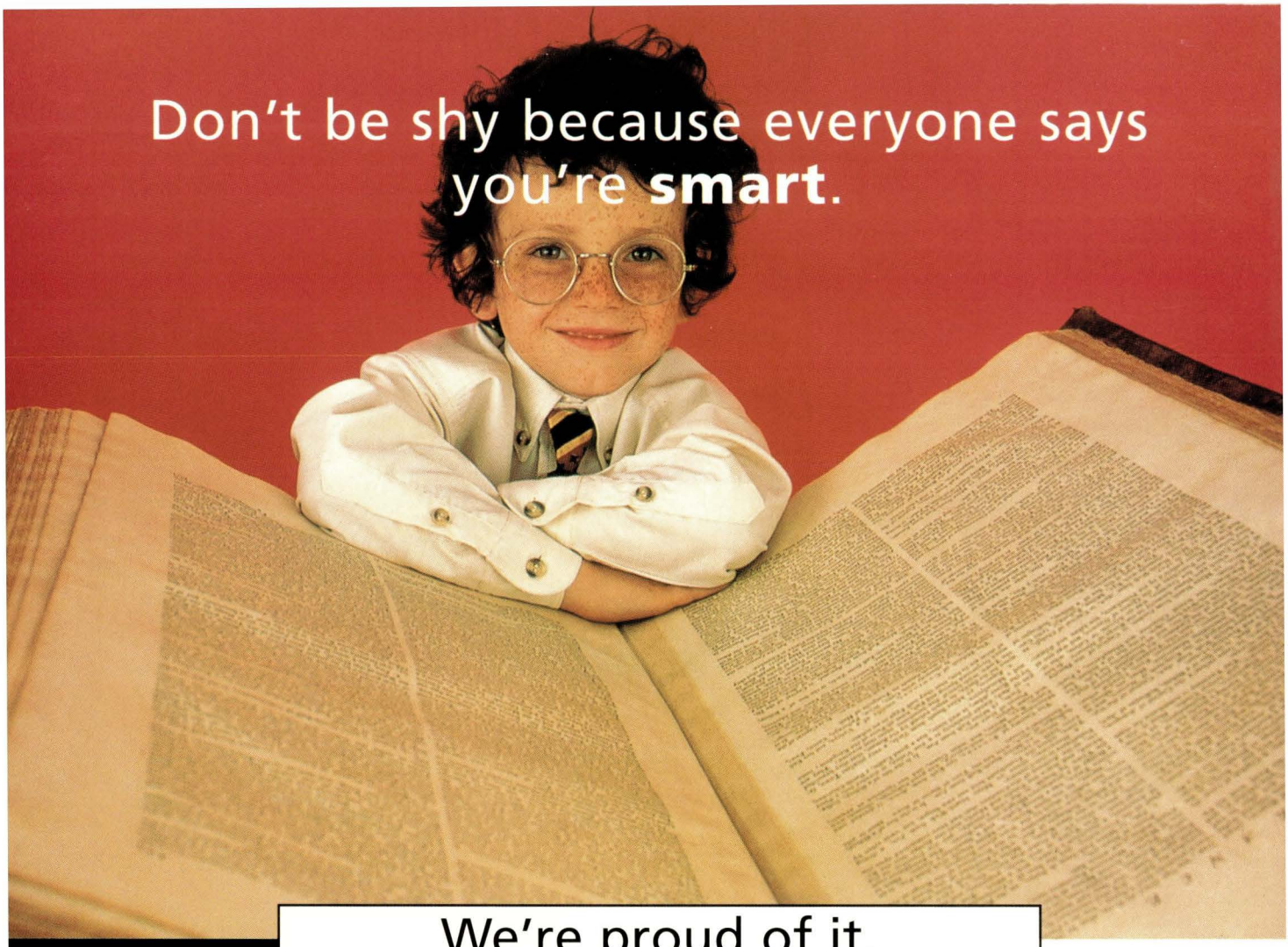

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