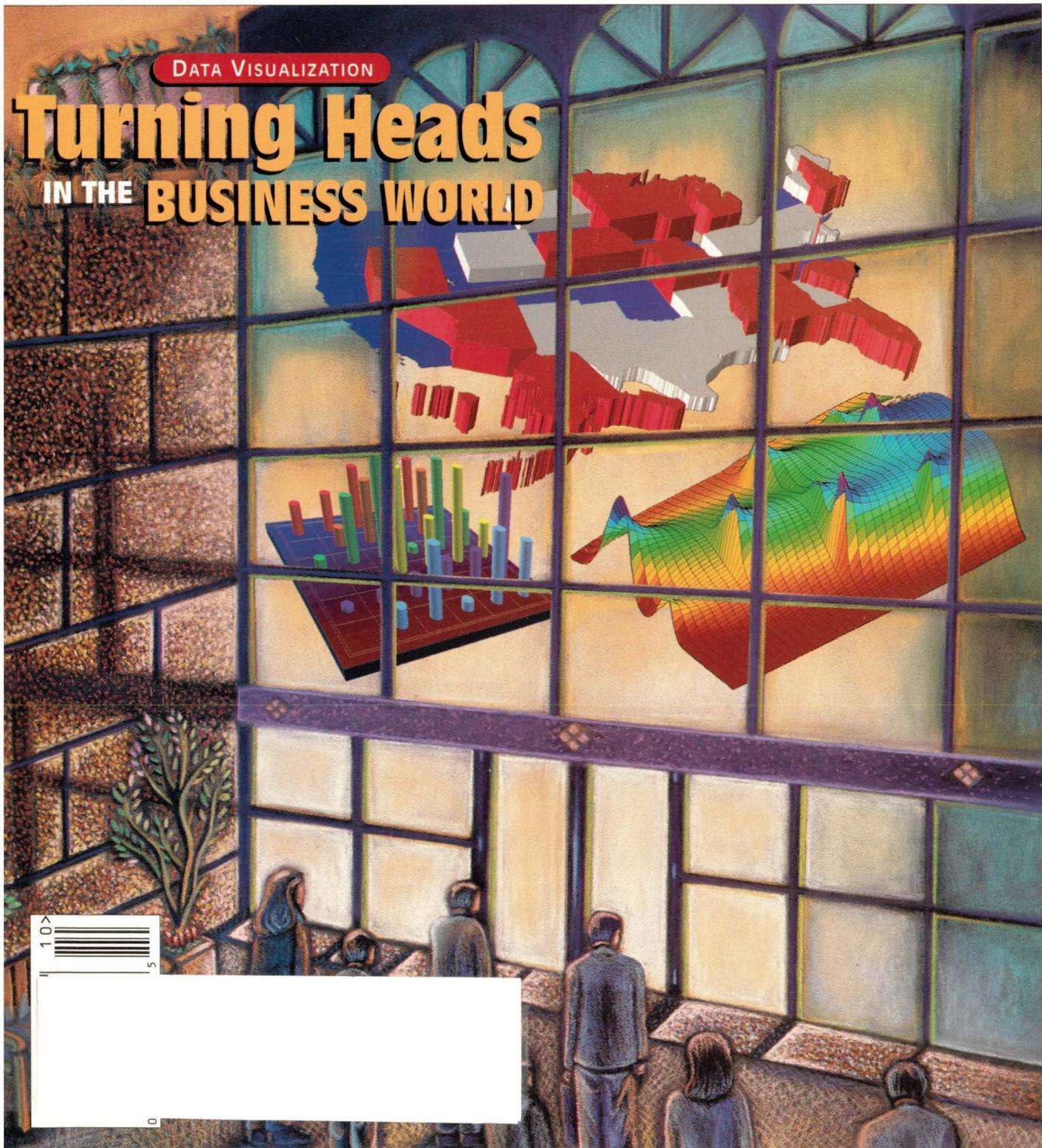


# SUNEXPERT

The Server/Workstation Magazine for UNIX/NT IS Managers

DATA VISUALIZATION

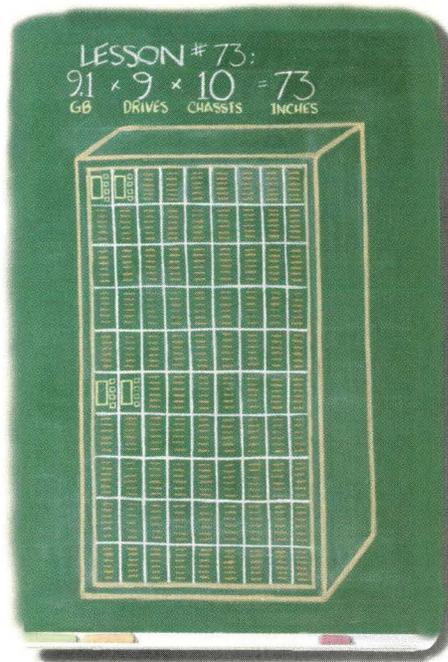
## Turning Heads IN THE BUSINESS WORLD



Survey: Visualization Software

Review: HP's LaserJet 6MP

# Artecon's New RAID Math



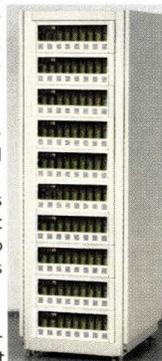
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# SUNEXPERT

The Server/Workstation Magazine for UNIX/NT IS Managers

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*Alex Simeonides, Staff Editor*

Bolstered by more powerful desktop systems, better user interface design and the desire to tap the vast stores of corporate data accumulated over the years, business analysts turn to data visualization software.

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*Compiled by Maureen McKeon*

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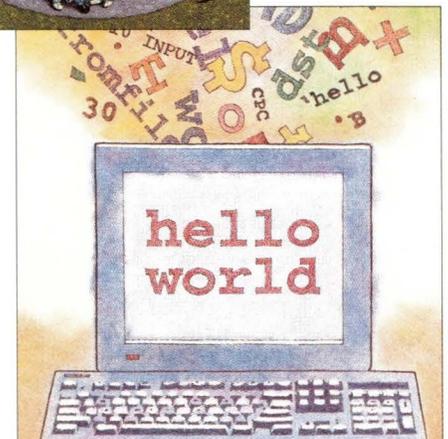
There's a neat little tool for detecting problems in *etc/group*.

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Cover illustration: Kristina Weiss  
Graphic images courtesy of: Graphic Intelligence Corp., Visible Decisions Inc., Conceptual Reality Presentations Inc.



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Material for publication should be sent to the attention of Doug Pryor at the above address or electronically mailed to dpryor@cpg.com. Letters sent to the publication become the property of the publication and are assumed to be intended for publication and may be used so. SUNEXPERT Magazine is not sponsored or endorsed in any way by Sun Microsystems Inc. All information herein is believed to be accurate to the best of our ability.



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HP's LaserJet 6MP and JetDirect EX Plus partner for an excellent personal or group printing solution.

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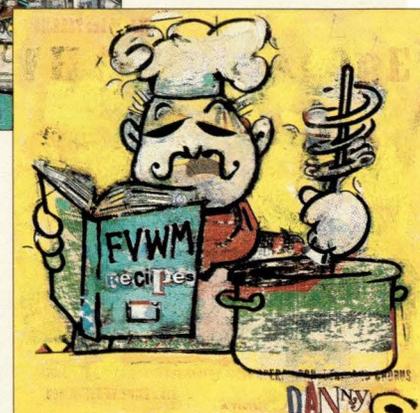
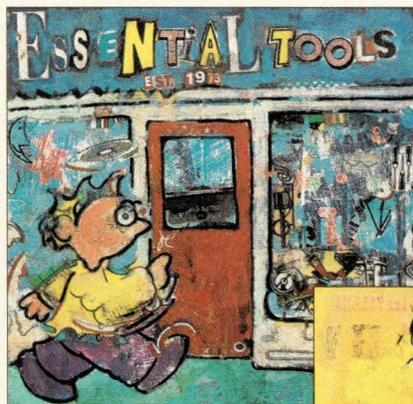
Amazingly enough, many users remain unfamiliar with these indispensable tools.

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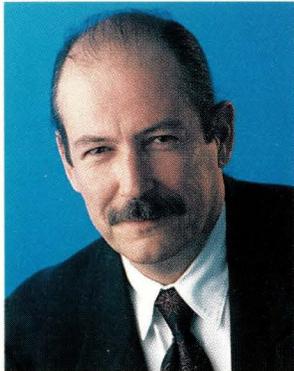
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# EDITORIAL

dpryor@cpg.com



## Oops

I would like to thank Robert Sansom, vice president, architecture, Fore Systems Inc., for calling our attention to a gotcha in the September issue. It occurs in the cover story, "Heavy Traffic Shifts Networks into Switched Gear," by Paul Korzeniowski. We have to plead guilty to perpetuating the myth that ATM to the desktop requires some infrastructure rewiring. As Robert points out, "The ATM Forum completed a specification for ATM at 155 Mb/s over UTP Category 5 wiring more than three years ago. And Fore has been shipping these products for more than two years." Of course, the article's main thrust is that ATM doesn't seem to have much of a presence on the desktop despite the hoopla of three or four years ago. ATM debates continue.

This month, Staff Editor Alex Simeonides revisits a topic that *SunExpert* has covered many times since our inception in 1989—data visualization. Once a meat-and-potatoes application of the scientific/engineering set, visualization products and their users have changed dramatically in these few years. As you'll see in the cover story, "Turning Heads in the Business World," Page 56, this software category is being redefined by a whole new crowd of users—data miners, OLAP users and even CEOs. Alex says, "Companies that have not traditionally catered to business users, that is, those whose products require a certain technical sophistication, are also making an effort to render their goods more accessible to a business market."

She also points out that while many engineers enjoy the challenge of a stripped-down graphics engine and programming language, business users accustomed to office productivity packages that may include a spreadsheet won't spend more than a few minutes trying to learn how to use this kind of tool. Many visualization software vendors have recognized this proclivity and are bridging the gap with targeted, bullet-proof applications designed for a particular business segment.

Be sure to check out this month's market survey "A Sampling of Visualization Software," Page 66, compiled by Research Editor Maureen McKeon.

*Doug Pryor*

Incorporating RS/Magazine

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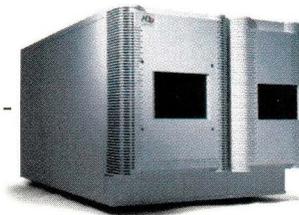
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## Solaris for Intranets Takes Aim at NT

With the official release of Solaris for Intranets, the first of several “modular” Solaris components slated to be announced over the next six months, Sun Microsystems Inc. shows that the company has a bead on Microsoft Corp. and Windows NT in the corporate enterprise.

year subscription for upgrades. A renewal notice is sent out by Sun to notify customers when a subscription is about to expire.

Formally called the Sun Solaris Server for Intranets, the latest software addition to the new version of Solaris is positioned by Sun as “Solaris for Intranets, [which] combines the best of

main trend here is that Sun continues to launch salvos at Microsoft and Windows NT, as both companies clamber for the hearts, minds and desktops of the corporate intranet. Time will tell whether users continue to bank their mission-critical and other applications on Windows, or implement and establish Solaris as the operating environment of choice for running their intranets—or if they will do both. Of course, Solaris already underlies many intranets, but it’s no secret that Windows 95 and NT are the mainstays of business, at least for now.

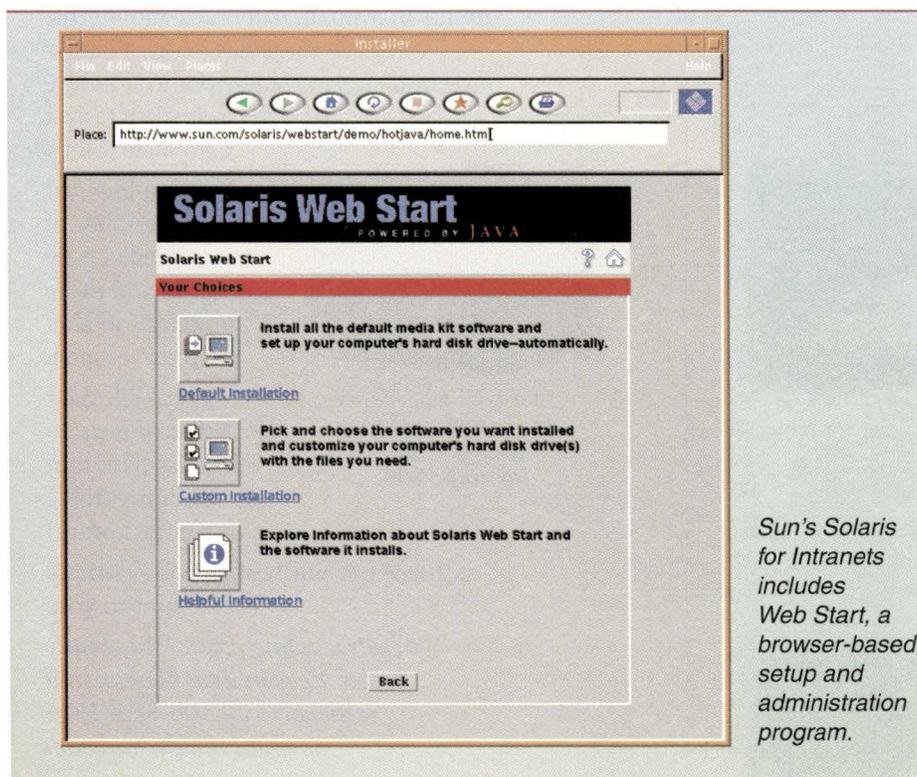
This is despite the fact that Solaris is cheaper than NT. And, of course, Sun has been shipping an Intel Corp. micro-processor-based version of Solaris for a couple of years now in addition to its SPARC editions.

The base-level Solaris 2.6 for five users costs \$695, compared with \$799 for NT. With the Intranet Server, Solaris costs \$1,290, and NT costs \$1,799. The new version is downwardly compatible with previous Solaris versions, which are a subset of the new OS.

SunSoft officials point out the historical shortcomings of NT. “One misconception is that UNIX is hard to administer,” says Sanjay Sinha, marketing manager for Solaris at SunSoft, “but we’ve eliminated that with one-button installation and point-and-click administration, all through the browser interface. And Microsoft is touting Windows NT 5.0’s very fast rebooting capability, and that’s not necessarily good.”

It’s true that frequent rebooting is not technically favorable in the corporate intranet. Rebooting invariably causes at worst a loss of services for a period of time, and at best a small dollar sum in lost productivity. What’s more, Solaris network services such as RPC, NFS and HTTP can be configured online without rebooting, even when remotely administered.

Industry analysts tend to agree that



*Sun's Solaris for Intranets includes Web Start, a browser-based setup and administration program.*

In August, SunSoft introduced Solaris for Intranets, which ships as part of the base Solaris operating system and provides the foundation for subsequent Sun Solaris component-oriented releases. The product is also part of Sun’s new subscription pricing scheme, available through standard channels, which lets users purchase Solaris and receive a two-

Solaris and the best of PCs to achieve seamless Windows NT interoperability, unmatched performance and maximum uptime.”

While they tout its primary features, SunSoft officials also do not hesitate to compare Solaris 2.6 with Windows NT, in terms of ease of use, reliability, scalability, performance and even price. The

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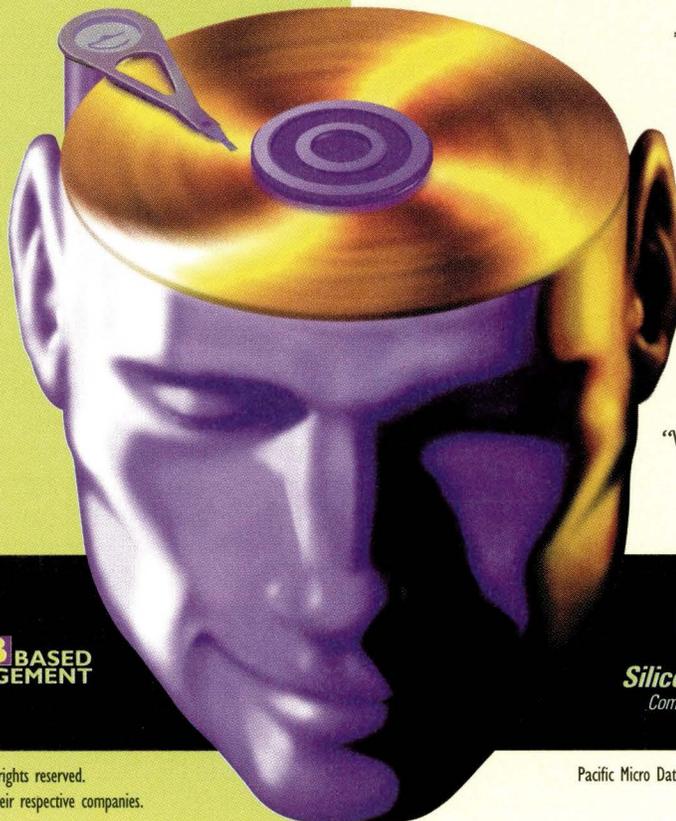


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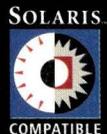
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Solaris is a superior operating environment for the enterprise, due to its stability and many features that let it interoperate seamlessly with Windows, Macintosh and other clients and networks.

"Solaris for Intranets is the software side of a multifront strategy by Sun to compete at the midrange with NT," says Robert Dorin, senior analyst at The Aberdeen Group, Boston, MA. "The enterprise computing features in Solaris are definitely better than NT's. Where Sun faces the challenge is they have to prove they have a product that the enterprise IS manager needs to bring into the company in volume. They [IS managers] definitely want Windows NT in the company, and there's no way they will stop buying Windows. Where Solaris is and should continue to be strong is in the back end."

According to SunSoft data sheets, Solaris works with native or existing network configurations such as Server Message Block protocol, Novell Inc. NetWare or Apple Computer Inc. AppleShare, and NFS lets users share files between Windows PCs and Solaris,

provided that Sun's NFS client is installed on the PC.

The primary components of Solaris for Intranets include:

- SunLink, which connects Solaris to Windows and Windows NT, NetWare, Macintosh and OS/2 systems.
- Web Start, a browser-based setup and administration program.
- Sun WebServer, Sun Internet Mail and SunScreen SKIP. The latter is Sun's high-end security software.
- Solaris Server, the underlying server operating system.

By allowing users to connect to the other operating environments and work with diverse clients, SunSoft presents a strong case for the use of Solaris as the hub of an enterprise network and intranet. And using Sun's Solstice AdminSuite, a set of tools for administering intranets scheduled to be introduced in the next several months, network administrators can perform account management, host management, group management, administrative data management, printer management, file system management and disk management, in addition to remote administration features.

SunSoft also states that Solaris for Intranets, while not including optional High Availability (HA) 1.3 software and HA data services (which can be purchased separately), is "cluster ready." The HA software and HA Netscape Services are a part of Sun's previously discussed Full Moon project, slated to deliver a full, single-system image cluster functionality to the Solaris platform. This is scheduled for release with cluster systems in a number of phases over the coming year or so.

Also, according to SunSoft, "WebNFS, a distributed file system, extends NFS to work over the intranet by using a Web convention, the NFS URL. This lets Java and Web-aware applications easily access a file anywhere on the Internet and allows site managers to export file systems onto the Internet in a secure manner. Remote file directories can be viewed on the client computer as a seamless extension of the client's local hard drive."

While all the new and enhanced features are impressive, Sun should use care in its treatment of Microsoft and Windows, says Aberdeen's Dorin, instead of

## NCR Adopts Solaris

In Scott McNealy's view of the market, the computer industry is now down to two operating systems: Solaris and Windows NT. In August, NCR Corp., Dayton, OH, reinforced the Sun Microsystems Inc. CEO's notion of a "Coke and Pepsi" world when it announced that it would sell and support Solaris on its Intel Corp. chip-based NCR WorldMark servers.

For the time being, the Sun-NCR agreement gives NCR customers a choice of two operating systems: Solaris or MP-RAS (Multiprocessing, Reliability, Availability, Serviceability), NCR's own UNIX operating system. MP-RAS, as the acronym implies, is optimized for large sites that require performance and reliability. However, with the promised release of 64-bit microprocessors from Intel Corp., scheduled for late 1998, Solaris will really come into play for WorldMark customers. By 1999, Solaris, unlike MP-RAS, will be a fully 64-bit operating system, able to take advantage of the increased address space of the new chip.

So this deal can be seen as NCR buying into a 64-bit strategy. But analysts say that the advantages to NCR don't stop there. "There are potentially an overwhelming number of benefits for NCR," says Robert Dorin, senior analyst at The Aberdeen Group, Boston, MA. Name recognition, for one: Clearly, Solaris has greater market share than MP-RAS.

Applications, for another: NCR customers running Solaris will have access to the hundreds of applications written for the Sun operating system (granted, not as many applications are ported to Solaris x86 as to Solaris SPARC).

As part of the deal, NCR will share some of the advanced technologies found in its MP-RAS operating system with Sun, for potential inclusion in Solaris. Given the reliability focus of MP-RAS, analysts suspect that any technology transfers between the two companies will revolve around those functional categories.

For Sun, though, the real benefits of the agreement are less tangible. An affiliation with NCR is a status symbol. "NCR has been selling into the enterprise for a long time," says Dorin. Compare this with Sun, which—marketing assertions to the contrary—has only become a player in the enterprise server space in the past couple of years. "NCR is validating the fact that Solaris is a valid enterprise platform," Dorin says.

Not only is NCR saying that Solaris is good enough for its customers, it is saying that it is good enough for its customers running Intel, traditionally the bastion of the Microsoft Corp. OS. So if, according to Dorin, in the next couple of years we witness an informal consolidation of the myriad UNIX platforms, Solaris will stand a good chance of becoming the heir to the UNIX empire.—as



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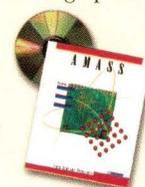
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**Circle No. 14**

continuing to fuel the current verbal jousting between the companies, because corporate buyers want an ally to Windows, not an adversary.

"These people are using Word, PowerPoint, etc., and Sun has a reputation as being a technology company. They [Sun] need to sell not by bashing Microsoft, but based on solutions and the ability to coexist with NT...Solaris has features that support Windows and Mac clients, and the average IT manager doesn't want to buy products from a company that hates Microsoft." —*jsw*

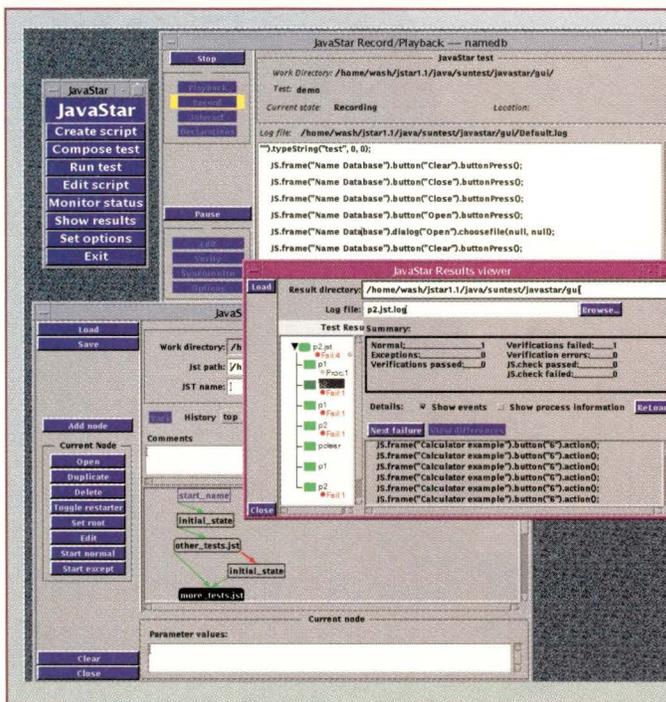
## Sun Division Devotes Itself to Testing Java

SunTest had been laying low within Sun Microsystems Inc. for about a year. In August, it surfaced in a big way, announcing its existence, a suite of Java testing tools and its first customer—IBM Corp.

The new suite of testing tools fills a void in the Java marketplace, says Joseph Ols, manager of marketing for SunTest. Whereas there are hundreds of testing tools devoted to applications written in C and C++, none of these are particularly well-suited to testing platform-independent Java programs. In fact, because traditional tools test executables at the operating system level, testing must be repeated for each and every platform that you want to support. Conversely, SunTest's Java testing tools are themselves written in Java and therefore operate at the level of the virtual machine. Theoretically, then, results are platform-neutral.

There are three new testing tools: JavaStar, a GUI testing tool; JavaSpec, for testing Java programs through their APIs; and JavaScope, which measures how thoroughly a given Java program has been tested.

The GUI-testing JavaStar corresponds to what most people think of when the subject of testing tools comes up: a tool that tests a program from the perspective of the end user. As such, JavaStar allows users to record test scripts simply by interacting with the program—the scripts are generated



*JavaStar, one of three new testing tools launched by SunTest, is a GUI testing tool that tests a program from the perspective of the end user.*

automatically. Also, Ols points out, the scripts themselves are generated as pure Java code—not an obscure proprietary scripting language. Programmers, therefore, do not have to learn a new language and can integrate the scripts directly into their Java debugging environments.

JavaSpec, on the other hand, tests components of a Java program that are not GUI-related. SunTest recommends JavaSpec in the event that a program does not have a GUI (Java servlets, for example), or as a complement to testing with JavaStar.

Finally, JavaScope provides insight into how much, and which, code has been tested. Code coverage is measured through branch, method, logical and relational metrics. According to Ols, this is the first such tool to appear in the Java marketplace.

IBM, meanwhile, has licensed the three tools for its internal Java development teams. However, the company also announced that it will make the tools available to developers using the IBM Validation Centers for Java, as they prepare their applications for 100% Pure Java certification.

JavaStar, JavaSpec and JavaScope are all available from SunTest's Web site, <http://www.suntest.com>. Pricing is set at \$1,995, \$1,495 and \$495, respectively. Also available at

the Web site are JavaPureCheck and JavaSpin, two free Java tools used in the 100% Pure Java certification process.—*as*

## Sun Acquires Info Appliance Vendor

With its August acquisition of all the outstanding shares of capital stock of Diba Inc., an information appliance vendor, Sun Microsystems Inc. looks to add a chunk of the home market to its arsenal of recent business-oriented product introductions—including high-availability servers and storage products, SMP systems, Java and Java-related software and hardware, even a Java-based SmartCard product. All of this verifies that the company wishes to be much more than a powerful UNIX desktop and operating system vendor.

Information appliances are computer-based devices such as financial assistants, Web browsers for standard television sets, email/fax phones and personal travel assistants. With its experience in this area, what does Diba bring to Sun's formidable enterprise computer lineup? For one thing, Diba is at the forefront of the information appliance marketplace.

At the company's core is an open,

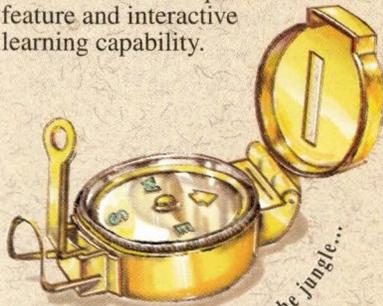
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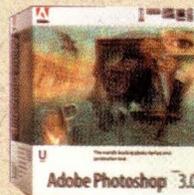
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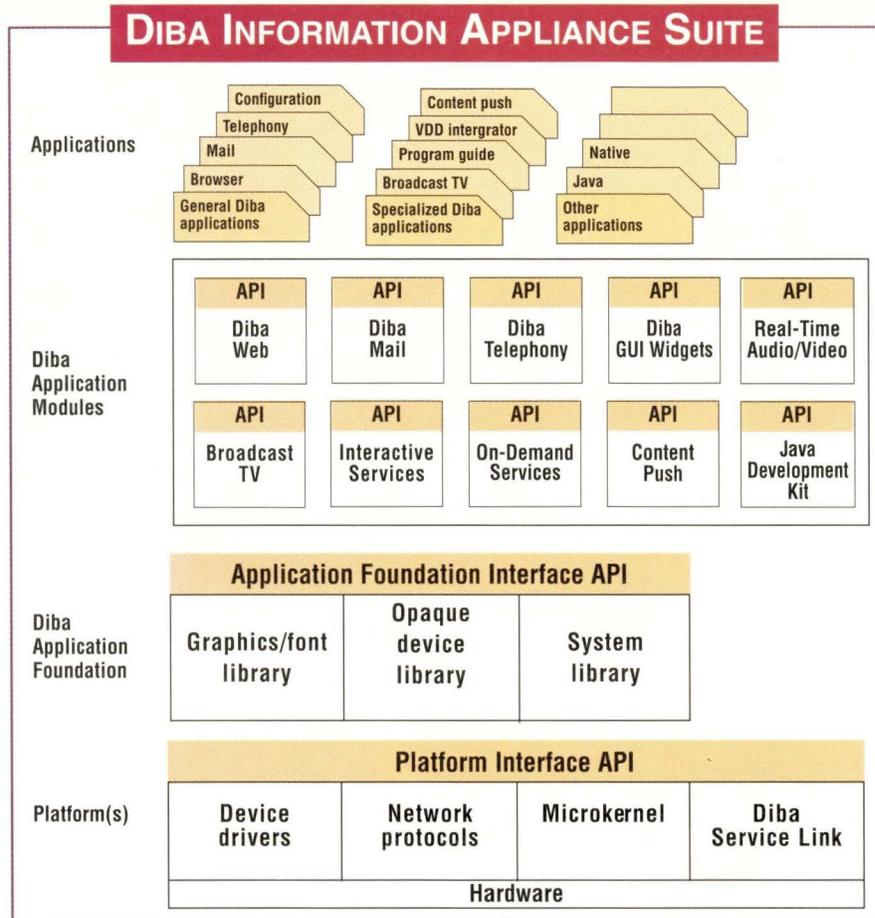
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At Diba's core is its Information Appliance Suite, an open, end-to-end architecture for information appliance development.

end-to-end architecture for the development and delivery of information appliances and services called the Diba Information Appliance Suite. First introduced in Fall 1996 and recently updated to Version 2.0 this Spring, the Diba Information Appliance Suite is a collection of programs that includes applications such as browser, mail and telephony programs; Diba Application Modules, each of which has its own open API for things such as GUI widgets, broadcast television, on-demand services and a Java Development Kit; Diba Application Foundation, which includes a graphics and font library, opaque device library and a system library; and a platforms interface API with device drivers, networking protocols, a microkernel and Diba Services Link. Underlying all this is the hardware platform itself, not supplied by Diba, whether it is a Sun Solaris system, a Windows PC or a Macintosh.

Says Scott McNealy, chairman and chief executive officer of Sun, "Information appliances represent an enormous opportunity for manufacturers who can deliver the right products at the right time. By leveraging the Java software platform and Java-enabled microprocessors with Diba's experience in assembling technology components into complete solutions, Sun hopes to enable OEMs to take advantage of the market's vast potential sooner rather than later." The market is already populated by names such as Microsoft Corp.'s Windows CE and Network Computer Inc.'s Navio. Sun plans to make Diba's product line 100% Pure Java-certified eventually.

According to Diba President and CEO Farzad Dibachi, "This union will be our company dream realized: to democratize information access by making it available to the full spectrum of consumers...Sun has the resources and complementary tech-

nologies [such as Java] necessary to accelerate the process of getting networked information appliances into consumers' hands."

Diba's less than 100-member staff will become a division of Sun Microelectronics Inc. and will reportedly be called the Consumer Technologies Group. Dibachi will report to Sun Microelectronics President Chet Silvestri.—*jsw*

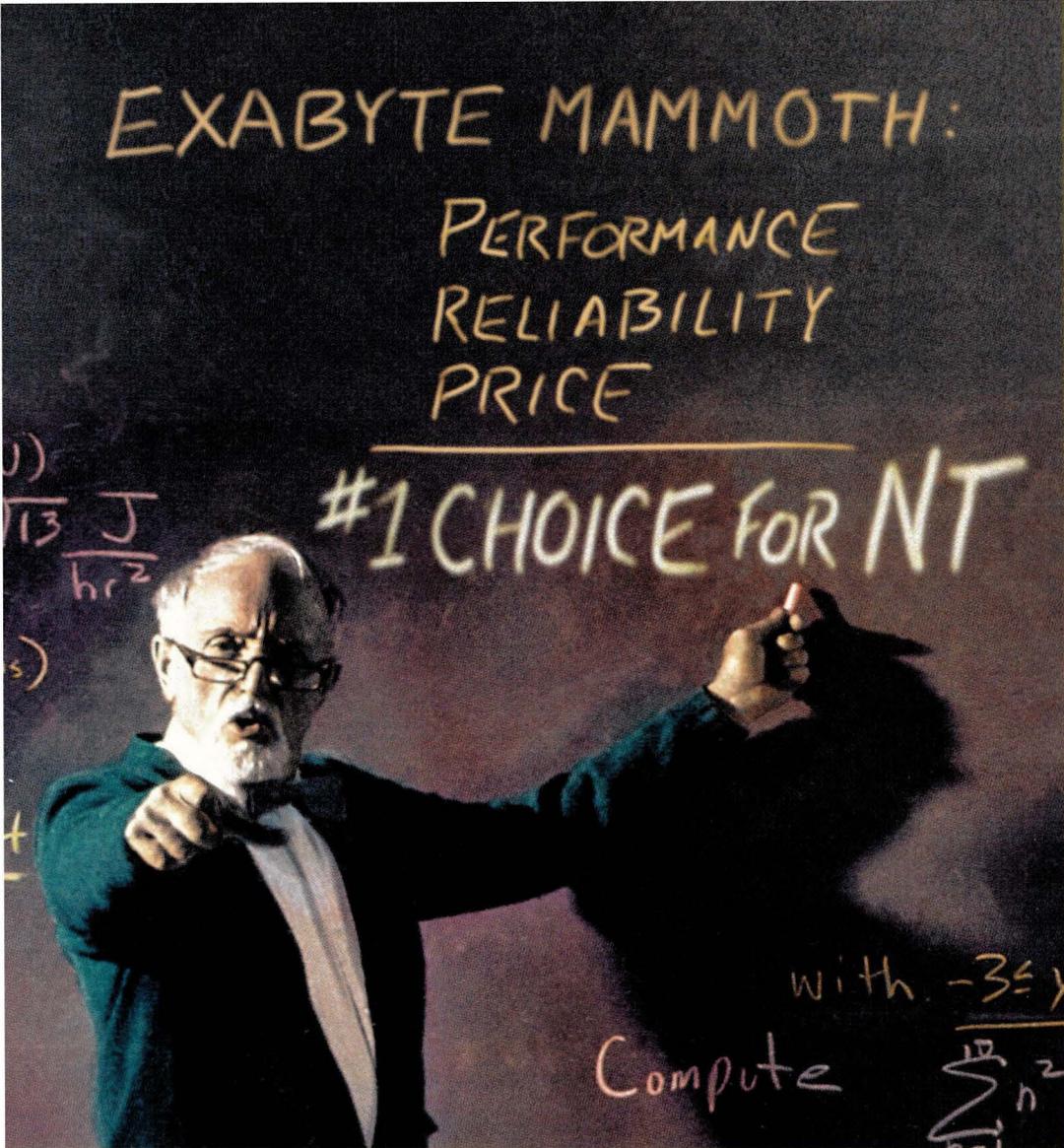
## San Francisco, Here It Comes

The Java movement received a boost with the introduction of IBM Corp.'s San Francisco project, a Java framework that takes a building-block approach to delivering business applications. The first products to see the light of day are the San Francisco Common Business Objects and the San Francisco General Ledger.

The idea behind San Francisco is to allow independent software vendors (ISVs) to license the technology from IBM for incorporation into their own mission-critical applications. This approach to development would allow for 40% of the application to be created in advance, facilitating ISVs in the creation of unique products, IBM says. Also, this would save development time and money.

The San Francisco framework consists of three layers: Foundation, Common Business Objects and Core Business Processes. The Foundation Layer is designed to provide an infrastructure for the other two layers while hiding differences in underlying technology from application developers. The benefit of that, according to IBM, is that multiple platforms are supported with greater ease while still exploiting platform-specific functions.

The Common Business Objects Layer is composed of several independent frameworks that are classified in two categories: business objects common to multiple domains and common application level services. The top layer of the framework is the Core Business Processes. The hope here is to have a highly extensible



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Do  
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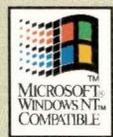
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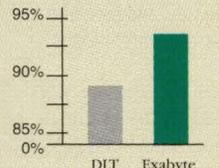
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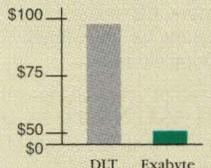
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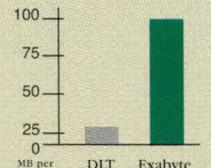
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objected-oriented implementation for the basic structure, thus offering an application provider the required features in a select application domain.

The Common Business Objects software offers developers reusable code for typical business data that all applications would share, such as customer data, currency information and calendar, IBM says. The General Ledger is the first function-specific business process component.

The project began in 1994, when after working with several business partners and software vendors, IBM realized that business management applications, such as basic accounting or human resources systems, were not very different at the subsystem level. "The differentiation didn't exist in creating customer records or objects, or creating an invoice and inventory item," says IBM's Joe Damassa, director of marketing for the San Francisco project. "So [the middle-tier ISVs] said we're the smaller guy, and we really

need somebody like IBM that can develop this infrastructure for us, so we can then take it and incorporate it into our application and build unique stuff on top and take it to market."

The theory goes that these smaller companies would not have to invest the time or money to redevelop new technologies, particularly on the server side. That would be left to IBM. In addition, because Java is the language of the framework, ISVs wouldn't have to invest in porting their software onto multiple platforms. To accomplish this, IBM worked with more than 200 global software firms including Client/Server Technology in Israel; EDB Gruppen Systems A/S in Denmark; Lab 2000, S.A. of Spain; Lawson Software, Minneapolis, MN; and Synon Corp., Larkspur, CA; to name a few. Big Blue also plans to implement an OEM pricing model.

Initially, the project called for C++ to be the language of the San Francisco framework, but then Java hit the mar-

ket. "We did some work with Sun, and it looked like it was a better environment for what we wanted to do," says Damassa. "So we switched all the work over to Java in early 1996."

### The Java Factor

One of the factors that could contribute to the success or failure of San Francisco is the success or failure of Java. Java is still seeking industry acceptance. There are issues of Java's performance and whether or not the promise of Java, "write once, run anywhere" can be delivered. On the other hand, the fact that a company of IBM's stature has invested in a framework completely based on Java is certainly a boost to the cause.

But is this a Catch-22? Does something like San Francisco—which brings the hopes of making mission-critical applications available to the market in 100% Pure Java—have to succeed for Java to be accepted? Or does Java have to win over the industry on its own? "They are very closely tied together,"

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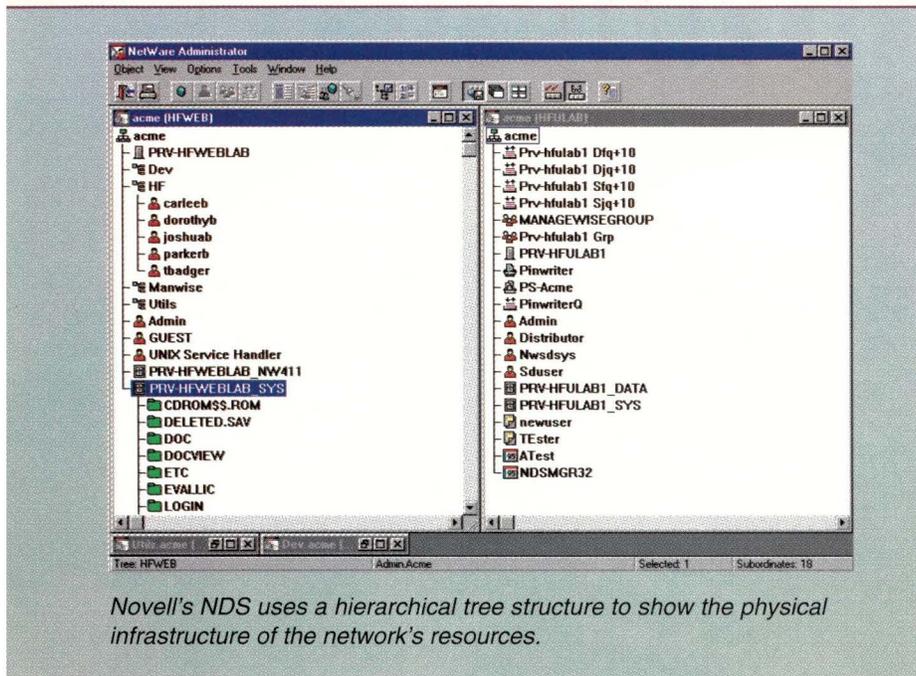
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Novell's NDS uses a hierarchical tree structure to show the physical infrastructure of the network's resources.

says David Andrews, managing partner of D.H. Andrews Group, a market research firm based in Cheshire, CT. "IBM has decided it's going to come down on the side of Java."

Dennis Byron, research manager for vertical industry applications at International Data Corp. (IDC), Framingham, MA, feels the Java approach is at least a plus for San Francisco. "The most important factor is that they are making it an all-Java effort, but time will tell."

The comments so far are favorable from analysts and ISVs. The very fact that IBM has begun to deliver product is important. While this won't result in software reaching the hands of end users this year, it is possible the first application based on San Francisco could reach the market by the end of 1998 or the beginning of 1999. Also, the potential of the multiple-platform availability is exciting to ISVs. "San Francisco gives the end user complete flexibility," says Peter Patton, chief technology officer at Lawson Software. "This amounts to a real standard. I expect it to be an ad hoc standard, and it may become a universal standard as well."

The future for San Francisco remains to be seen. If all goes well, IBM will market the technology to ISVs and offer a certification program that could result in

the phrase, "San Francisco Inside," entering the lexicon of marketing slogans. Additional components will be released to developers over the coming months; in particular, a product called the Combined Ledger is scheduled for 1998. The performance issue, which many analysts feel will be improved both with Java and even San Francisco, is certain to improve its chances of success. As IDC's Byron says, "time will tell."—*ptc*

## RS/6000 to Support NDS

Add IBM Corp. to the list of companies that have partnered with Novell Inc., Provo, UT, to license the Novell Directory Services (NDS). The agreement, announced in July, allows IBM to integrate NDS with all of its operating systems including AIX. At press time, Novell had licensed NDS to 11 other companies, including Sun Microsystems Inc., Hewlett-Packard Co., Santa Cruz Operation Inc., Oracle Corp. and Netscape Communications Corp.

The inclusion of the RS/6000 family into the NDS fold makes the Novell technology available on most UNIX systems on the market. "We were interested in having IBM as a partner because the RS/6000 is an incredibly strategic platform," says Michael Simpson, direc-

tor of marketing for the network services group at Novell. "It's one of the top couple of UNIX platforms."

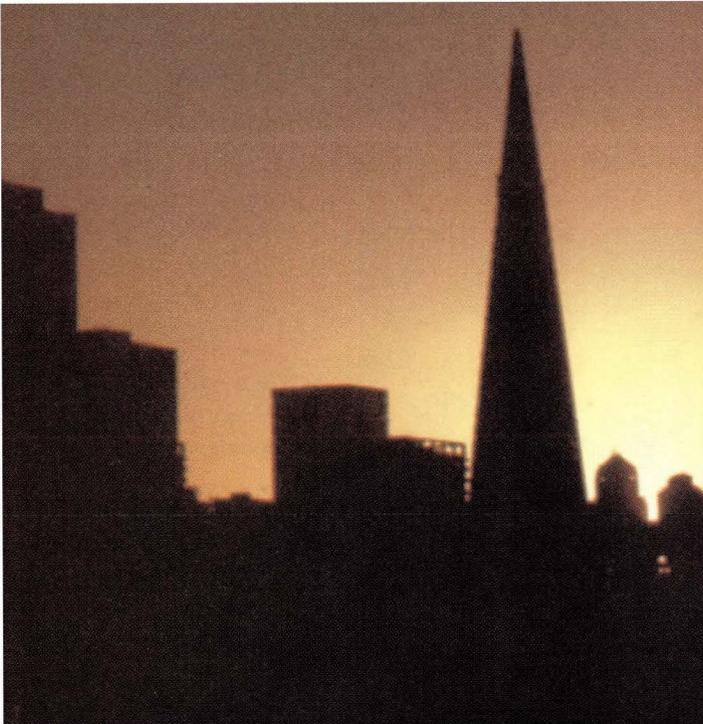
NDS is a Lightweight Directory Access Protocol (LDAP)-enabled directory, designed to help administrators manage network resources, including users, groups, printers and volumes. NDS uses a hierarchical tree structure, showing the physical infrastructure of the network's resources, Novell says. "Let's say you have an RS/6000 in your network, and you have an NDS tree that is maybe made up of HP-UX, SCO and NetWare," says Simpson. "When you get an AIX box, you can run on it any of our applications, application launchers and things like that."

Simpson adds, NDS will provide some of the value that NetWare does for the rest of the network, such as the single sign-on feature.

The agreement allows IBM to ship NDS with the RS/6000 system and S/390 enterprise servers. Users of AIX 4.2.1 and higher will be the first to take advantage of this news. "One of the key strategic missions of the RS/6000 is to support standards in a heterogeneous environment," says Ken Stokes, program manager of RS/6000 alliances at IBM.

Some analysts are not impressed with Novell's recent agreements. "It's really a shallow announcement. What you want is the application directory to adhere to a common product, not so much the operating system," says Jon Oltsik, senior analyst at Forrester Research Inc., a market research company based in Cambridge, MA. "Novell has really worked long and hard convincing the market that having NDS on all the operating systems is really important," says Oltsik. "It would have been nice if it were true four years ago."

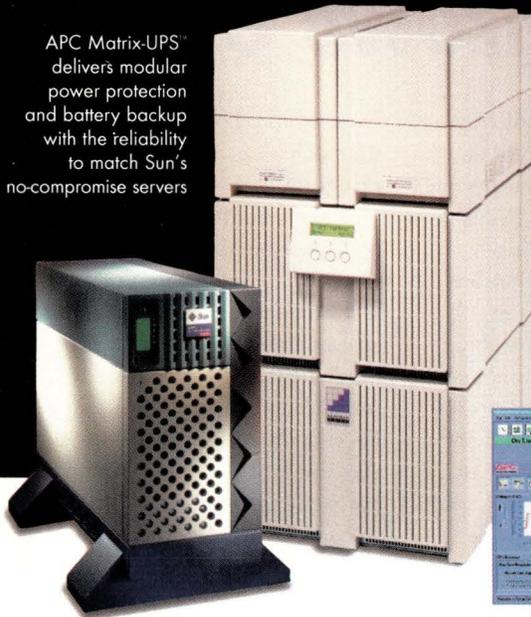
John Laurencelle, a consultant for Applied Systems Management Group, a Hillsdale, NJ-based consultancy firm, supports NDS for several of his clients. He thinks the news is definitely a positive for customers. "It streamlines things for distributed data center support people," Laurencelle says. "Anything to make things more seamless from the user's standpoint is critical."—*ptc* ➤



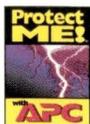
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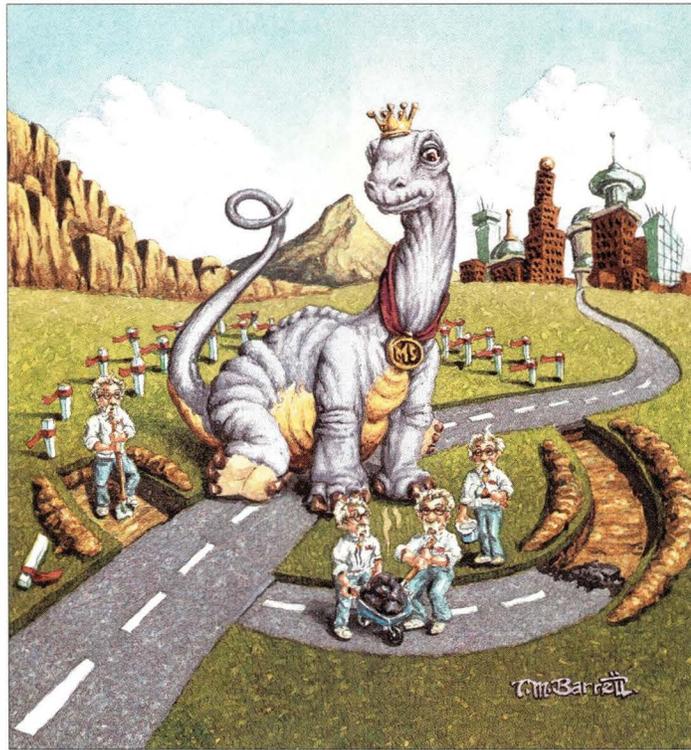
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# Ask Mr. Protocol

by Michael O'Brien



TOM BARRETT

*"In the year 2525...."*  
— Zager and Evans,  
eponymous

*"I saw her on the corner  
by Ellie's Cafe / Lookin' like  
a Cubist painting someone  
threw away...."*

— Susan James, "Eileen"

*"Let it be, let it be...."*  
— The Beatles, "Let It Be"

## Mr. Protocol Grows Up

**Q:** Look, I don't know where in the heck you guys got the protocols you run now, but I've gotta tell you, it looks like the Net's getting away from you. All these new services are based on proprietary protocols used in only a single product. Lots of them do about the same thing, and the only difference is how well they work over a 28.8-, 33.6- or 56-Kb/s modem. Don't you think Mr. Protocol is becoming irrelevant? The whole Net's going to be all-Microsoft in about five years anyway.

**A:** Well, I'll be darned. You've actually gone and done it! Up until this very moment, I would have sworn on my overly cushy job as his amanuensis that Mr. Protocol had not one speck of humor in him. But just look at him! I've never seen anybody in such hysterics. I think he's going to hurt himself.

It would be too easy if there were anything I could easily point out about your concerns. If they were patently ridiculous, I don't think The Bitwise One would so much as crack a smile. No, he's probably

yukking it up because the reasons why your scenario of doom won't occur are numerous and obscure. And if there's one thing Mr. P. likes, it's numbers. (Mostly, he likes numbers of Big Stuf Ding-Dongs, but in a pinch any old numbers will do, so long as they fit over a wire.)

Microsoft is hungry. Vendors are coming out with increasing numbers of special-purpose, specially tuned protocols that have never seen the inside of a standards process. But there are lots of other things going on too, less visible and more far-reaching, which work against these. And, to a certain extent, they work against themselves.

Let's take a look at that second point first. Aside from being successful, Microsoft as a corporation has one glaring feature: It is, and has always been, profoundly unoriginal. Every single one of its many software products is a copy of someone else's original. Windows 95 mimics the Macintosh, which mimics the Alto, which hardly anybody ever saw except the Xeroids and Mr. Protocol.

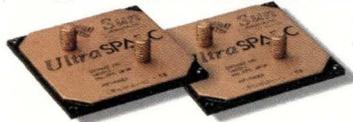
Excel mimics Lotus 1-2-3, which in turn mimics Visicalc. Word mimics a slew of predecessors. And so forth.

This is not to say that Microsoft could not be original. It has hired the top people in just about every area of software design. There are rumors that at least some of its current products are implemented using startlingly advanced software tools (one fellow claims that Excel is implemented in Lisp, while at the center of Word is a Prolog engine). For whatever reason, Microsoft prefers to concentrate almost wholly on marketing and not on original product development. And it is always reactive, not proactive, to market needs. Products are created and marketed to fill needs, not to create them.

"Those who are ignorant of history are doomed to write endless term papers about it," as Santayana never said. Mr. Protocol, being profoundly ignorant of all history predating Paul Berens' paper on packet switching, therefore dumps on yours truly, his amanuensis, the task of



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## Ask Mr. Protocol

grotting around in historical texts for exemplary tales. But this time, I don't think I'll bother. Just about anybody who is even glancingly familiar with Roman history knows what happened when the empire became reactive, rather than proactive, oriented toward conserving the empire rather than expanding it. Not that Rome ever officially declared an end to expansionism, of course. It merely

found that, at a certain point, actual expansion became impractical.

IBM hit this limit years ago. It made the mistake of discounting the importance of the microcomputer architecture that it developed. IBM survived, but it no longer dominates the field.

Microsoft nearly made a similar mistake when it ignored the Internet during its formative years. In many ways, this

may have been a Catch-22 situation. Had the Internet been subjected to the tender mercies of the Microsoft marketeers, there is at least a possibility that one or both entities would not have survived the collision. Now, Microsoft has a warm and tender vision of a PC in every home in America, running Microsoft software. It seems unlikely. But even if it were to happen, it would no longer mean the end of the pluralistic Internet we have known and loved.

Why not? Mr. Protocol is glad you asked.

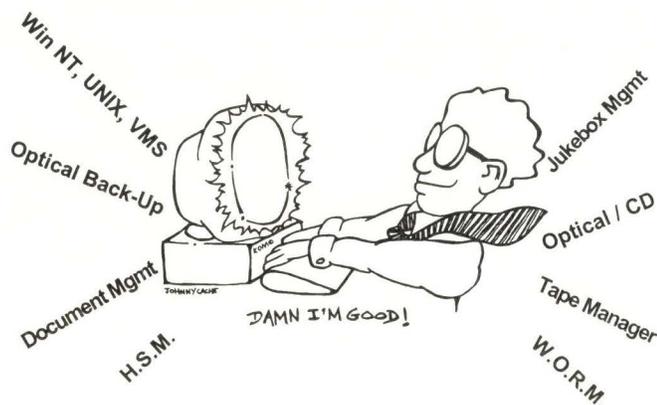
Because, even if there were a Microsoft PC in every home, the Internet would not be limited to the Microsoft home PC, or even the Microsoft office PC (or the Microsoft Office PC, either). There are too many other things for the Internet to be doing.

***Had the Internet been subjected to the tender mercies of the Microsoft marketeers, there is at least a possibility that one or both entities would not have survived the collision. Now, Microsoft has a warm and tender vision of a PC in every home in America, running Microsoft software. It seems unlikely.***

There are all sorts of non-Internet computer networks in existence. We don't see them even when we interact with them directly, because they are so specialized that they might be said to have protective coloration. They're invisible even when they're in front of us.

Consider Sprint. These days, it's a telephone company and the owner of one of the Internet backbone networks. It used to be just a telephone company. And, before that... Not too many people remember that the "S-P-R" in "Sprint" stands, or stood, for "Southern Pacific Railroad." Sprint came into existence

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## Ask Mr. Protocol

when Southern Pacific decided to make use of its right-of-way corridors to lay fiber-optic cable. The original purpose was to provide the railroad with a signaling and telephony system that would allow it to control its network of cars and track without paying good money to AT&T to carry the telephone traffic. It worked too well: Sprint spent a bundle and wound up with a network with

a far greater capacity than it would ever use. It decided to sell the excess capacity to the public, becoming a long-distance telephone provider.

It worked, but it had a really rocky start. Not too many home consumers agreed that an industrial telephone system with minimal noise suppression and rigidly controlled voice bandwidth was an entirely acceptable replacement

for AT&T's high-quality landline service. Also, Sprint had to learn the wonders of running a truly huge billing system. It thought it already had one. Hah. Lots of people think Sprint hasn't gotten that part right even yet.

But back when Sprint was just a part of the railroad, passengers were supported by this network without even being aware of its existence. And today, there are financial networks that owe nothing to the Internet. Stock trading networks are also immense, and likewise free of any Internet protocols.

This state of affairs will probably not last, however. The advantages of an integrated network are so large that security and compatibility problems will be attacked with vigor, the profit motive ever strong, if not in the hearts of the implementors, then at least in the hearts of the people they work for.

And we can see indications of the solutions today. There is an extension of the TCP protocol, called Transaction TCP, or TTCP, that is designed to allow a single-query-single-response style of interaction, as used on the financial networks, to operate over IP with the same reliability as regular TCP, but without the typical overhead of opening and closing a connection. At the application level, trading houses are beginning to make their services available over the commercial Internet to subscribers, who can now carry out trades on the various exchanges as easily as if they were at the broker's location.

Some of these applications use Microsoft software, and some do not. This is exactly as it should be, thinks Mr. Protocol. The right tool for the right job. Commonality is important in trading situations, more important than the overall beauty of the software...and people like Morgan Stanley have enough money that even Microsoft is quick to fix any bugs that may arise.

But there are other Internet arenas as well. Mr. Protocol has discussed with keen interest the wireless Internet connection available through Metri-com's Ricochet product. This entire network technology was initially developed by a company that planned to use it to read neighborhood electric meters automatically. Power companies in



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## Ask Mr. Protocol

general would love to be able to get rid of the human meter reader. This has led to the pioneering of at least two new wireless network technologies.

The first, exemplified by Ricochet, involves the installation of a regular grid of wireless network nodes throughout an area. Each node has buffer memory and acts as a store-and-forward network element. In its intended application, each

power meter has a network "leaf node" attached to it, which transmits the meter reading to the nearest store-and-forward radio packet switch node. The packets representing the meter reading are then bounced along the network from node to node until they make it back to the power company's billing facility. Progress along the Net is done by geographical addressing—basically latitude

and longitude—because each node, being immobile, has a permanent, known geographical location. Addressing and routing are handled by making the network's physical and logical topologies identical.

This application does not necessarily have to be implemented as a TCP/IP network. But these protocols were already available and would certainly do the trick. But wait! As they say, there's more. Because Metricom used standard TCP/IP in its network, it could as easily pass packets from any other kind of a leaf node. Network traffic didn't have to be limited to power meter readings. The result was a strong product that promised 28.8-Kb/s network connectivity, wireless, for a very reasonable monthly flat fee.

And no way is this a Microsoft product.

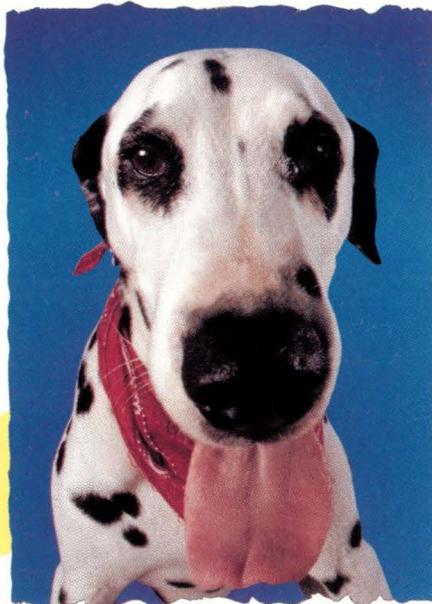
Even more fun is being had in the satellite industry. An entire satellite-based subindustry is growing around the so-called "little LEOs," which are small (in some cases, breadbox-size) satellites in low earth orbit. These satellites can communicate to and from orbit using much lower power than the fixed communications satellites in geosynchronous orbit, because they're only a couple of hundred miles up instead of tens of thousands of miles up in space. The downside is that they travel extremely rapidly in their orbits and are generally above the horizon for a maximum of 20 minutes apiece. For reading power meters, though, this is plenty of time, and these things are so small, and the orbits so low, that they can literally be thrown into orbit by the dozen. Together they form a low-speed network, useful for paging, messaging, the ubiquitous meter-reading applications and doubtless a raft of other things that haven't been thought of yet.

The pressure to integrate the diverse special-purpose networks into the global Internet is strong, because it brings new users and services to the table of each of these individual networks, as well as a whole raft of pretested and predeployed tools for things such as network management and security.

And no way are any of these Microsoft products.

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```
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UX:ls: ERROR: Cannot access general.ledger:
No such file or directory
```

```
corp:/acctg >ls payroll.1qtr
UX:ls: ERROR: Cannot access payroll.1qtr:
No such file or directory
```

```
corp:/mfg >ls inventory.cont
UX:ls: ERROR: Cannot access inventory.cont:
No such file or directory
```

```
corp:/mfg >ls order.entry
UX:ls: ERROR: Cannot access order.entry:
No such file or directory
```

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to absorb all these peculiar networks without a hiccup. In some cases, special protocols will be necessary. In other cases, extensions to existing protocols will be required. For example, consider the wonders of the 18-inch dish.

This is a case of a geosynchronous satellite on steroids. The notion is almost embarrassingly simple. The more power you use from orbit, the smaller the earth-

side antenna you can get away with. And if you use enormous power in orbit, you can use teeny antennas on earth. The enormous popular success of services such as PrimeStar prove that people who wouldn't be caught dead with giant satellite dishes, or whose neighbors would kill them if they tried, are perfectly willing to buy an 18-inch dish that can be pointed out of a convenient window and never

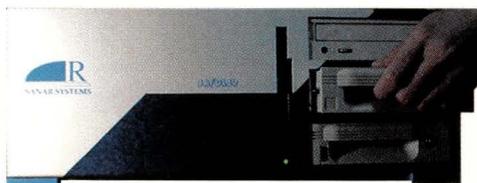
moved. The only secret is the willingness to expend scandalous amounts of in-orbit power. In some cases, at least, this is achieved by using multiple transponders, all transmitting the same signal, for an  $n$ -fold increase in overall signal strength.

The upside is that the economies of scale have made the set-top boxes for this service amazingly cheap. The other part of the upside is that every box ever made for this service has a 23-Mb/s data jack on the back.

The downside is that it's one-way. No way can an 18-inch dish running off of house current create a strong enough signal to be heard in orbit, at least, not by these satellites. The high-speed connection is one-way only. To be used as part of the Internet, a separate back channel must be used. This could be in the form of the rest of the (terrestrial) Internet, sending packets back to the uplink site (or wherever) to complete a round-trip path from source to destination. This works well for certain usage models, less well for others. It's nearly ideal for Web surfing, because that is a highly asymmetric operation. Large volumes of data flow over the satellite link, and a relatively small traffic of button-clicks and packet acknowledgments flows over the terrestrial Net. It's just about pessimal for any kind of a server.

Let us finish by looking to the future. The future of IP is IPv6, the next generation of IP. With a 128-bit address space, and just beginning experimental deployment, it is in somewhat the same condition as a newly finished, five-acre warehouse built from prestressed concrete. The few people standing around inside it are so bewildered by the sheer sense of open space that it's difficult to figure out just where the dividing walls go. The placement of these "walls," or subnets, in the new IP, is the hottest current topic of debate regarding the IPv6 network. There is a spirited debate among the various network implementors, each bringing their "lessons learned" from watching how IPv4 was collapsing under the load. Some want physical aggregation of network addresses, some want logical aggregation, some want processors to pay attention to both at the same time. Mr. Protocol is of the opinion that anyone who thinks that a one-size-fits-all style

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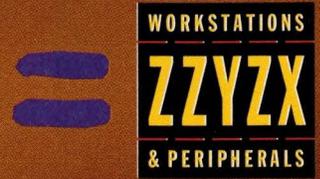
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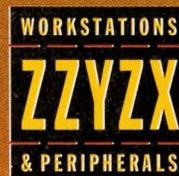
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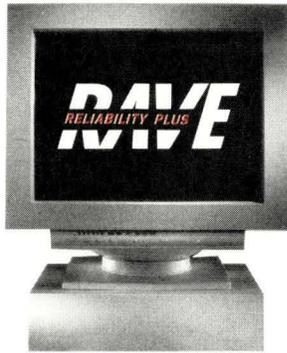
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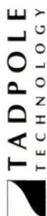
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## Ask Mr. Protocol

of redecoration of the warehouse is all that's required is missing a bet.

Yes, route aggregation is important, because no, we can't have arbitrarily huge routing tables. But there's something else at work here. Route aggregation is simplest in a strongly hierarchical network, and that seems to be the general direction things are taking. People who are worried about the number of individual processors in their homes are woefully behind the times. Just adding up the number of hierarchical subnets in any given house will be the impossible task to undertake tomorrow. Processing power will be ubiquitous, and the organization of the network into local hierarchies will be the only way to hold a useful, hierarchical image of the aggregated nets in mind.

And, in the end, Clifford Stoll is not entirely wrong in *Silicon Snake Oil*. There really isn't anything on the Internet that's quite like the impossible colors of a beach sunset, producing shades that no monitor could reproduce, the illuminated manuscript of the sky. The Internet will be ubiquitous, nonhomogeneous to a fault no matter who's playing Corporate God, and ultimately limited to what its abstract universe of sights and sounds can offer.

Some authors are now giving credit to the music that was playing while they were writing. Why not? This column was brought to you by Susan James, *Shocking Pink Banana Seat*. Mr. Protocol gives it two checksums up. Absolutely. <http://www.pacificnet.net/~susanj> ➔

**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](mailto:amp@cpg.com).



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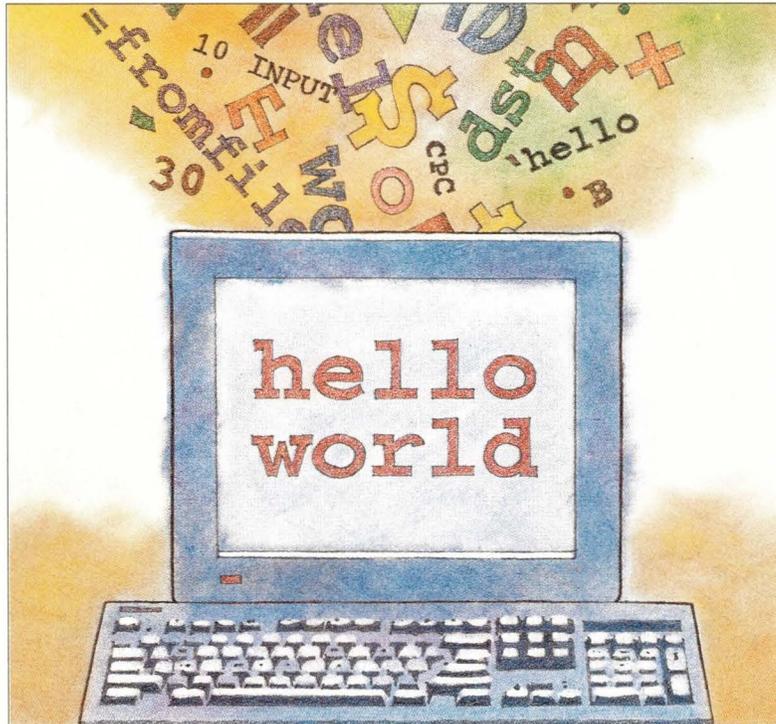
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# UNIX Basics

by Peter Collinson, Hillside Systems



GARY DAVIS

## Analyzing Syntax

I think that nearly all the programs I have written in my life have contained an element of text processing. Some programs take input from users in the form of interactive dialogue; others read data from files. It has always been a sensible approach on UNIX systems to store primary data as text so people can use general-purpose editors to access and maintain the files and utilize the rich UNIX tool set to search or otherwise manipulate the data.

Programmers who plan to take text input from a file or from the user's keyboard face similar sets of problems when designing what that text should be. The fundamental problem is that the program is performing what amounts to pattern recognition. In general, the program will see the text come in one character at a time, and it needs to understand the format, allowing it to pick out meaningful information from the data stream. We, as humans, can experience the problem when listening to others talking in an unfamiliar language. If the language is

completely unknown to us, then we will hear a meaningless jumble of sounds. However, we only need a very small understanding of the language to break those sounds down into words that we might learn to understand.

The task, then, of any program that wants to read text is to take the characters it sees and change that text stream into something comprehensible.

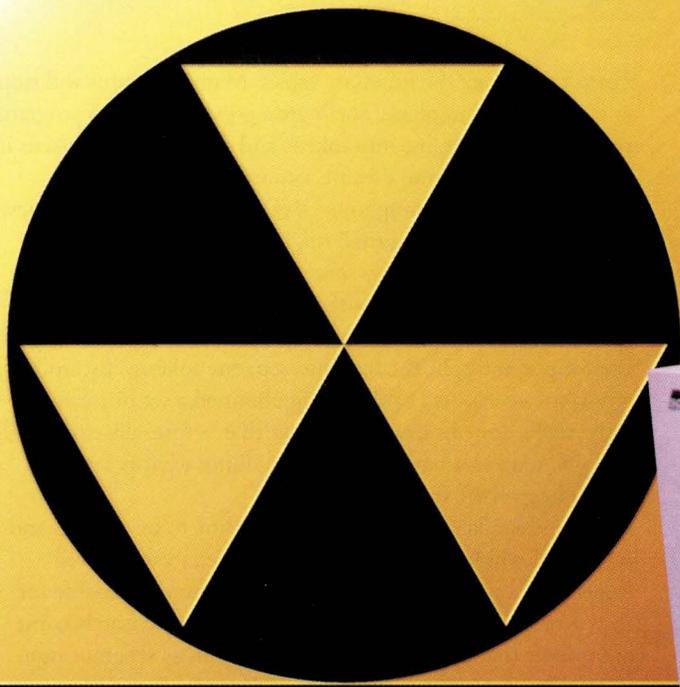
Much of our understanding about how text recognition should be done is taken from the work of the pioneers in program language design. Compilers and interpreters for languages like FORTRAN or BASIC tended to recognize text using a character-by-character approach. For early BASIC, each line started with a number that was the line number, statements looked like this:

```
10 INPUT A
20 B = A + 1
30 PRINT B
```

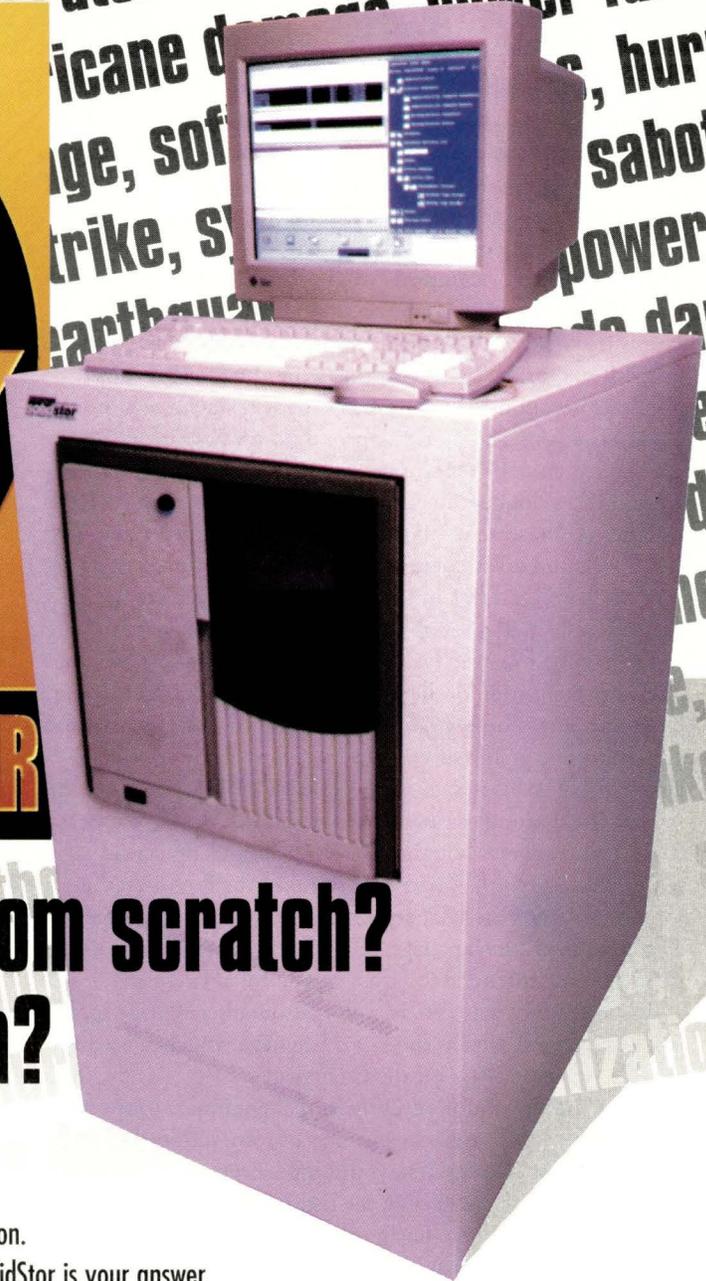
So for each line, the interpreter starts

by reading numeric characters until it finds a character that is not a number. It will turn the sequence of characters into a decimal number that is the line number. Scanning on, the next non-space character will be the first character of a command or the start of an arithmetic statement. Characters are read until it's clear what the statement is. Then, the arguments to the statement are processed. This is an example of "bottom-up" parsing. We take the characters that make up the input and attempt to collect them together, making a higher-level object.

Early computer scientists realized the character-by-character approach does not scale. It doesn't allow you to share code. Each statement in the language is understood by an individual part of the program that is coded separately to deal with each type of statement. The process is error-prone. No formal rules are being applied to the text, so each statement has to be examined to see if it fits in with the rules of the language.



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It was realized that the fundamental pattern recognition problem was actually one of language recognition, that programming a computer was a form of language use. Computer designers began to look at the work of linguists. Natural languages all have grammar, a set of rules that are used to create the phrases or sentences. If a grammar was imposed on a language intended for computer input, then it would be possible to use the rules of the grammar to verify that input from the user was syntactically correct. In fact, parts of the early languages used formal grammar; they used the familiar infix algebraic notation to express mathematical statements. It was a matter of generalizing the approach to a whole language.

These grammars tend to be “top-down.” We start the translation process looking for a “program” that comprises several varieties of “statement.” For primitive BASIC, each statement is a “line-number” followed by a “command.” One command is a “keyword” (`INPUT` in the example above) followed by a “variable list,” and a variable list is a single “variable name” or a variable name followed by a comma and another variable list.

The specification of the Algol language was the first time a complete programming language was described using a formal grammar. The grammar was specified with the reference language called Backus-Naur Form (or BNF) that was used by the international group of people who developed Algol. I suspect that Algol is always thought of as a European language by many folks in North America. It shouldn't be forgotten that John Backus was the U.S. representative on the committee that established the language, and that the language was from the beginning intended to be an international language.

Later, BNF became the basis for automatic language specification systems, such as the `yacc` language, which is used to provide syntax analysis for the C language.

Algol and the notion of using formal grammars to specify languages taught us that the business of recognition should be done in several phases: First, you should attempt to make sense of the characters by analyzing the text into identifiable chunks known as tokens. Then, having built a representation of the structure of the text, that structure can be examined using a top-down approach to check its syntax. Finally, having validated the input, the statement can be interpreted, compiled or stored, depending on the application.

## Tokens and Shells

Well, this article started from the thought that I take the notion of a token for granted. When I am looking at C, a shell script, an `awk` script or Perl program, I mentally parse the line into tokens in the same way that you are reading this text. You know that each word is delimited by spaces and your brain gets very confused when they are omitted. Well, it's not quite true to say that words in English text are only delimited by spaces. Some words are terminated by punctuation characters. Punctuation is also used to give you information about the intended phrasing of the text. Also, some words are terminated by the end of a line.

Many UNIX programs use the approach of breaking the input line into tokens. Some programs will then use a formal grammar to process the tokenized data, often making use of

`yacc` to generate the necessary tables. Many programs will stop at the tokenization phase. Shells are a good example of programs that split the input line into tokens and then use those tokens in a bottom-up fashion to execute a command for the user.

On the whole, throughout UNIX, there's a consistent view about what a token in a shell might be. Tokens on a shell input line are separated by spaces or tabs (which I tend lump together as “white space,” although of course the color of the space depends on the settings on your screen). Shells will read their input and split the line into separate tokens, discarding any white space. As I said, having obtained a set of tokens, most shells don't possess a grammar that is formally expressible and will tend to analyze their input, doing what is needed depending on what they find.

All shells take the first token on the line to be a command name and will look for a file of that name in various well-known places defined by the `PATH` environment variable (or the `path` variable in `csh`). Other tokens on the line become arguments that are passed into the program as separate arguments. It's the job of the program to decode these arguments and take the action that the user has started.

The early UNIX shells did very little more than take input from the user and call commands. The shell did recognize that a token containing an asterisk or a question mark meant that the token should be expanded into a list of file names before the command is called, each of the matching file names becoming a separate argument to the program that is being invoked.

Later, variables were introduced into shells. When a token starts with a dollar character, it is assumed to be a variable that contains a value. When the command is being created, any contents of shell variables are inserted into the command at the appropriate position. So, for the Bourne shell,

```
$ src=fromfile
$ dst=tofile
$ cp $src $dst
```

The first statements set the variables `src` and `dst`. When the `cp` command is read, the `$src` and `$dst` tokens are replaced by the contents of the variables before the command is called.

Because the first object on a line is also a token, there is no reason why it cannot also be a shell variable, if we follow on from the example above and use `mv` as the command name rather than `cp`:

```
$ CPCMD=mv
$ $CPCMD $src $dst
```

Once you introduce characters that have a special meaning like dollar, asterisk or question mark, then you need a way of telling the shell not to use that special meaning, that you want the special character to be passed intact into the program that is being called. Actually, we also need a way of passing space or tab characters into the program. We need a method of telling the shell that the space should not act as a token delimiter but should be considered part of the token. We need a way to quote character sequences.

Quoting in shells is somewhat of a minefield. Each shell does things slightly differently. I will concentrate on the Bourne

#13



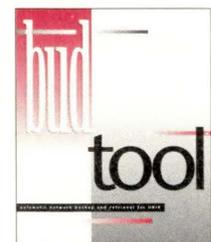
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Circle No. 28

# UNIX Basics

shell (sh) and its offspring the Korn shell (ksh). Beware that the rules may be different if you are using publicly available clones of these shells. Also, quoting in csh is much more restricted than in the Bourne shell, making the Bourne shell the first choice for writing scripts.

In the Bourne shell, you can stop the special meaning of any single character by preceding it with a backslash. So,

```
$ echo hello world
hello world
```

will call the echo command with two arguments: hello and world, while

```
$ echo hello\ world
hello world
```

will call the command with a single argument hello world. However, using the backslash isn't particularly user-friendly; it looks kind of ugly. We usually use a pair of quote characters to create the single token:

```
$ echo 'hello world'
hello world
```

The shell sees the opening single quote and takes all the input that follows as part of the token until the closing quote is found. The quotes are discarded when the command is called.

The Bourne shell also allows new lines to be enclosed in single quotes so single arguments that span several lines can be specified simply:

```
$ echo 'hello
world'
hello
world
```

The single quoted token is "super-quoted"; that is, it ignores all special characters, including the backslash. The only character that you cannot put inside a single-quoted token is another single quote. All other characters are carried through unchanged to the command that you are executing. Actually, missing an end quote in a complex shell script is a great way to introduce hard-to-find errors, so great care needs to be taken to match opening and closing quotes when laying out the text.

There are many occasions where you want to use the shell to create a single argument but also have part of the token created from shell variables. A double-quoted token achieves the effect:

```
$ src='hello world'
$ echo "$src and thanks"
hello world and thanks
```

Here, we set a variable to a value containing a space, then type an echo command. The \$src is replaced in the token by

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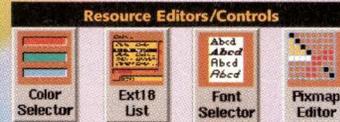
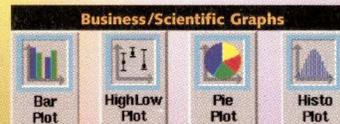
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Circle No. 18

# UNIX Basics

hello world, but because the string is quoted it will be passed as a single argument into the echo command. Note that we can do string formatting by adding text inside the quoted string.

A good and little-used feature of the token recognition system is that when we place two quoted sections together, they are treated as a single token. In shell scripts, I often use this feature to hop in and out of the different quoting forms:

```
$ echo 'It''''s a small world after all'  
It's a small world after all
```

adding a single quote into token that is passed into the echo command. I agree that the example above is overkill. It's hard to think of a real one that doesn't need 17 pages of explanation.

It's important to understand the Bourne shell, its quoting rules and variable expansion, because many other programs follow its lead. A good grasp of how things work in the shell helps considerably with programs like awk or Perl. The shell is somewhat odd because it's very much a complex string processing language sitting behind a language that implements a set of imperative commands that act on named files and have a set number of fixed parameters.

## Tokens in Email

The use of formal grammars and tokens spring up in what you might think are odd areas. For example, we have implicit token recognition and syntax analysis when we send or receive

email. Several fields in the mail header, including the sender address (the From: line) and the destination address (the To: line), are constrained to a certain grammatical form by RFC 822, which defines the way we all deal with mail on the Internet. RFC 822 also specifies the syntax of the Date: field, ensuring that the line is comprehensible to automatic systems that may wish to use it, perhaps for sorting the contents of your mailbox into chronological order.

Mail addresses are something that we use every day, and it's often poorly understood that there is a set of rules that govern their construction. Incidentally, what follows is a little abbreviated. You are encouraged to read RFC 822 to obtain the full gory unexpurgated details.

The simplest form of an address field is something like this:

```
To: aperson@someplace.domain
```

As you know, you can place comma-separated lists of addresses on the line. Also the header line can be folded, by inserting a new line and at least one white space character at the start of the next line:

```
To: aperson@someplace.domain,  
another@somewhere.else
```

Notice that the line is separated into tokens using white space as the separator. This means that someone's mailbox address

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# UNIX Basics

cannot contain a space. Well, strictly it can, if you are prepared to always quote the name using double quotes:

```
To: "A Person"@someplace.domain
```

Actually,

```
From: A Person@someplace.domain
```

is syntactically incorrect. The use of double quotes to quote parts of the mail address is poorly understood, so you are creating grief for yourself if you create a mailbox address with a space. Incidentally, you can also use the backslash to quote a single character in addresses, but the standard explicitly says that

```
From: A\ Person@someplace.domain
```

is incorrect.

Most people like to put a human-readable name into the address, and the most common way is to use angle brackets:

```
From: Agnes Person <aperson@someplace.domain>
```

There are rules about what may be placed in the part of the address before the angle-bracketed section. You are not supposed to put one of the special characters used in the mail address here. So, for example, a period is not allowed unless

you quote it, so

```
From: "A. Person" <aperson@someplace.domain>
```

is legal because it's a quoted string. Most mail systems don't enforce these particular rules, so there's considerable laxity in general practice.

The other common way of inserting your name into the address is to use the comment facility of the syntax. Any character can be placed inside round brackets and will be treated as a comment, ignored by the mail system:

```
From: aperson@someplace.domain (A. Person)
```

or

```
From: (A. Person) aperson@someplace.domain
```

Notice that the angle brackets have been removed. Strictly,

```
From: (A. Person) <aperson@someplace.domain>
```

is not legal. The commented section in round brackets acts like a single space, and so the line becomes

```
To: <aperson@someplace.domain>
```

which is not actually allowed in the syntax. Again, most mailers don't complain and will get on with the job of sending the mail.

As I said, there's a bunch more stuff in the syntax that isn't in common use. At the time the standard was written, it was considered important for users to be able to route their own mail, hopping it from machine to machine. The widespread takeup of the Internet where domain addresses for mail are distributed using the DNS has superseded the requirement. Because of the widespread use of spam mail, many sites are no longer prepared to relay mail for random third parties either.

## Finally

If you look around your system for programs that are intended to understand the text that you type, then you'll find tokenization and parsing rules. You'll often find that the syntax contains ways to ensure that the program can unambiguously decode what the user has typed. The design of the input is often a trade-off between what is easy for the system to comprehend and what "feels natural" for the human.

I recommend you take a look at RFC 822. RFC's are widely distributed, I got my copy from <ftp://ftp.uu.net//.vol/2/inet/rfc/rfc822.Z>, which mirrors <ftp://nic.ddn.mil/rfc>. →

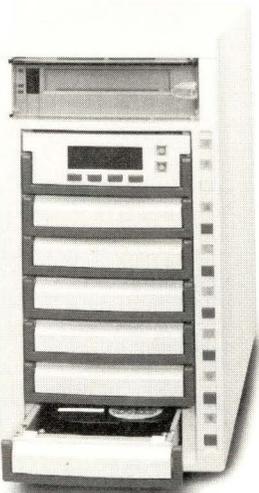
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*Peter Collinson runs his own UNIX consultancy, dedicated to earning enough money to allow him to pursue his own interests: doing whatever, whenever, wherever... He writes, teaches, consults and programs using Solaris running on a SPARCstation 2. Email: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

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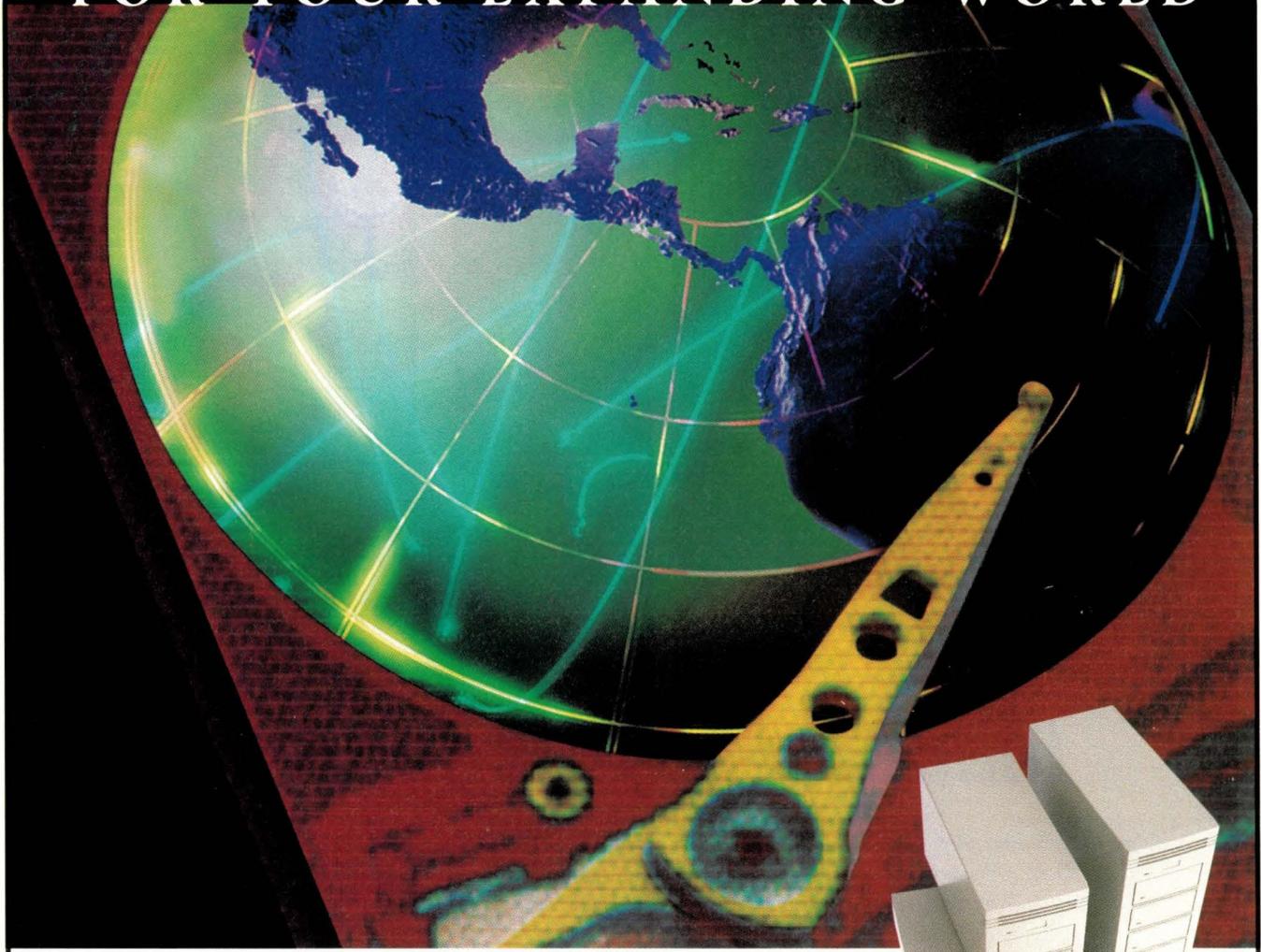


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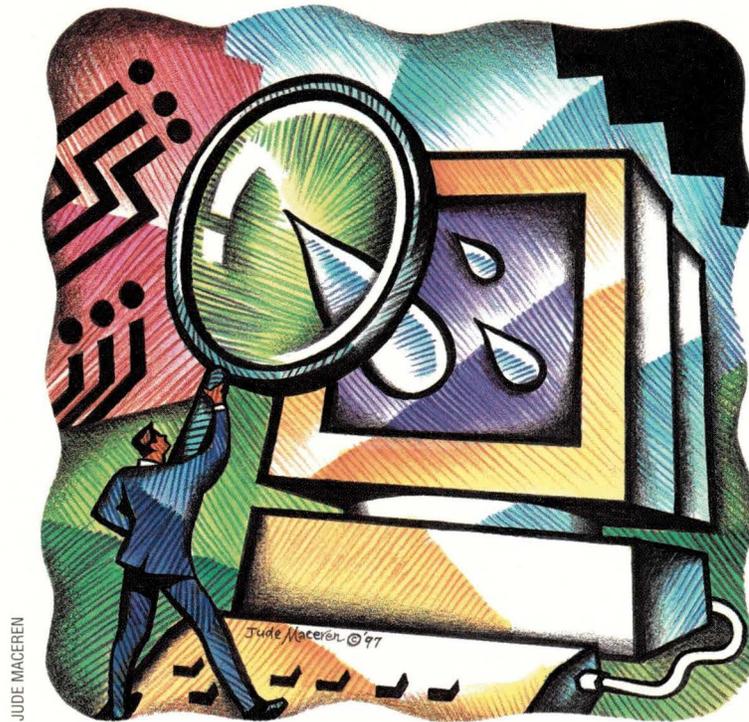
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# I/Opener

by Richard Morin, Technical Editor



## MacPerl – A Little Gem

**I**n Summer 1991, I was called by the Swiss army to do my compulsory 17 weeks of military basic training. While my duties were not unduly harsh, I soon experienced withdrawal symptoms from my programming habits and therefore started looking for a programming project to do on weekends. Since I had ported *gawk* to the Macintosh the preceding winter, and recently had become interested in Perl, I decided to attempt a port of Perl.

Excerpt taken from “Casting Perl Before Macintoshes” by Matthias Neeracher, *The Perl Journal*, Volume 1, Issue 2, Summer 1996.

Although MacPerl has been around for several years, many Perl aficionados—even those who regularly use and/or administer Macintosh systems—have never given it a try. This is very unfortunate. MacPerl is an extremely handy tool to have in the Mac OS environment. Perl has pretty much replaced *awk* as the “Swiss army

knife” of UNIX systems, thus, it might behoove you to examine this “Swiss army port” of Perl to the Mac.

### What Is Perl?

Perl is an interpreted scripting language, based on bits of syntax from *awk*, *sed*, *tr* and even Basic-Plus. It is capable of performing a wide range of functions, including many that could otherwise be done by combinations of UNIX commands. However, it is also able to access low-level system functions (for example, networking primitives), support complex data structures and object-oriented programming methods, and generally function as a modern, powerful programming language.

Because of Perl’s scripting roots, it is very common for a Perl script to be orders of magnitude shorter than an equivalent C/C++ program. Features such as hashes (associative arrays), globbing (file name expansion), regular expressions and very loose type rules make Perl a powerful language.

For more information, visit The Perl Institute’s Web site at <http://www.perl.org>. While you’re there, follow the link to *The Perl Journal*. It’s a great little publication and I predict that it will grow rapidly as Perl matures. If you get seriously interested in Perl, be sure to obtain the definitive “Camel” and “Llama” books, published by O’Reilly and Associates: *Programming Perl*, 2nd Edition (aka “The Camel Book”) by Wall, Christiansen and Schwartz, 1996, ISBN 1-56592-149-6; and *Learning Perl*, 2nd Edition (aka “The Llama Book”) by Schwartz and Christiansen, 1997, ISBN 1-56592-284-0.

O’Reilly also sponsors the O’Reilly Perl Conference. Next month’s I/Opener, in fact, will be an informal report from this year’s conference in San Jose, CA (August 19 to 21).

Under UNIX, Perl’s ability to emulate other commands is simply a pleasant side-effect of the language’s overall capabilities. Under Mac OS, however, it can be a real lifesaver. Lacking any sort

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## I/Opener

of convenient scripting facilities—Macintosh Programmer's Workshop, or MPW, is not generally available, and I don't count either AppleScript or HyperCard for much—the Mac OS can be a real annoyance when a large, related set (i.e., a batch) of actions is needed. Although Perl is somewhat more verbose than the UNIX shell, it is acceptably terse and very functional.

Let's say you need to scan a directory tree, making copies of all the C or HTML files. Using the Mac OS Finder, this could take hours of tedious, error-prone labor. With MacPerl, however, it becomes a trivial scripting task. Using some of MacPerl's other features, you can do automated retrieval of HTML files, creation of input files for spreadsheets and databases, packet filtering or routing and many other useful tasks.

And because MacPerl is optimized for use under Mac OS, you can use it to create "droplets," which are Perl applications that support the Mac OS "drag and drop" protocol. Your users may not (and certainly need not) even know that you are using Perl to create these applications, but they certainly will be happy to have them.

In summary, MacPerl is a very complete port of Perl 5 to Mac OS, augmented by various Mac-specific features. It can be run in any of a variety of ways, providing convenience for both programmers and users. Finally, because MacPerl scripts do not rely on external UNIX commands, they tend to be unusually portable.

MacPerl makes some effort to act in a "reasonable" manner, bearing in mind the differences between Mac OS and UNIX. For instance, writing the string "\n" in MacPerl will produce a carriage return (ASCII \015, the Mac OS end-of-line delimiter), rather than a line feed (ASCII \012). If you really need a line feed, of course, you can specify the octal code.

For obvious reasons, MacPerl supports neither the `fork` call nor the backquote mechanism (though some

special cases, such as ``pwd``, are emulated for convenience). The `system` call is only supported if MPW ToolServer has been installed. This tends to produce a more self-contained style of coding than is normally found in UNIX-based Perl. But, because in Perl "There's More Than One Way To Do It" (TMTOWTDI), there is generally at least one way to do it in MacPerl.

## Programming with MacPerl

Apple Computer provides an extensive programming and batch execution environment known as Macintosh Programmer's Workshop. Inspired by both the Smalltalk "Workspace" and the UNIX command



set, MPW is quite popular among Mac OS programmers. Apple supplies it to registered developers, and it is also included in some commercial development environments, including CodeWarrior. If you have access to

MPW, you may wish to look into MacPerl's MPW support features.

The rest of us can use MacPerl as a stand-alone Finder application. MacPerl provides a built-in text editor, works with external text editors and has modes of operation ("droplets" and "runtimes") that work well within Mac OS. The Macintosh Toolbox modules provide access to a variety of features, including AppleEvents, the Open Scripting Architecture, QuickTime components and several Managers (File, Gestalt, Memory, Process and Resource).

MacPerl's built-in text editor (based on Apple's TextEdit facility) is mostly a tool of last resort. It suffers from a 32-KB file size limit, doesn't really understand fixed-width fonts and has no real support for programming. Basically, it is an embedded version of Apple's TeachText editor, with all of the limitations you would expect.

Consequently, most MacPerl programmers edit their code using "real" text editors such as Alpha or BBEdit. The Alpha editor, which many MacPerl programmers recommend quite



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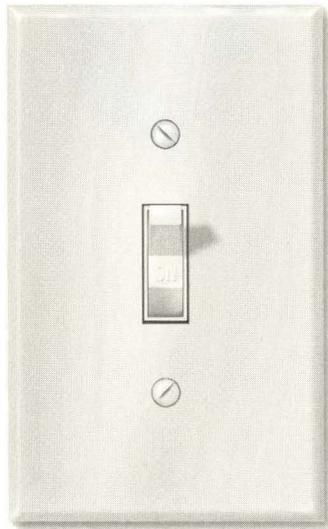
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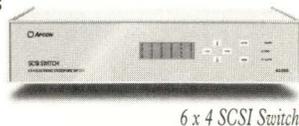
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highly, is available as shareware from most Mac OS-specific FTP archives.

BEdit, which I use on a regular basis, has many pleasant and valuable features (for example, syntax-based text coloring, regular expression-based search and replacement facilities). In addition, explicit support features are available for MacPerl programming. Bare Bones Software sells BEdit 4.5 for under \$120 (educational or cross-upgrade discounts may apply), see <http://www.barebones.com>. It also distributes a reduced-functionality version, "BEdit Lite," at no extra charge.

Most MacPerl programmers will want to keep their scripts around as text files, to allow them to be modified. If you are setting up an application for your users, however, you may wish to create a MacPerl droplet. Droplets are editable, using the MacPerl editor, but mostly act like Mac OS programs. For instance, if you drag a file to the icon for a droplet, the droplet's Perl code will start up, using the file as its input. It is also possible to double-click on a droplet and have it bring up a dialog requesting specific information on what you want it to do.

If you want to send a MacPerl program to someone who may not have a copy of MacPerl installed, you can have MacPerl create executable MacPerl applications (runtime files), which contain copies of the MacPerl runtime code. This is not a very efficient way to transmit Perl code, but it can be quite useful in some situations.

### Available Support

Because MacPerl is closely tied to Perl, it benefits from all the standard Perl support facilities. For instance, many of the modules from CPAN (Common Perl Archive Network) simply drop in and work. Again, visit <http://www.perl.org> to find out what's available.

There is a very active mailing list for MacPerl itself. List members are generally quite knowledgeable and helpful; some regularly do things to enhance MacPerl's utility. For instance, list members have ported and tried out many of the more popular CPAN modules, including a MacPerl port of LWP, the Library for World Wide Web access in Perl. To join the MacPerl email list, send a message containing the body "subscribe" to [mac-perl-request@iis.ee.ethz.ch](mailto:mac-perl-request@iis.ee.ethz.ch).

Current versions of the MacPerl distribution are always available on the CPAN. In addition, both a MacPerl Web site, <http://www.ptf.com/macperl/> and a MacPerl CD-ROM are under construction and should be available by the time you read this. Visit the Web site for late-breaking news about MacPerl, including information on the status of the CD-ROM. ➡

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

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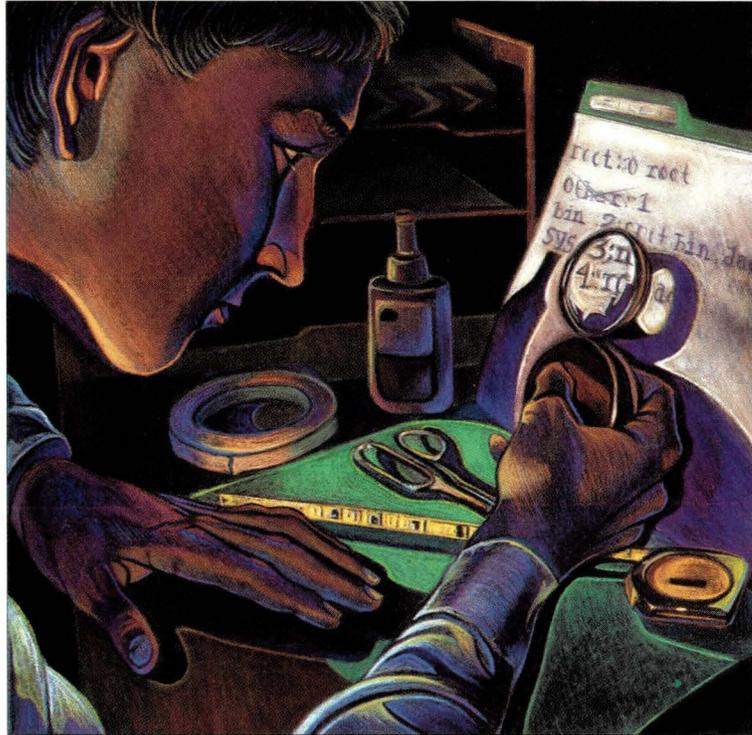
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# Systems Administration

by S. Lee Henry



KRISTINA WEISS

## Checking Groups

Everybody and his dog knows how to set up a group in UNIX. The `/etc/group` file allows groups to be assigned textual names, passwords (rarely used) and members. But everybody and his dog doesn't know, at least myself and my dog just found out, that there are some problems that can crop up in the `/etc/group` file, and that there is a neat little tool for helping to detect them.

The group check tool, `grpck`, checks the format of the group file. It tells you if any names are redundantly defined, that is, if they are members of a UNIX group by virtue of the `GID` field in the `etc/passwd` entries and also included in the `/etc/group` file.

Although being doubly defined as members of a group may not cause problems for those particular users, it might cause problems for other users of that group. For example, once a group entry gets to be longer than  $X$  members or  $Y$  characters long, the line in the

`/etc/group` file will be declared too long by the `grpck` tool. As a result, users at the tail end of the group may not be given the group privileges that you expect.

If you run the `grpck` command against the `/etc/group` file (what other file would you check?), it will inform you of users who are already members of a given group and if a group definition is too long. It will also tell you if any members of a group don't exist in the `/etc/passwd` and `/etc/shadow` files (that is, that they are not defined on the system). This can help you pinpoint and remove old usernames from your `/etc/group` file. You will see errors like the one shown below if you have problems.

If you find that you have a large number of doubly defined users, you can remove them from the group corre-

sponding to their `GID` entries. The script shown in Figure 1 will write out a group (of your choosing) to a file and then check each member against the appropriate `/etc/passwd` entry.

At the end, the script will display a complete group entry in sorted order with any doubly defined usernames removed. You can cut and paste this on top of the old `/etc/group` entry, or you can remove the old entry and insert the new as shown in Figure 2. Removing the doubly defined members will reduce the overall size of the group entry and may bring it back within the allowable group size.

I couldn't find in any of the man pages I read what the maximum allowable size of a group defined within the `/etc/group` file is or any hints that it might be possible to include groups as members of groups (as I can with

```
timmy - Duplicate logname entry (gid first occurs in passwd entry)
Line too long
```

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**Figure 1. Checking Group Members Against /etc/passwd Entries**

```
#!/bin/csh
#

echo -n "Please enter name of group> "
set GRPNAME = $<
set GRPNO = `grep ^$GRPNAME": " /etc/group | awk -F: '{print $3}'`
if (" $GRPNO" == "" ) then
    echo "Sorry -- there is no such group"
    return
else
    echo "Checking group $GRPNAME, group number $GRPNO"
endif

foreach person (`grep ^$GRPNAME": " /etc/group | tr ":", " "\012\012" | tail +4`)
    set PRIME_GRP = `grep ^$person": " /etc/passwd | awk -F: '{print $4}'`
    if ($PRIME_GRP != "$GRPNO") then
        touch /tmp/grp$GRPNO.outsiders$$
        echo $person >> /tmp/grp$GRPNO.outsiders$$
    endif
end

echo "Here are the usernames which NEED to be in the $GRPNAME group:"
set NEWGRP = `cat /tmp/grp$GRPNO.outsiders$$ | sort | tr "\012" ", " | awk '{print substr($0,1,length($0)-1)}'`
echo $NEWGRP
rm /tmp/grp$GRPNO.outsiders$$
```

**Figure 2. Inserting a New /etc/group File**

```
myhost# cp -p /etc/group /etc/group-
myhost# cat /etc/group | grep v :30: > /tmp/group
myhost# fix_group
Which group?> sales
sales::30:billybob,corey,nici,timmy,vancouver
myhost# echo sales::30:billybob,corey,nici,timmy,vancouver >> /tmp/group
myhost# mv /tmp/group /etc/group
```

**Figure 3. Figuring out the Limit**

```
head -80 /etc/passwd | awk -F: '{print length($1),$1}' | sort -n | awk {print $2} | tr \012 ,
tail -60 /etc/passwd | awk -F: '{print length($1),$1}' | sort -n | awk {print $2} | tr \012 ,
```

netgroups). Figuring out the limit, therefore, took a bit of experimentation. Here's what I did: First, I made a list of users taken from the top of the list (the first 80) and another list of users from the bottom of the list (the bottom 60); second, I made groups out of them (commands are shown in Figure 3), this left me with one large group composed of a lot of short usernames and one large group with fewer longer names.

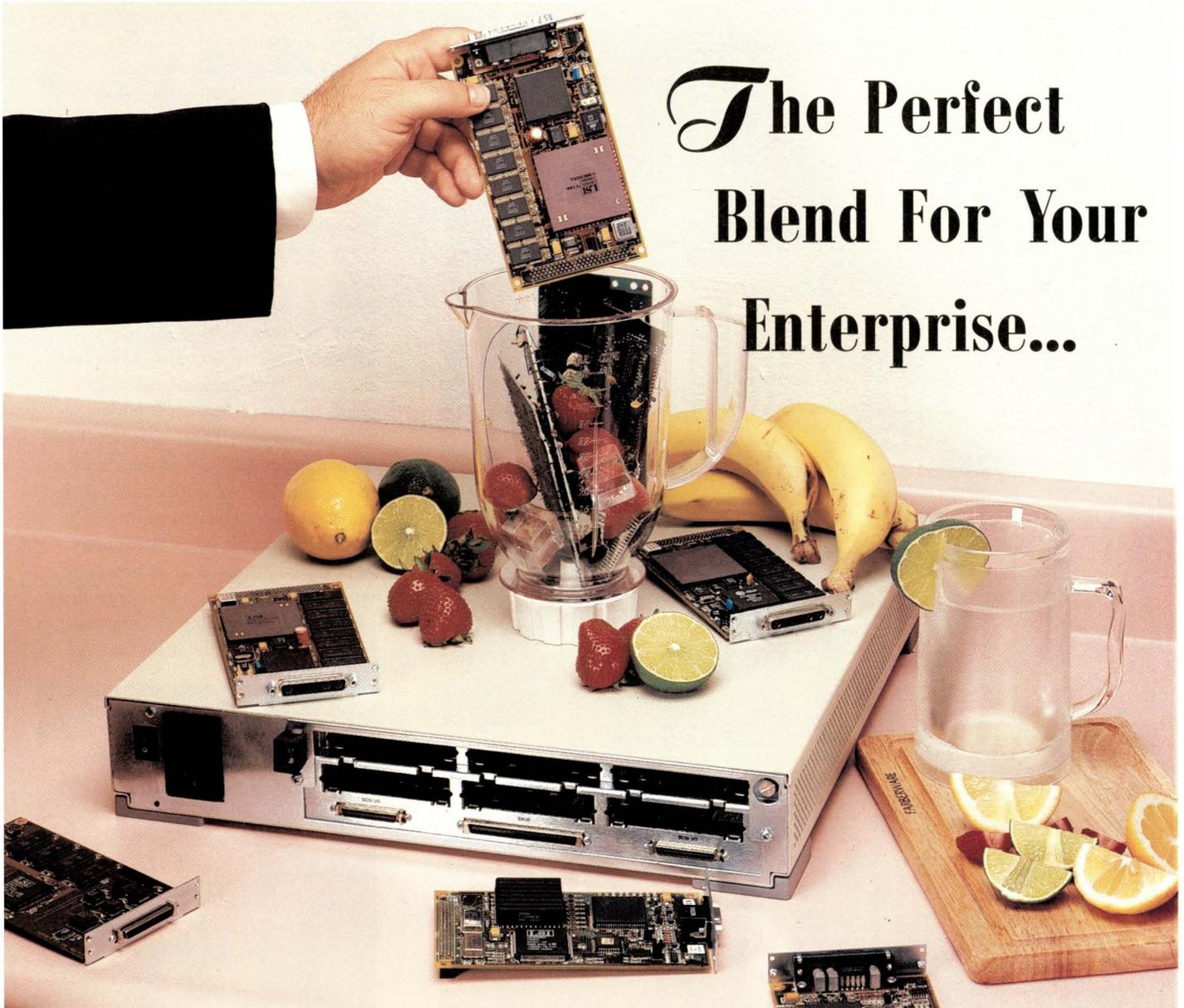
I simply removed the final comma and added these lines to my /etc/group file with the strings sales1::66:

and sales2::77: preceding them. Then, I repeatedly used the grpck command and dropped members from the tail end of the first group and the head end of the other until each was acceptable—that is, until grpck no longer complained.

The result? The list with many users with short usernames wound up with 75 members and a total length of 499. The list with fewer users with longer usernames wound up with 47 members and a total length of 497. Clearly, this suggests that the limiting factor is the length of the group

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**Figure 4. Showing the Length and Number of Group Members**

```
# grep sales /etc/group | awk -F, '{print NF}'  
75  
47  
# grep sales /etc/group | awk -F: '{print length($4)}'  
499  
497
```

record. To show the length and number of members in your groups, use the commands shown in Figure 4.

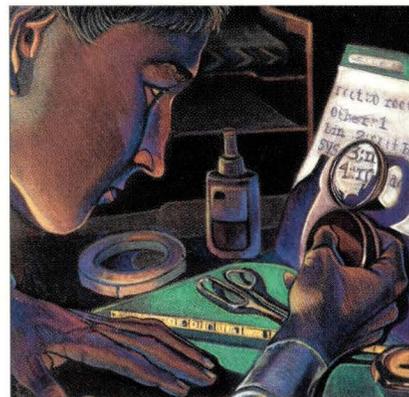
The `/etc/group` file is only one way to define groups, of course. NIS and NIS+ may have different limitations for group members.

Another problem that Jaspar and I ran into with groups is related to the length of usernames in UNIX. Most places I've worked have limited usernames to eight characters to avoid some inconsistencies that seem to crop up with longer usernames. It seems to me that UNIX, in some cases, ignores characters after the eighth (as it does with passwords). Then, at other times, it pays attention to all of the characters in a username. We noticed that truncated usernames had crept into our `/etc/group` file when these users weren't being treated as members of the group. The `grpck` tool finds these problems easily, issuing a "Logname not found in passwd file" error message.

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With my groups properly defined, I can avoid overusing world privilege. As far as I can tell, any number of users can be defined as members of the same group if the assignment is made in the `/etc/passwd` file. It is only when I want a large number of the same users to be members of a second group that I run into problems. →

*S. Lee Henry is a security services engineer at Infonet in El Segundo, CA, where no one else necessarily shares any of her opinions. Jaspar chases cats for a living and actually knows very little about UNIX.*

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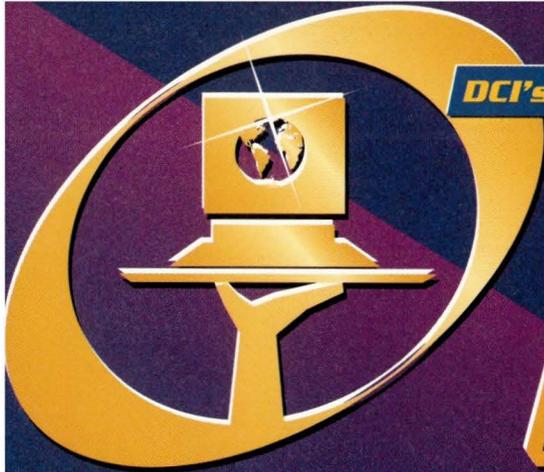
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# NTegration

by Eileen Frisch



## Making yourself Feel at Home

In the previous two columns, we've taken some initial steps into the Windows NT world. This month, we'll look at some freely available and commercial software packages that can make this new place look and feel more like what we're used to: the familiar UNIX environment.

### NT Resource Kit's POSIX Utilities

The Windows NT Resource Kit is an add-on product to the basic operating system sold by Microsoft. There are separate kits for the workstation and server versions of the operating system. The Resource Kit has two components: supplementary printed documentation and additional software, including many important administrative programs. Although Microsoft charges money for the Resource Kit, the software contained in it is unsupported.

You should consider the Resource Kit a required part of any Windows NT installation. It's unfortunate that

there is additional cost associated with it because its contents really ought to be part of the normal Windows NT product. You can purchase the Resource Kit at most large bookstores (in the computer section), at many retail software stores and from mail order hardware and software suppliers. The street price for the workstation and server versions is about \$55 and \$150, respectively.

One of the software items is a set of command-line utilities known as the POSIX Utilities. When installed, the executable files for these commands are located in the POSIX subdirectory of the Resource Kit installation directory (usually `C:\NTResKit`). The following utilities are included: `cat`, `chmod`, `chown`, `cp`, `find`, `grep`, `ln` (for hard links only), `ls`, `mkdir`, `mv`, `rm`, `rmdir`, `sh`, `touch`, `vi` and `wc`. Most of them behave as expected, but `find` is somewhat eccentric. When using them, be aware that they treat filenames as case-sensitive and that filenames on FAT (Windows-format) file systems are converted to uppercase.

### GNU Utilities for Win32

The GNU utilities collection has been ported to Win32 systems (in other words, to Windows 95 and NT). It is available free of charge (as always) from Sunnyvale, CA-based Cygnus Solutions at <ftp://ftp.cygnus.com/pub/gnu-win32/latest>. You can choose to download some or all of the available software, ranging from user utilities to the GNU development environment. The former consist of most of the commonly used UNIX commands and utilities.

Listing 1 contains some examples that will give you a flavor of what running these utilities on a Windows NT system is like. As you can see, `grep` and `ls` work as expected. The `ps` command is more limited.

The `find` command is somewhat nonstandard in that it is the usual GNU version of this utility, but it works the same way on Windows NT systems as it does on other systems where the GNU utilities are installed. For example, the following command is one way to find

# NTegration

all files in the current directory having the extension `html`:

```
C:\> find . -regex .*\.html -print
./TIPS.html
./TIPS2.html
./TIPS3.html
```

You can combine these commands with Windows NT commands as desired. For example, the first command in Listing 2 extracts a `ps`-style process list from the (overly verbose) output of the `pstat` command (included in the Resource Kit). In the same vein, the second command in Listing 2 displays the five highest priority processes currently running on the system.

## The Hamilton C Shell

The Cygnus collection of GNU utilities includes the `bash` shell. Users who prefer a C shell may be interested in the excellent Hamilton C Shell package from Hamilton Laboratories, Sudbury, MA (it costs \$350). It includes a C shell supporting all of the usual features (aliases and command completion are the most important to me); most existing C shell scripts will run correctly without modification.

The package also includes a variety of UNIX-style utilities that may be run from within the C shell or from the Windows

NT command line. Among them are the following utilities, which are missing from the GNU set:

- A cron-style facility (named “cron” but implemented somewhat differently).
- A `df` command, which is inexplicably named `du` (see Listing 3).
- An `mt` command for manipulating tapes.
- The `uudecode` and `uuencode` utilities.
- A shell script functioning as a `whereis` command.

The package also includes a number of “extras,” including many cool sample scripts and the following useful utilities:

- `des` – A DES encryption utility/filter.
- `binedit` – A binary file editor (`sed`-like).
- `xd` – A hexadecimal dump tool.
- An enhanced version of the `pwd` command, which displays the current directory on every disk drive on the system:

```
C:\> pwd
c:\ntreskit\perl
d:\aefrisch\columns
e:\
...
k:\
l:\hamilton\bin
```

## Listing 1. Sample Commands from the Cygnus GNU Utilities

```
C:\> grep "u.*.*see[^\ ].*.*p" *.html
TIPS3.html:submit the solution to a problem you've seen occur, please

C:\> ls -l *.html
-rw-r--r--  1 544      everyone    22256 Mar 29 18:54 TIPS.html
-rw-r--r--  1 544      everyone    12843 Mar 29 15:55 TIPS2.html
-rw-r--r--  1 544      everyone     3980 Mar 28 19:05 TIPS3.html

C:\> ps -ef
  PID      PPID      WIN32-PID  UID  COMMAND
 1000      1000              327  500  C:\\ps.exe
```

## Listing 2. Combining Windows NT and GNU Commands

```
C:\> pstat | awk "/Pri/ || /^ 0:00/ {print $0}"
  User Time  Kernel Time  Ws  Faults  Commit  Pri  Hnd  Thd  Pid  Name
0:00:00.000 20:58:41.945 16   1       0    0  0   1   0  Idle Process
0:00:00.000 0:00:56.240 120  2016    36    8 251 30   2  System
0:00:00.180 0:00:00.220 120  2032   164   11 36   6  23  smss.exe
0:00:03.575 0:00:21.420 1304 1899   1220  13 246  7  31  csrss.exe
0:00:02.012 0:00:08.722 568  15470   668  13 67   2  37  WINLOGON.EXE
...

C:\> pstat | awk "/Pri/ || /^ 0:00/ {print $0}" | sort +5 | head -6
  User Time  Kernel Time  Ws  Faults  Commit  Pri  Hnd  Thd  Pid  Name
0:00:00.000 21:00:11.243 16   1       0    0  0   1   0  Idle Process
0:00:00.000 0:00:00.000 52   10     108    8  5   1  196  sort.exe
0:00:00.000 0:00:00.010 52   10     104    8  5   1  236  head.exe
0:00:00.020 0:00:00.010 524  128     280    8  8   1  230  awk.exe
0:00:00.010 0:00:00.020 892  222     332    8 14   1  237  PSTAT.EXE
```

# SUN

# DEC

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## Listing 3. The Hamilton C Shell's du Command

```
C:\> du
c: 612.832 M Total = 561.337 M Used + 51.495 M (08.40%) Free ariadne
d: 511.784 M Total = 469.248 M Used + 42.536 M (08.31%) Free ananke
e: 620.206 M Total = 620.206 M Used + 0.000 M (00.00%) Free ntsrv40a
g: 1044.095 M Total = 4.421 M Used + 1039.674 M (99.58%) Free aporia
h: 522.112 M Total = 4.419 M Used + 517.693 M (99.15%) Free acrasia
i: 700.287 M Total = 4.379 M Used + 695.908 M (99.37%) Free aveya
j: 1189.888 M Total = 91.325 M Used + 1098.563 M (92.32%) Free amelia
k: 308.208 M Total = 286.457 M Used + 21.751 M (07.06%) Free amanda
l: 449.788 M Total = 165.800 M Used + 283.988 M (63.14%) Free anitra
```

Demonstration versions of the Hamilton C shell are available from the Hamilton Laboratories Web site, <http://www.hamiltonlabs.com>.

## MI/X X Server Software

If you'd like to be able to use a Windows NT system as the display for X windows initiated on a UNIX system, then the free MI/X X Server software from MicroImages Inc., Lincoln, NE, may be just what you're looking for. You can download it from the Internet at <http://www.microimages.com/freestuf/mix.htm>. Once it is installed, the simplest way to use it is to initiate a telnet session from the Windows NT system to the desired UNIX system and start the X Server executable (`xs`). Then, issue the following commands on the UNIX system (where `vala` is the name of the Windows NT system):

```
unix-102>> setenv TERM xterm
unix-103>> setenv DISPLAY vala:0
unix-104>> xterm &
```

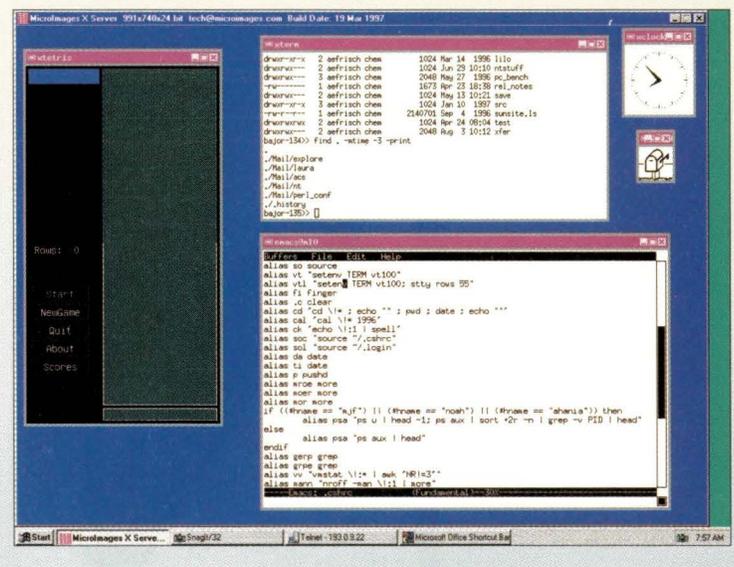
These C shell commands will cause an `xterm` window to appear within the X Server application window (as you know, the Bourne shell commands for setting environment variables are slightly different). Once it is functioning, the telnet session may be terminated.

Figure 1 illustrates the X Server environment with several X-based applications running. The X Server includes the `twm` window manager, which may be fully customized, including a startup file to automatically initiate X applications when the server is started.

## OpenNT: Going All the Way

If a few user utilities are not enough to satisfy your UNIX appetite while working on a Windows NT system, consider the OpenNT package from Softway Systems Inc., San Francisco, CA. It provides an impressively rich UNIX-style working environment under Windows NT. Architecturally, OpenNT is structured as an enhanced POSIX subsystem, and so it is able

Figure 1. The MicroImages X Server



to provide not only user-level utilities but a full POSIX programming environment designed to make porting UNIX applications to Windows NT simple.

OpenNT includes four shells—`sh`, `csh`, `ksh` and `tcsh`—all of which support full job control. It also includes various UNIX commands and facilities, including some that are generally missing from the free software collections (for example, `strings` and `umask`).

The following simple examples illustrate some features of the OpenNT environment. First, here is a `find` command (which, unlike other available versions, conforms to the standard syntax):

```
> find . -mtime -1 -name \*y\* -print
/OpenNT/usr/lib/perl5/auto/DynaLoader
/OpenNT/usr/lib/perl5/opennt/5.00305...
/OpenNT/usr/lib/perl5/Sys
```

Most of the included commands work as well as this one does.

However, there are a few glitches. For example, while the `ps` command uses the proper display format, it still does not work as expected:

# NIntegration

```
> ps -ef
USER      PID      PPID  ELAPSED  TTY      TIME      CMD
197108   1638400      1      0:54.95  n00      0:00.45  tcsh
197108   6422529  1638400  0:00.03  n00      0:00.02  ps -ef
```

This is not a bug but simply a limitation of using a POSIX subsystem as the product's base: Only those processes running under the subsystem will appear in the list.

Mixing Windows NT commands and OpenNT is possible but sometimes a bit tedious. For example, consider this command to set the C shell prompt:

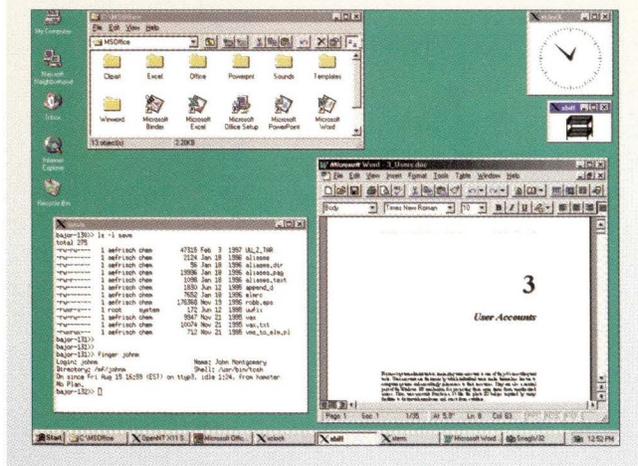
```
> set prompt = " %HOSTNAME.EXE`-!\!>> "
vala^M-58>> _
```

The `hostname` command is a Windows NT command (located in `C:\WinNT\System32`). In order for it to be found, its location must be in the search path, and its full name must be entered in the correct case (uppercase in this instance). Extensions are not applied by default to command names, and all pathnames are truly case-sensitive, both of which are completely in line with standard UNIX but are inconvenient when you have gotten used to Windows NT's laxness.

OpenNT includes many X clients, and the server version also includes an X Server—which can be purchased separately. Figure 2 illustrates a Windows NT desktop when the X Server is running. As Figure 2 demonstrates, this product makes it easy to run UNIX, X and Windows NT applications simultaneously. In this example, we have an `xterm` window on a remote UNIX host, a Windows NT file browsing window, a Microsoft Word session, two other X-based utilities (one of which is running from the remote UNIX system), as well as the usual Windows NT icons on the desktop. Each process runs in its own window, and multiple processes of any type are supported.

Prices for the OpenNT products start at \$229 for the Lite

**Figure 2. The OpenNT X-Based Environment**



version (no X Server) and \$379 for the single-system Workstation version. Server versions (which include a `telnet` server product) range from \$979 for one to 25 users to \$1,899 for unlimited users. The Software Development Kit costs \$199.

## Other Stuff

Almost every UNIX facility that you might want to put on a Windows NT system is out there somewhere. Here are sources for two of the most requested classes of tools:

- Perl for Win32 systems is available at <http://www.perl.com/perl/info/software.html>.
- Various TCP/IP daemons and World Wide Web-related facilities can be obtained at Jim Buyens' amazing software site, see <http://www.primenet.com/~buyensj/ntwebsrv.html>. ➔

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# Turning Heads

## IN THE BUSINESS WORLD

**Bolstered by more powerful desktop systems, better user interface design and the desire to tap the vast stores of corporate data accumulated over the years, the upper echelons of today's business analysts are turning to data visualization software.**

# Data Visualization

by **ALEX SIMEONIDES, Staff Editor**

**D**ata visualization: It's not just for engineers anymore. Granted, MBAs aren't exactly storming the Egghead Computer shelves for new 3D, 4D and *n*D modeling software. "For the most part, business people are still tied to 2D graphs and pie charts," says Alexandra Ohlson, Sun Microsystems Inc. senior engineer on the XIL (an imaging library) development team. And the business users who do use these tools tend to rank high on the sophistication scale: statisticians performing risk analysis on Wall Street, artificial intelligence experts mining marketing databases and so forth. Users with these sorts of analytic skills are scarce, and unless something drastic happens to the U.S. education system, will probably remain so. Meanwhile, the director of marketing and the chief financial officer have yet to be enlightened.

Vendors playing in this space admit that data visualization will never be a big hit with business users of, say, the World Wide Web. "It can be a tough sell," says Mitchell Bring, president of Graphic Intelligence Corp., Croton, NY, a consulting firm that applies data visualization techniques to economic data. "The perception is that data visualization is purely a presentation tool."

Nevertheless, data visualization is slowly catching on with business users. Experts attribute the gradual

Illustration: Kristina Weiss; Graphic images courtesy of: Graphic Intelligence Corp., Visible Decisions Inc., Conceptual Reality Presentations Inc.

# Data Visualization

acceptance to the fact that people are beginning to understand multidimensional graphs. "I see the industry as a whole making the transition toward understanding their data in 3D," says Sun's Ohlson.

And slowly, users are seeing that data visualizations not only look cool but can be useful too. "I've had the most success when I've been able to show a customer a visualization of their data that taught them something they didn't know before," Bring says.

At International Data Corp., a Framingham, MA-based industry analysis firm, analysts have identified a new class of applications designed for the high-end business user. According to Henry Morris, program director for data warehousing and applications, "analytic applications" help users understand the content of their data, and not, as is the case with simple online analytical processing (OLAP) tools, to simply gain access to it. Increasingly, analytic applications include a visualization component.

Similarly, some vendors applying visualization techniques to business problems don't feel their software is well served by the term "data visualization." At Visible Decisions Inc., Toronto, Ontario, for example, maker of the business-focused Discovery visualization package, employees refer to the "information visualization" trend.

But as data visualization travels the course between science and business, it's becoming apparent that it's going to take more than a name change to make a scientist's tool fit the corporate realm. Business—and business people—have needs all their own, and what's good for the goose is not necessarily good for the gander. This article will look at the needs of this new class of user, how they are distinct from those of traditional data visualization software users, and how vendors are translating those needs into marketable products.

## Cultural Differences

Scientists and engineers are renowned not only for being able to put up with lousy user interfaces, but also for creating them. Take the UNIX command shell, for example. On the other hand, it seems that marketing folks would rather hang themselves than learn the arguments to the `grep` command, no matter how useful it is. Traditional data visualization software, written by scientists for scientists, seems to leave business folks with this same feeling of despair.

The truth of the matter is that scientists and business people think differently. If you need evidence to back up that claim, just pick up any of Scott Adams'

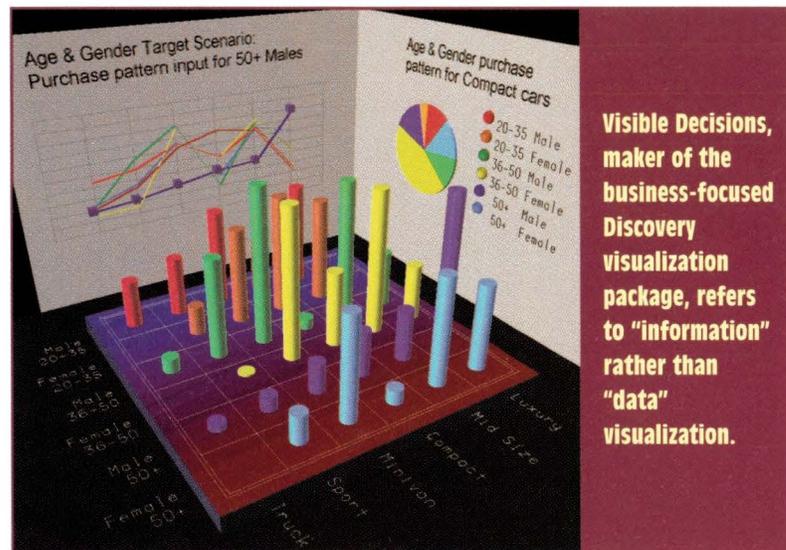
However, the connection between diapers and videotape sales may not be so obvious to people without children.

In a paper that she and her colleagues will present at the IEEE Visualization '97 Conference in Phoenix, AZ, this month (called "Case Study: Visualizing Customer Segmentations Produced by Self Organizing Maps"), Rushmeier summarizes, "Business applications have decidedly different goals from scientific applications. The goal of visualization in business is action, not insight." In other words, while an engineer wants to understand the problem at hand, a business user wants to see results that indicate in which direction they should

take their business.

On a more basic level, business users are typically less computer-literate than their scientific counterparts. It's not that they can't drive the car from Point A to Point B, it's just that you probably wouldn't ask them to redesign the carburetor.

At Stats Canada in Ottawa, Ontario, for example, analysts are using Discovery from Visible Decisions to view multidimensional graphs of monthly survey



Dilbert books, and consider what percentage of the strips revolve around the conflict between Dilbert and his boss.

One researcher at the IBM Thomas J. Watson Research Center in Yorktown Heights, NY, found out firsthand what separates scientists from business users. Holly Rushmeier, research staff member at the Watson lab, is a member of the Data Explorer (DX) team, IBM's venerable data visualization package. Last year, she joined a team whose mission it was to incorporate Data Explorer as the visualization component of a neural network data mining application. In mining the database, the customers hoped to elicit some previously unthought-of buying patterns in their marketing database. For example, it comes as no surprise that people who buy a lot of diapers tend to consume a lot of graham crackers.

vey data on manufacturing, construction and energy. But while the application itself is seen as cutting edge, the analysts using Discovery are not. John Foley, project manager for the redesign of the *Monthly Survey of Manufacturing Redesign*, describes his users as "experts of their particular industry," oil or steel, for example. But they're no computer experts. "They know word processing and spreadsheets, but they're not programmers. Computers are a tool, but it's not what they're about."

Whether business people don't want to learn complex applications or don't have the mathematics skills necessary to do so remains to be seen. But one thing's for certain: Even if they wanted to learn, they probably don't have the time. For an anthropologist reconstructing a model of a Paleolithic bone fragment, the data

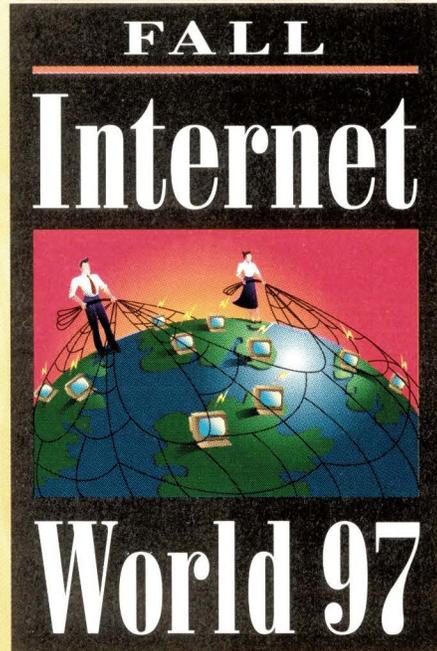
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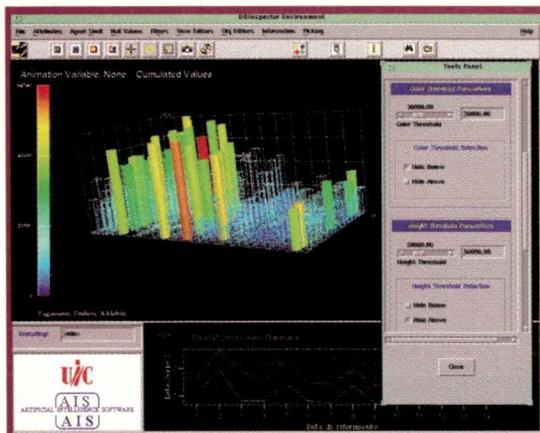
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# Data Visualization



**Artificial Intelligence Software's VisualMine is based on AVS/Express graphics tools from Advanced Visual Systems.**

visualization package is probably their main working environment. The business user, on the other hand, is more likely to spend most of his working day in a spreadsheet, word processor or doing research on the Web.

"Remember," says John Brocklebank, product manager for Enterprise Miner, a data mining product from SAS Institute Inc., Cary, NC, "these users aren't necessarily pounding on the program all day the way an engineer might. They might play with it for a couple of hours, then move on to something different."

Vendors are finding that if an application is too complex, users will quickly jump ship, no matter how useful the program may be to them. In her paper, IBM's Rushmeier writes that while the "images generated by the visualization program [Data Explorer] developed for decision makers were successful in communicating results, the interactive program itself was found to be too complex to appeal to nonquantitative decision makers." As a rule of thumb, data visualization tools should be as intuitive and easy to learn as possible, and never more complex than the user's core working application, say, the spreadsheet.

## Where Spreadsheets Leave Off

What business users do have in common is a familiarity with office productivity applications, most notably, with PC-style spreadsheets such as Microsoft Corp.'s Excel and Lotus Development Corp.'s 1-2-3. "I'd say that about 90% of our customers use Excel," says James

Ong, director of product marketing at Belmont Research Inc., Cambridge, MA. Belmont Research is the developer of CrossGraphs, a visualization tool for viewing arrays of two-dimensional graphs. "It's only the most qualitatively sophisticated business users that use tools more complicated than a spreadsheet."

Because spreadsheets these days are so powerful, and because users know them so well, convincing a user to try out some newfangled visualization tool isn't always easy. In fact, according to Ong, users will only begin to consider another application when they've outgrown their spreadsheet.

One such CrossGraphs user is Mario Guralnik, medical affairs director for Asta Medical Inc., a pharmaceutical company based in Hackensack, NJ. "I've been using Microsoft Excel since Version 1," says Guralnik. "I love it and couldn't imagine life without it." However, Guralnik acknowledges that in his business, Excel is often not up to par. For example, in order to get a drug approved by the Food and Drug Administration, the company must submit graphs of the results of clinical trials. "First of all, Excel has a size limit of, I believe, 32,000 rows; we surpass that easily."

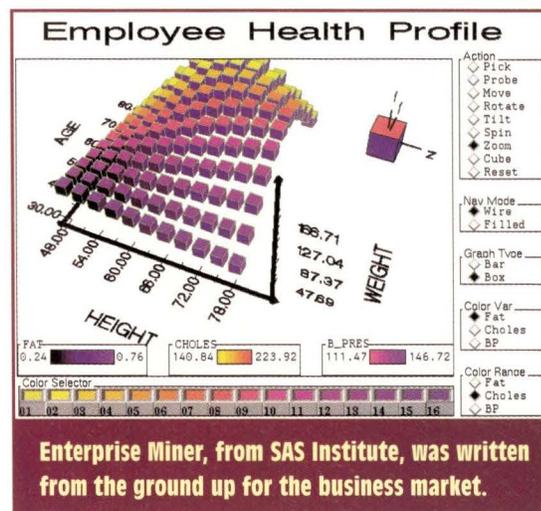
But assuming that you have less data than that, Guralnik says that using Excel would still be practically infeasible: "If you have 200 patients, and you want to graph each of their white blood cell counts, red blood cell counts, platelets and lymphocytes, then right there, you have 800 graphs to create." Because Excel has no automation facilities, this can take days, sometimes weeks, of manipulating rows and columns, creating graphs and formatting attractive, professional printouts. Simply put, "you can't do anything 10,000 times and still enjoy it," Belmont Research's Ong says.

## Plug-and-Play Solutions

All this underlies the fact that if data visualization vendors are to have any success appealing to business users, they must make their applications extremely accessible. While an engineer might enjoy the challenge and the freedom of a barebones graphics engine and a programming language, it's unreasonable to expect a business user to spend even five minutes trying to learn how to use this kind of tool.

For vendors selling data visualization wares to nonscientific users, one way to bridge this gap is to provide users with targeted, bulletproof applications designed for their particular business segment. "The main difference in the business sector is that users play a less proactive role," says Francesco Gardin, president of Artificial Intelligence Software S.p.A. (AIS), Milan, Italy, maker of the VisualMine data mining application. In other words, Gardin says, business managers expect to have a set of views prepared for them from the outset. They do not want to design their own graphs and templates, the way an engineer does.

It's not surprising, therefore, to find out that vendors selling data visualization to businesses are typically not pure software development houses, but rather, industry consultants that happen to have extensive skills in graphic modeling. AIS, for example, bases its VisualMine product on AVS/Express graphics tools, from Advanced Visual Systems Inc. (AVS), Waltham, MA. AVS/Express is software used for applying 3D visual-



# Data Visualization

ization and imaging techniques to complex data and applications, typically in such heady industries as geospatial, engineering, oil and gas, and aerospace.

However, AIS also did extensive consulting work creating targeted views for the Ufficio Italiano dei Cambi (UIC), a branch of the Italian central bank responsible for identifying anomalies related to money laundering. Users can look at multidimensional views sometimes representing as many as 20 variables, for example, geographic regions, size of wire transfers or percentage of non-Italian banks. At the same time, AIS has been contracted to customize VisualMine for a Siense bank. The resulting application, MarketMine, will reportedly enable the bank to better understand the makeup of its customer base.

Users at UIC, however, probably have no idea that the AIS applications weren't designed from the ground up specifically for them. "AVS is totally transparent; users interact with the layer we've applied on top of it," Gardin says.

Similarly, the feeling at Stats Canada is that the effort to provide analysts with data visualization tools would not have been successful if the analysts had been left to design their graphical views on their own. To this end, a group of developers program the actual Discovery applications, working in conjunction with the analysts to better determine what type of information users want to see. According to Stats Canada's Foley, "The analysts are on the verge of being overwhelmed by information. Our aim is to simplify their jobs, not bring them added complexity."

Companies that have not traditionally catered to business users, that is, those whose products require a certain technical sophistication, are also making an effort to render their goods more accessible to the business market. At The MathWorks, Natick, MA, for example, there's been a long-standing initiative to provide MATLAB users not only with the tools to crunch their own numbers, and to display their data, but also to deploy so-called mini applications to a wider group of users—users usually less mathematically inclined than themselves, says Mike Wolf, general manager

of financial products at the company. Thus, a MATLAB application written by an engineer working on a Sun workstation can also be deployed across any other platform supporting MATLAB, including Windows and Macintosh. "People who would never have viewed themselves as being able to develop applications are now working in MATLAB," Wolf says.

## Porting to a Business Platform

Selling into the business segment typically presents a very basic problem to data visualization vendors: Their software doesn't run on Windows. Or didn't, at any rate. Up until a couple of years ago, data visualization software typically ran on Solaris, IRIX, AIX and so on, but rarely on Windows. And except for a few high-end users on Wall Street, business

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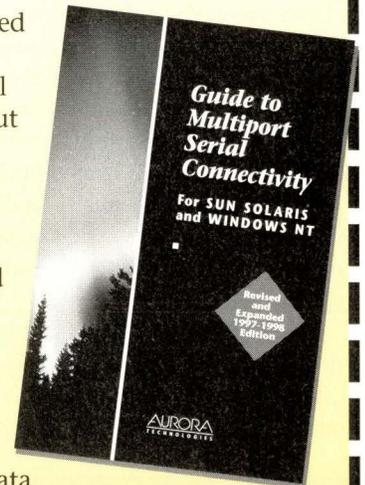
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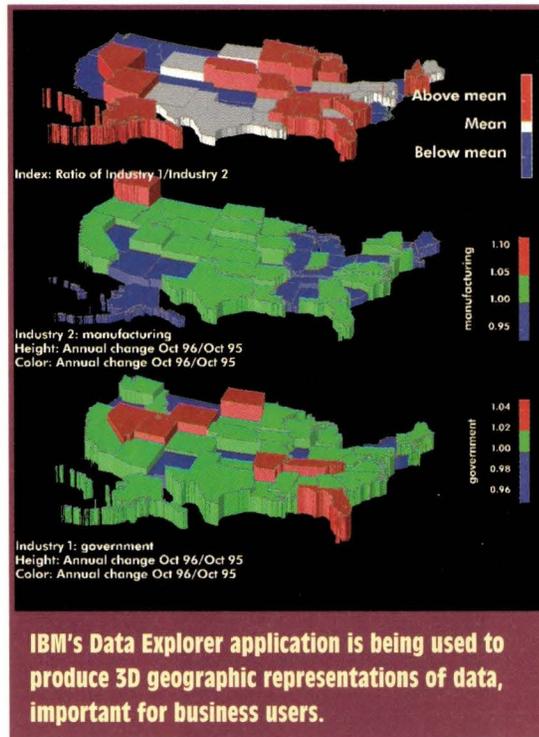
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users didn't run on anything but.

UNIX application vendors, of course, are steadily embracing the Windows NT platform, with announcements of ports coming fast and furious. However, for traditional data visualization vendors, porting an application to a business user's platform means more than paying homage to the Win32 API—it means reworking the entire product so it behaves like a modern Windows product.

Bill Wright, chief designer of application solutions at Visible Decisions, explains that today's visualization products have different requirements than yesterday's scientific visualization products. "Information visualization faces a lot of 1997 issues," says Wright. "Users expect animation, interaction, navigation. Software is based on new object-oriented paradigms, and we can afford to add new features, thanks to better performing hardware." Wright also adds that users expect greater reliability, ease of use and the ability to integrate their software with a whole host of other tools and technologies—ActiveX, ODBC, databases and so on.

For SAS Institute, known for its statistics packages, reengineering legacy applications for use by business users is not an option. Therefore, when the company



decided to enter the data mining arena with its Enterprise Miner package (currently in beta), SAS opted to develop the application from fresh. "Enterprise Miner was written from the ground up for a new market," says SAS' Brocklebank.

Enterprise Miner user Sherif Sewihy, a database modeler for NationsBank, Charlotte, NC, says the new Windows NT interface saved him a lot of coding time. "It's a completely point-and-click

interface. The novice user could figure out how to use it because it supplies defaults, but the more sophisticated user can benefit from it."

Not all Windows ports are up to snuff yet, though. At Graphic Intelligence, which uses IBM's Data Explorer software as its visualization foundation, Windows users get to access the software the old-fashioned way—through a PC X server.

## Different Data, Different Views

"It's funny. Some of the worst visualization techniques are used over and over again," says Belmont Research's Ong. "Personally, I think that 3D bar graphs are really horrible. They're like taking a picture of a group of people with the tall people in front and the short people in back." Steve Labute, program manager at Comshare, an Ann Arbor,

MI-based decision support software vendor, concurs: "A lot of users have a really hard time both understanding 3D graphs and navigating them."

Scientists and business people have different goals, different skills and different data. It only makes sense that they would want to look at different graphics.

According to Visible Decisions' Wright, scientific visualization software has its roots in trying to display objects

## Companies Mentioned in this Article

### Advanced Visual Systems Inc. (AVS)

300 Fifth Ave.  
Waltham, MA 02154  
<http://www.avs.com>  
Circle 150

### Artificial Intelligence Software S.p.A. (AIS)

Via Carlo Esterle, 9 - 20132  
Milan, Italy  
<http://www.iunet.it/ais>  
Circle 151

### Belmont Research Inc.

84 Sherman St.  
Cambridge, MA 02140  
<http://www.belmont.com>  
Circle 152

### Graphic Intelligence Corp.

12 Prickly Pear Hill  
Croton, NY 10520  
Circle 153

### IBM Corp.

Thomas J. Watson Research Center  
P.O. Box 218  
Yorktown Heights, NY 10598  
<http://www.research.ibm.com>  
Circle 154

### InXight Software Inc.

3400 Hillview Ave.  
Palo Alto, CA 94304  
<http://www.inxight.com>  
Circle 155

### The MathWorks Inc.

24 Prime Park Way  
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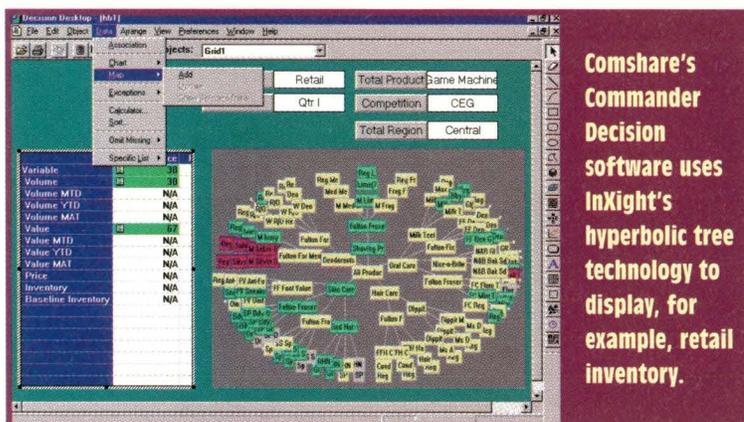
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# Data Visualization

that conform to 3D Euclidean space. "In science, there's an underlying physicality—an engine, a chemical, an airplane wing and so on—that maps to a basic x, y, z, layout," says Wright. "In business, you don't have those underpinnings." Instead, users try to map abstract concepts—brand names, gender, age and so on—in these same spaces.

The goal therefore becomes, how do we visually represent several variables against one another without confusing the user?

By some accounts, the solution is to keep down the number of dimensions. According to Belmont Research's Ong, most users are more comfortable looking at five arrays of 2D graphs next to one another than at a single 5D graph (3D plus color plus animation). "What



I like to do is print out my graphs and tape them all up together on my wall," says CrossGraphs user Guralnik. "When you look at them all together like that, you can really see the correlations." Another benefit of this approach is that the user does not necessarily need to be using the application in order to absorb the data.

Research, though, shows that most people are capable of looking at more than two relationships at a time. "The human brain has a significant ability for

visual pattern recognition," says AIS' Gardin. "Our tool lets users take advantage of their powerful visual intelligence, the wired-in capacity that human beings have."

Gardin concedes that developers need to coin useful, intuitive "visual metaphors." He says: "We employ four people developing our visual metaphors. It is not a sci-

ence, it is an art." For example, one particularly successful visual metaphor developed for the Milan Stock Exchange used the image of a battlefield to represent the price formation of a stock. Tanks in the battlefield represented various brokers, with their market clout represented by the size of the tank. By animating the tanks around the battlefield, viewers were able to see the broker's attitude toward the stock over time.

Experimenting with different ways to visualize data is a perennial favorite among computer and cognitive scientists. In the data mining realm, one of the concerns that academics are addressing is how to present high-level views of large amounts of data. One solution comes from InXight Software Inc., Palo Alto, CA, an outgrowth of Xerox's Palo Alto Research Center (PARC). Examples include the hyperbolic tree, licensed into Comshare's Commander Decision software, and the table lens.

Another key requirement is that users be able to explore their data views. "Analysts want to be able to click on an anomalous segment of a graph and drill down for more specific information," says Foley of Stats Canada. "We used to think that we wanted a really good statistics package first, with visualization as an aside. Then, we realized that our statistics routines were good enough, but that interactivity was really important."

What it all boils down to is not simply making the numbers look sexy, but extracting the most information, from the most data, with the least hassle possible. Says Foley: "Users are tired of leafing through 50 pages of graphs. They want to point and click and have the story come to them easier." ➔

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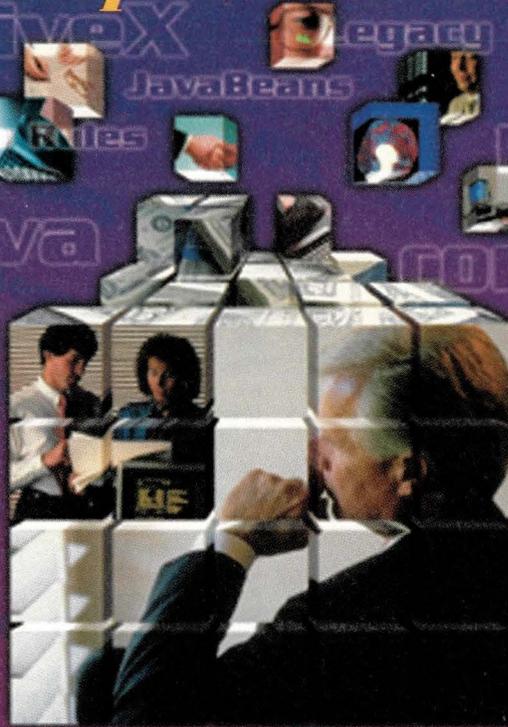
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ULEZX01



# Visualization Software

compiled by MAUREEN MCKEON

**Advanced Visual Systems Inc.**

300 Fifth Ave.  
Waltham, MA 02154  
Circle 200

**Product:** AVS/Express Developer's Edition, AVS/Express Visualization Edition for end users

**Type of software:** Scientific and business visualization

**Architecture:** Stand-alone or embedded in an application

**Platforms supported:** Digital Alpha, Digital VAX/VMS, Sun, SGI (all platforms), HP workstations, IBM workstations, PC

**Operating systems supported:** Digital UNIX, Alpha NT, Solaris, IRIX, HP-UX 10.20, Windows 95/NT

**RAM required:** 32 MB

**Disk space required:** 200 MB

**Graphics requirements:** Motif and X11; also supports Open GL

**Other requirements:** C++ compiler

**Data formats supported:** ASCII, binary, more

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** Yes, using VRML

**Setup, configuration or programming required:** None

**Customer support:** Toll-free telephone, email, WWW (includes international support)

**Maintenance fees:** First year free, contact vendor for detailed pricing after initial period.

**Site licensing:** Yes, contact vendor for pricing.

**Price:** Developer's Edition (UNIX version) \$25,000 for first seat, \$6,000 for additional seats. Runtime licenses quoted on a per-use basis. Visualization Edition (UNIX version) starts at \$6,000.

**Amtec Engineering Inc.**

3055 112th Ave. N.E.  
Bellevue, WA 98004  
Circle 201

**Product:** Tecplot

**Type of software:** Scientific visualization

**Architecture:** Stand-alone

**Platforms supported:** IBM RS/6000, HP/9000 (700&800), Digital Alpha, Digital VAX/VMS, Sun SPARC/x86, SGI, Data General AViiON, Intel PC

**Operating systems supported:** AIX 3.2.5 or 4.1+, HP-UX 9.0+, Ultrix 4.3+, Digital UNIX 3.2+, Alpha Windows NT, Alpha OpenVMS, VAX/VMS, SunOS 4.1+, Solaris 2.4+, IRIX 4.x or 5.2+, DG-UX 5.4R4.11+, Intel x86 (DOS 3.1+, Windows 3.1x+, Windows 95/NT, OS/2, Solaris 2.4+, Linux 1.2+, Interactive UNIX)

**RAM required:** 12 MB (UNIX), 8 MB (Windows)

**Disk space required:** 66 MB (UNIX), 25 MB (Windows)

**Graphics requirements:** Motif 1.2 in UNIX except Linux and SunOS 4.1; static-linked versions available

**Other requirements:** None

**Data formats supported:** ASCII, binary, Plot3D

**Maximum data size:** Limited only by virtual memory

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** Yes, using NASA's Raster Meta File Format. Available for free via Amtec's Web site.

**Setup, configuration or programming required:** None

**Customer Support:** Toll-free telephone, email, WWW

**Maintenance fees:** First 90 days free. Upgradable to one year, which includes software updates released during that year. Extended support pricing is approximately 17% of purchase price.

**Site licensing:** Yes, contact vendor for pricing.

**Price:** UNIX X/Motif personal license \$2,195, network license for server and first concurrent user \$2,995, additional concurrent users cost \$2,195 each. VMS X/Motif Workstation personal license \$2,195 (not available as a network license).

**Angoss Software International Ltd.**

34 St. Patrick St., Ste. 200  
Toronto, Ontario, Canada M5T 1V1  
Circle 202

**Product:** KnowledgeSEEKER 4.3

**Type of software:** Business visualization

**Architecture:** Stand-alone

**Platforms supported:** Sun, HP/9000, IBM RS/6000, Digital Alpha, SGI Indy, Sequent, Siemens Nixdorf, Intel

**Operating systems supported:** Solaris 2.4+, HP-UX 9.05+, OpenServer 5.x+, AIX 4.0+, IRIX 5.x and 6.x+, Dynix 4.1x+, Sinix 5.41, Intel Linux 2.x+

**RAM required:** 8 MB (minimum), 16 MB (recommended)

**Disk space required:** 10 MB to 20 MB

**Graphics requirements:** Motif and X11

**Other requirements:** None

**Data formats supported:** ODBC, Gauss, Stata, more

**Maximum data size:** Limited only by virtual memory

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** Software installation

**Customer support:** Telephone

**Maintenance fees:** First year free. Approximately 17% of purchase price annually thereafter.

**Site licensing:** Yes

**Price:** \$4,625/single-user license, \$20,000/five-user license, \$325,000/site license

**Aptech Systems Inc.**

23804 S.E. Kent-Kangley Road  
Maple Valley, WA 98038  
Circle 203

**Product:** Gauss

**Type of software:** Primarily scientific, but also used for business analysis, operations research and market research.

**Architecture:** Stand-alone with optional add-on applications that use the Gauss language

**Platforms supported:** IBM RS/6000, HP/9000 (700&800), Digital VAX/VMS, Sun SPARC/UltraSPARC, SGI, Intel x86 and compatibles

# Visualization Software

**Operating systems supported:** Solaris 1.0-2.6 (including x86), HP-UX, Windows 95/NT, OS/2, DOS (most flavors), IRIX

**RAM required:** 6 MB

**Disk space required:** 6 MB

**Graphics requirements:** Motif and X11; also supports OpenGL

**Other requirements:** X Window on UNIX platform

**Data formats supported:** Gauss, ASCII, Excel, dBase, Lotus, Quattro, Symphony

**Maximum data size:** Limited only by virtual memory or system/hardware-imposed

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** None

**Customer support:** Telephone, email. Several maintenance/support options available.

**Maintenance fees:** First 60 days free. Three levels of support offered after initial period, contact vendor for detailed pricing.

**Site licensing:** Yes, academic only

**Price:** Corporate pricing is \$3,495/single-user license, \$3,995 for initial network and \$2,995 for each additional network (academic and government discounts available).

## BBN Domain Corp.

150 Cambridge Park Drive

Cambridge, MA 02140

Circle 204

**Product:** Cornerstone

**Type of software:** Scientific and business visualization

**Architecture:** Stand-alone

**Platforms supported:** SPARC, HP/9000 (700&800), PC

**Operating systems supported:** Solaris, HP-UX, Windows 95/NT

**RAM required:** 16 MB

**Disk space required:** 40 MB

**Graphics requirements:** Motif

**Other requirements:** None

**Data formats supported:** ASCII, ODBC, more

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** —

**Setup, configuration or programming required:** None

**Customer support:** Telephone, software updates

**Maintenance fees:** Approximately 15% of purchase price

**Site licensing:** Yes, contact vendor for pricing.

**Price:** Contact vendor

## Belmont Research

1250 Bayhill Drive, Ste. 101

San Bruno, CA 94066

Circle 205

**Product:** CrossGraphs

**Type of software:** Originally scientific, but currently used to support research data analysis in engineering and business.

**Architecture:** Stand-alone or embedded in an application

**Platforms supported:** Sun SPARC, HP/9000, Microsoft Windows PC, Macintosh

**Operating systems supported:** Solaris, HP-UX, Windows 3.1/95/NT, Mac OS

**RAM required:** 32 MB (UNIX), 16 MB (Windows 3.1), 24 MB (Windows 95/NT)

**Disk space required:** 25 MB

**Graphics requirements:** Motif

**Other requirements:** None

**Data formats supported:** ASCII, dBase, SAS, Oracle databases, ODBC-compliant data sources

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** Yes. No specific language required. CGI, Perl and HTML are suggested.

**Setup, configuration or programming required:** None

**Customer support:** Toll-free telephone, email, WWW

**Maintenance fees:** First 90 days free. (UNIX prices) \$320/name used for

annual software maintenance fee, which includes technical support and software upgrades. \$1,595/computer for annual server maintenance.

**Site licensing:** Yes, contact vendor for pricing.

**Price:** (UNIX prices) \$1,595/user for software; \$7,995/computer for CrossGraphs Server; \$3,995/username for customization option.

## DataMind Corp.

2121 S. El Camino Real, Ste. 1200

San Mateo, CA 94403

Circle 206

**Product:** DataCruncher

**Type of software:** Business visualization

**Architecture:** Stand-alone

**Platforms supported:** Sun SPARC, IBM RS/6000, HP/9000 (700&800), SGI, PC

**Operating systems supported:** Solaris, AIX, HP-UX, IRIX, Windows 95/NT

**RAM required:** 8 MB (UNIX), 7 MB (Windows NT)

**Disk space required:** 8 MB (UNIX), 5 MB (Windows NT)

**Graphics requirements:** None

**Other requirements:** None

**Data formats supported:** ASCII, flat files and relational data structures

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** Yes, but not automated as when using CGI.

**Setup, configuration or programming required:** Maximum value obtained when deployed with a data warehouse

**Customer support:** Toll-free telephone with 1-hour turnaround.

Mandatory 1-year maintenance agreement.

**Maintenance fees:** Varies with level of support

**Site licensing:** Contact vendor

**Price:** \$150,000+

## DSP Development Corp.

One Kendall Square

Cambridge, MA 02139

Circle 207

**Product:** DADiSP 4.0

**Type of software:** Scientific visualization

**Architecture:** Stand-alone

**Platforms supported:** Sun SPARC, IBM RS/6000, Digital Alpha AXP,

Digital VAXstations, DECstations, HP/9000 (700&800), SGI, Concurrent

**Operating systems supported:** SunOS 4.1+, Solaris 2.2+, AIX 3.2+, OSF/1 1.2+, VMS 5.4+, Ultrix 4.1+, HP-UX 9.05+, IRIX 5.2+, Apollo Domain 3.0+

**RAM required:** 8 MB

**Disk space required:** 6 MB

**Graphics requirements:** X11

**Other requirements:** None

**Data formats supported:** ASCII, binary, predefined data types, .PRN, .WAV, more

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** None

**Customer support:** Telephone, email, fax, WWW, replacement of damaged disks, free or reduced-price software updates, subscription to *The DADiSP Window* newsletter

**Maintenance fees:** First three months free, approximately \$600 annually thereafter.

**Site licensing:** Yes, contact vendor for pricing.

**Price:** \$2,995+/single-user license, depending on platform.

## Fortner Software LLC

100 Carpenter Drive

Sterling, VA 20164

Circle 208

**Product:** Plot

**Type of software:** Scientific visualization

**Architecture:** Stand-alone

**Platforms supported:** HP/9000 (700&800), Sun SPARC, SGI, Macintosh, PC

# Visualization Software

**Operating systems supported:** HP-UX 8.07+, IRIX 5.3+, Solaris 2.1+, SunOS 4.1+, Mac OS, PowerMac, Windows 3.1/95/NT

**RAM required:** 16 MB

**Disk space required:** 16 MB

**Graphics requirements:** 8-bit display

**Other requirements:** None

**Data formats supported:** ASCII, HDF, binary

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** None. All features can be accessed through menu-driven commands.

**Customer support:** Toll-free telephone, email, fax, WWW

**Maintenance fees:** Free to users with latest version

**Site licensing:** Yes, contact vendor for pricing.

**Price:** \$295/1-5 users

**Product:** Transform

**Type of software:** Scientific visualization

**Architecture:** Stand-alone

**Platforms supported:** HP/9000 (700&800), Sun SPARC, SGI, Macintosh, PC

**Operating systems supported:** HP-UX 8.07+, IRIX 5.3+, Solaris 2.1+, SunOS 4.1+, Mac OS, PowerMac, Windows 3.1/95/NT

**RAM required:** 16 MB

**Disk space required:** 16 MB

**Graphics requirements:** 8-bit color

**Other requirements:** None

**Data formats supported:** ASCII, HDF, binary, MATLAB, PDM, xwd, GRASS

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** None. All features can be accessed through menu-driven commands.

**Customer support:** Toll-free telephone, email, fax, WWW

**Maintenance fees:** None

**Site licensing:** Yes, contact vendor for pricing.

**Price:** \$595/1-5 users

**IBM Corp.**

**1505 LBJ Freeway**

**Dallas, TX 75234**

**Circle 209**

**Product:** IBM Visualization Data Explorer

**Type of software:** Mainly scientific, but business visualization is a growing segment that uses this product.

**Architecture:** Stand-alone or embedded

**Platforms supported:** (Single-processor workstations) IBM RS/6000 including PowerPC; Sun SPARC; HP/9000 (700&800); SGI Indigo, Indy, Onyx, Challenge or O2; Data General AviiON; Digital 3000 and Alpha; PC. (Multiprocessor workstations) IBM RS/6000 Models G30, J30 and R30; PowerPC; Sun SPARCstation (10 models); SGI Onyx and Challenge. (Supercomputers) IBM POWERparallel Systems SP machines

**Operating systems supported:** AIX 3.2.5 or 4.1+, Solaris 2.3+, HP-UX 9.05+, IRIX 5.2+, DG/UX 5.4.2+, OSF/1 2.0+, Windows 95/NT

**RAM required:** 32 MB

**Disk space required:** 50 MB

**Graphics requirements:** X Window, 8-bit color recommended

**Other requirements:** None

**Data formats supported:** Native support for many public domain structures, such as netCDF, CDF, HDF, included. Supports ASCII and binary. Many image file formats supported such as TIFF, GIF and RGB. Additional filters have been built in to include most finite element codes such as CFD codes and GIS filters. A data prompter will assist users with importing unique data formats that are not directly supported.

**Maximum data size:** Limited only by virtual memory

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** Yes, via multithreaded Web server

**Setup, configuration or programming required:** IBM provides a visual programming interface for the development environment. The development

team can construct the visual analysis by connecting modules within the visual programming interface.

**Customer support:** Toll-free telephone, email

**Maintenance fees:** None

**Site licensing:** Yes, contact vendor for pricing.

**Price:** 30-day free trial, \$3,125/single node-locked license, \$4,980/SMP single license (discounts on quantity, GSA, site and academic purchases)

**ILOG Inc.**

**1901 Landings Drive**

**Mountain View, CA 94043**

**Circle 210**

**Product:** ILOG Views

**Type of software:** Business visualization

**Architecture:** The product is a graphics library.

**Platforms supported:** Sun SPARC, IBM RS/6000, HP/9000, SGI, Digital Alpha, PC

**Operating systems supported:** Solaris 2.4, 2.5; SunOS 4.1; AIX 3.2, 4.1, 4.2; HP-UX/9&10; IRIX 5.3, 6.2; Digital Windows NT (Alpha); OSF/1 4.0; OS/2 Warp 3.0 (PC); Linux 2.0 (PC); Windows 95/NT PC

**RAM required:** 8 MB

**Disk space required:** 50 MB

**Graphics requirements:** X11 (UNIX), PM (OS/2), SDK (PC)

**Other requirements:** Native C++ compiler

**Data formats supported:** ASCII, binary, more

**Maximum data size:** Unlimited

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** Yes, using CGI

**Setup, configuration or programming required:** Varies, depending on applications

**Customer support:** Toll-free telephone, email, WWW

**Maintenance fees:** First 30 days free, contact vendor for detailed pricing after initial period.

**Site licensing:** Yes, contact vendor for pricing.

**Price:** Contact vendor

**InRight Software Inc.**

**3400 Hillview Ave.**

**Palo Alto, CA 94304**

**Circle 211**

**Product:** Hyperbolic Tree (HT) VizControl

**Type of software:** Business visualization

**Architecture:** Embedded software component

**Platforms supported:** PC

**Operating systems supported:** Java JDK 1.0x, Intel Win32

**RAM required:** 8 MB

**Disk space required:** 100 KB

**Graphics requirements:** None

**Other requirements:** Available for Win32 C++ as DLL or header files, and for Java VM as .class files

**Data formats supported:** ASCII, MCF, user-defined data types, predefined data types

**Maximum data size:** Limited only by virtual memory

**Exportable visuals:** No

**Visualization of data via intranet/Internet:** Yes, via Java

**Setup, configuration or programming required:** Developer is responsible for providing HT with space in its application window to draw, and for providing data to HT, invoking HT functions to draw the view and to handle mouse input. HT view installation generally takes up to one day.

**Customer support:** Telephone, email

**Maintenance fees:** Part of license contract

**Site licensing:** Yes, contact vendor for pricing.

**Price:** Contact vendor

**Product:** Table Lens VizControl

**Type of software:** Business visualization

**Architecture:** Embedded software component

**Platforms supported:** PC

**Operating systems supported:** Intel Win32

**RAM required:** 8 MB

**Disk space required:** 250 KB

# Visualization Software

**Graphics requirements:** None

**Other requirements:** Table Lens is an ActiveX control.

**Data formats supported:** ASCII, RDBMS

**Maximum data size:** Limited only by virtual memory

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** Yes, via ActiveX

**Setup, configuration or programming required:** Designed to be used in applications built with Visual Basic 4.0/5.0, Visual C++, Access 95, Borland Delphi 2, PowerBuilder 5.0 and other development environments that support OCXs or ActiveX controls.

**Customer support:** Telephone, email

**Maintenance fees:** Part of license contract

**Site licensing:** Yes, contact vendor for pricing.

**Price:** Contact vendor

## Khoros Research Inc.

6001 Indian School Road N.E., Ste. 200

Albuquerque, NM 87110

Circle 212

**Product:** Khoros Pro

**Type of software:** Scientific visualization

**Architecture:** Stand-alone

**Platforms supported:** Sun SPARC, SGI, Digital Alpha, Intel x86, Pentium, Pentium Pro

**Operating systems supported:** Solaris 2.4, 2.5; SunOS 5.4; IRIX 5.3; OSF/1 3.2; Linux 2.0 18 (PC)

**RAM required:** 32 MB

**Disk space required:** 64 MB

**Graphics requirements:** X Window X11R5 or higher

**Other requirements:** Modern UNIX variant (POSIX.1-compliant preferred), GUI system (Khoros Pro Widget Set included), FORTRAN system (FORTRAN 77 runtime environment) and DPU with built-in FPU (recommended)

**Data formats supported:** ASCII, AVS image (avs), Sun Raster (rast), X Window dump (xwd), X Bitmap (xbm), X Pixmap (xpm), more

**Maximum data size:** Limited only by virtual memory

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** Software installation

**Customer support:** Free 30-day installation and support

**Maintenance fees:** 4-hour response time annual support contract \$1,895/year, per-call technical support \$125/hour, consulting support services \$190/hour

**Site licensing:** Yes. Government contractor/all platforms site license \$10,000, Enterprise/all platforms site license \$30,000.

**Price:** \$549/single-user license, \$2,495/1-5 users. Khoros Pro ISD License, single platform site license \$5,000. Annual license maintenance costs \$950, which includes upgrades.

## LOOX Software Inc.

4962 El Camino Real, Ste. 206

Los Altos, CA 94022

Circle 213

**Product:** LOOX

**Type of software:** Scientific and business visualization

**Architecture:** Development tool consisting of an interactive visualization screen builder and a programming API.

**Platforms supported:** Sun SPARC, HP, IBM RS/6000, Digital Alpha, SGI, Intel

**Operating systems supported:** Solaris 2.4+; HP-UX 9.0, 10.10, 10.20; AIX; Digital UNIX; OpenVMS; IRIX 5.3, 6.x; SCO UNIX

**RAM required:** 32 MB

**Disk space required:** 60 MB

**Graphics requirements:** Motif and X11

**Other requirements:** None

**Data formats supported:** ASCII, DXF, GIF, xwd, LOOX G format, other formats via filters

**Maximum data size:** Limited only by virtual memory and hardware

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** None

**Customer support:** Toll-free telephone, email

**Maintenance fees:** \$2,150/first license, \$1,150/subsequent license. Price includes customer support and product upgrades (renewable annually).

**Site licensing:** Yes, contact vendor for details.

**Price:** \$8,950/developer, no runtime or royalty fees (volume discounts available)

**Product:** LOOX++

**Type of software:** Scientific and business visualization

**Architecture:** Development tool consisting of an interactive visualization screen builder and a programming API.

**Platforms supported:** Sun SPARC, HP, IBM RS/6000, Digital Alpha, SGI

**Operating systems supported:** Solaris 2.4+; HP-UX 9.0, 10.10, 10.20; AIX; Digital UNIX; IRIX 5.3, 6.x

**RAM required:** 32 MB

**Disk space required:** 60 MB

**Graphics requirements:** Motif and X11

**Other requirements:** C++ compiler

**Data formats supported:** ASCII, DXF, GIF, xwd, LOOX G format, other formats via filters

**Maximum data size:** Limited only by virtual memory and hardware

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** None

**Customer support:** Toll-free telephone, email

**Maintenance fees:** \$2,150/first license, \$1,150/subsequent license. Price includes customer support and product upgrades (renewable annually).

**Site licensing:** Yes, contact vendor for details.

**Price:** \$8,950/developer, no runtime or royalty fees (volume discounts available)

## Macsyma Inc.

20 Academy St.

Arlington, MA 02174

Circle 214

**Product:** Macsyma

**Type of software:** Scientific visualization

**Architecture:** Stand-alone

**Platforms supported:** Sun SPARC, SGI, IBM RS/6000, HP/9000 (700&800), IBM-compatible PC

**Operating systems supported:** Solaris 2.3+, SunOS 4.1.3, IRIX 5.3, AIX 4.1, HP-UX 9.03, PC running Windows 3.x/95/NT

**RAM required:** 16 MB

**Disk space required:** 50 MB (UNIX)

**Graphics requirements:** X11R5

**Other requirements:** None

**Data formats supported:** ASCII CSV (UNIX)

**Maximum data size:** Limited only by virtual memory

**Exportable visuals:** Yes

**Visualization of data via intranet/Internet:** No

**Setup, configuration or programming required:** Software installation (supported by a 20-page manual)

**Customer support:** Toll-free telephone

**Maintenance fees:** \$445/year full service, \$177/year continuing upgrade service

**Site licensing:** Yes, contact vendor for details.

**Price:** \$499/single-user license, contact vendor for academic and volume discount information.

## The MathWorks Inc.

24 Prime Park Way

Natick, MA 01760

Circle 215

**Product:** MATLAB

**Type of software:** Scientific visualization

**Architecture:** Stand-alone

**Platforms supported:** Sun SPARC, SGI, IBM RS/6000, HP/9000 (700), Digital Alpha, x86 (Linux), Macintosh, PC

**Operating systems supported:** Solaris, IRIX, AIX, HP-UX, Digital UNIX, Linux, Mac OS, Windows 95/NT

**RAM required:** 16 MB

**Disk space required:** 16 MB

**Graphics requirements:** 8-bit graphics adapter

**Other requirements:** 387/487 math coprocessor chip

**Data formats supported:** User-defined data types

**Maximum data size:** Limited only by virtual memory and hardware

# Visualization Software

**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** Yes, using Java or HTML  
**Setup, configuration or programming required:** None  
**Customer support:** Toll-free telephone, email  
**Maintenance fees:** Lifetime, free customer support  
**Site licensing:** Yes, contact vendor for details.  
**Price:** Single-user pricing starts at \$1,795 (PC/Macintosh). Quantity and education discounts available, contact vendor for further details.

**Minitab Inc.**  
3081 Enterprise Drive  
State College, PA 16801  
Circle 216

**Product:** Minitab Statistical Software  
**Type of software:** Scientific visualization  
**Architecture:** Stand-alone  
**Platforms supported:** Sun SPARC, SGI, IBM RS/6000 (MIPS, RS, RC), HP/9000, Digital VAX, PC, Macintosh  
**Operating systems supported:** SunOS, Solaris, IRIX, AIX, RISC-OS, Digital UNIX, HP-UX, Windows 3.1/95/NT, Mac OS, PowerMac  
**RAM required:** 2 MB  
**Disk space required:** 24 MB to 38 MB  
**Graphics requirements:** None  
**Other requirements:** None  
**Data formats supported:** ASCII  
**Maximum data size:** 200,000 cells  
**Exportable visuals:** No  
**Visualization of data via intranet/Internet:** No  
**Setup, configuration or programming required:** None  
**Customer support:** WWW, fax  
**Maintenance fees:** Free customer support  
**Site licensing:** Yes, contact vendor for details.  
**Price:** \$1,875/single-user license, \$2,250/1-5 users

**Numerical Algorithms Group Inc.**  
1400 Opus Place, Ste. 200  
Downers Grove, IL 60515  
Circle 217

**Product:** IRIS Explorer  
**Type of software:** Scientific visualization  
**Architecture:** Stand-alone  
**Platforms supported:** Sun SPARC, SGI, IBM RS/6000, HP/9000, Digital Alpha, Intel NT, Cray Y-MP  
**Operating systems supported:** Solaris, IRIX, AIX, HP-UX, Digital UNIX/NT, Cray Y-MP UNICOS, Windows 95/NT  
**RAM required:** 200 MB  
**Disk space required:** 16 MB  
**Graphics requirements:** Motif, X11, X Window, OpenGL (UNIX); Windows 95 (Intel); Windows NT (Intel/Digital Alpha)  
**Other requirements:** None  
**Data formats supported:** Binary, HDF, PDB, Plot3D, SEGY, MIF, NTF, ESRI, Inventor, predefined data types, user-defined data types, more  
**Maximum data size:** Limited only by virtual memory  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** Yes, using VRML  
**Setup, configuration or programming required:** None  
**Customer support:** Telephone, email, WWW  
**Maintenance fees:** Free maintenance and technical support for the first year.  
**Site licensing:** Yes, contact vendor for details.  
**Price:** Priced by the number of simultaneous users. A license manager regulates a node-locked or floating license across your network. One node-locked license costs \$3,000, one floating license costs \$4,000 (UNIX). Additional academic and volume discounts are available.

**P-STAT Inc.**  
230 Lambertville-Hopewell Road  
Hopewell, NJ 08525  
Circle 218  
**Product:** P-STAT  
**Type of software:** Business visualization  
**Architecture:** Stand-alone

**Platforms supported:** Sun SPARC, IBM RS/6000, Digital Alpha/VAX, Data General AViiON, Intel-based PC  
**Operating systems supported:** Solaris, AIX, Digital UNIX, DG/UX, Windows 3.1/95/NT  
**RAM required:** 8 MB  
**Disk space required:** 10 MB  
**Graphics requirements:** Can run in character mode or graphics mode, using Motif, X11, OpenWindows or Microsoft Windows  
**Other requirements:** None  
**Data formats supported:** —  
**Maximum data size:** Limited only by virtual memory  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** No  
**Setup, configuration or programming required:** None  
**Customer support:** Telephone, email  
**Maintenance fees:** Dependent on license type. Ranges from a one-day option to a 12-month bundled option (approximately \$300/year).  
**Site licensing:** Yes, contact vendor for details.  
**Price:** \$995/single-user license, \$2,195/five-user license (UNIX)

**SAS Institute Inc.**  
SAS Campus Drive  
Cary, NC 27513  
Circle 219

**Product:** Enterprise Miner Software  
**Type of software:** Scientific and business visualization  
**Architecture:** Stand-alone add-on to SAS' data mining solution  
**Platforms supported:** Sun SPARC, IBM RS/6000, Digital VAX, HP/9000, PC  
**Operating systems supported:** Solaris, AIX, Digital UNIX, HP-UX, Windows 95/NT  
**RAM required:** 48 MB  
**Disk space required:** 45 MB  
**Graphics requirements:** User interface available on Windows only  
**Other requirements:** None  
**Data formats supported:** ASCII, more  
**Maximum data size:** Unlimited  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** No  
**Setup, configuration or programming required:** Software installation  
**Customer support:** Telephone, WWW, video and computer-based training courses, local/regional/national user groups  
**Maintenance fees:** Free customer support and software updates  
**Site licensing:** Yes, contact vendor for details.  
**Price:** \$45,000+ (renewal rates are lower, volume and academic discounts available)

**SPSS Inc.**  
444 N. Michigan Ave.  
Chicago, IL 60611  
Circle 220

**Product:** SPSS Diamond  
**Type of software:** Scientific and business visualization  
**Architecture:** Stand-alone  
**Platforms supported:** Sun SPARC, IBM RS/6000, PC  
**Operating systems supported:** SunOS, AIX, OS/2, Windows 3.1/NT  
**RAM required:** 4 MB  
**Disk space required:** 6 MB  
**Graphics requirements:** X Window (AIX and SunOS)  
**Other requirements:** None  
**Data formats supported:** SPSS portable, BMDP portable, SAS transport, Excel, Lotus, dBase, ASCII  
**Maximum data size:** Unlimited for UNIX and OS/2; 16,367-character limit for Windows  
**Exportable visuals:** No  
**Visualization of data via intranet/Internet:** No  
**Setup, configuration or programming required:** None  
**Customer support:** Telephone, free updates, documentation  
**Maintenance fees:** Free customer support and software updates  
**Site licensing:** Yes, contact vendor for details.  
**Price:** \$817/single-user license (UNIX), \$495/single-user license (Windows), contact vendor for volume discounts.

# Visualization Software

**Stata Corp.**  
702 University Drive E.  
College Station, TX 77840  
Circle 221

**Product:** Stata 5.0  
**Type of software:** Scientific visualization  
**Architecture:** Stand-alone  
**Platforms supported:** Convex C-Series supercomputers, Digital Alpha AXP, DECstation, HP/9000 (700&800), IBM RS/6000, Sun SPARC, Intel 80386+, Macintosh, PowerMac  
**Operating systems supported:** Convex, OSF/1 1.3+, Ultrix 4.1+, HP-UX A.08+, AIX 3.2+, Linux 1.1.59+, SunOS 4.1+, Solaris, Windows 3.1/95/NT, Mac OS System 7  
**RAM required:** 8 MB  
**Disk space required:** —  
**Graphics requirements:** X Window  
**Other requirements:** None  
**Data formats supported:** ASCII, Stata binary  
**Maximum data size:** Only limit on observations is virtual memory; 2,047 variables  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** No  
**Setup, configuration or programming required:** X Window installation  
**Customer support:** Toll-free telephone, email, WWW, Listserv, FTP sites, *Stata Technical Bulletin* (bi-monthly journal), 30-day money-back guarantee  
**Maintenance fees:** Free customer support  
**Site licensing:** Yes, contact vendor for details.  
**Price:** \$945/single-user license, \$2,579/1-5 users, contact vendor for further details.

**StatSci, a Division of MathSoft Inc.**  
1700 Westlake Ave. N., Ste. 500  
Seattle, WA 98109  
Circle 222

**Product:** S-Plus  
**Type of software:** Scientific visualization  
**Architecture:** Stand-alone  
**Platforms supported:** Sun SPARC, IBM RS/6000, Digital Alpha, Digital DECstation, SGI IRIS/Indigo, HP/9000  
**Operating systems supported:** Solaris, AIX, Digital UNIX, Windows 95/NT  
**RAM required:** 16 MB  
**Disk space required:** 65 MB  
**Graphics requirements:** X Window  
**Other requirements:** None  
**Data formats supported:** ASCII, SAS datasets  
**Maximum data size:** Unlimited  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** Yes  
**Setup, configuration or programming required:** Software installation  
**Customer support:** Telephone, WWW, email, fax, software support and update program  
**Maintenance fees:** Contact vendor for customer support and software pricing.  
**Site licensing:** Yes, contact vendor for details.  
**Price:** \$960+/single-user license, \$2,000+/site license

**Statware Inc.**  
260 S.W. Madison Ave.  
Corvallis, OR 97333  
Circle 223

**Product:** Statit 5.1  
**Type of software:** Scientific visualization  
**Architecture:** Stand-alone  
**Platforms supported:** Sun SPARC, IBM RS/6000, HP/9000 (700&800), 486/586, Pentium  
**Operating systems supported:** Solaris, AIX, HP-UX, Windows 95/NT  
**RAM required:** 16 MB  
**Disk space required:** 40 MB

**Graphics requirements:** Motif, X Window, OpenWindows 3.1+, OpenGL  
**Other requirements:** None  
**Data formats supported:** ASCII, numeric, character, monetary, data and/or time, binary, Excel, Lotus, Oracle, Sybase, Informix, ODBC, more  
**Maximum data size:** Limited only by hardware  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** Yes, via HTML or Java  
**Setup, configuration or programming required:** Java-enabled Web browser  
**Customer support:** Telephone, WWW, email, fax, software updates with 90-day money-back guarantee  
**Maintenance fees:** First year of support/updates free, optional programs thereafter.  
**Site licensing:** Yes, contact vendor for details.  
**Price:** Contact vendor

**Visible Decisions Inc.**  
200 Front St. W., Ste. 2203  
Toronto, Ontario, Canada M5V 3K2  
Circle 224

**Product:** Visible Decisions In3D  
**Type of software:** Business visualization  
**Architecture:** Stand-alone or embedded in an application  
**Platforms supported:** Sun SPARC, UltraSPARC; SGI Indy, Indigo, Indigo2, Onyx; PC with Intel  
**Operating systems supported:** Solaris 2.5.1+, SGI IRIX 6.2, Windows 95/NT  
**RAM required:** 64 MB (Sun), 48 MB (SGI), 32 MB (Windows)  
**Disk space required:** 100 MB  
**Graphics requirements:** 8-bit minimum (Sun), 24-bit minimum (SGI), 800x600 dpi (Windows)  
**Other requirements:** C++ compiler  
**Data formats supported:** ASCII, binary, more  
**Maximum data size:** Unlimited  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** Yes, using VRML  
**Setup, configuration or programming required:** None  
**Customer support:** Telephone  
**Maintenance fees:** Based on percentage of license/purchase price  
**Site licensing:** Yes, contact vendor for pricing.  
**Price:** Pricing is dependent on license option.

**Visual Numerics Inc.**  
9990 Richmond Ave.  
Houston, TX 77042  
Circle 225

**Product:** PV-WAVE 6.1  
**Type of software:** Scientific and business visualization  
**Architecture:** Stand-alone  
**Platforms supported:** Digital Alpha, Digital VAX, Sun SPARC, SGI, HP/9000 (700), IBM RS/6000, Intel  
**Operating systems supported:** OpenVMS 6.1, Digital UNIX 3.2, SunOS 4.1.4, Solaris 2.4, IRIX 5.3, HP-UX 10.0, AIX 4.1.2, Linux, Windows 95/NT  
**RAM required:** 24 MB (PC & UNIX)  
**Disk space required:** 90 MB (minimum), 250 MB (full installation) UNIX  
**Graphics requirements:** None  
**Other requirements:** None  
**Data formats supported:** ASCII-delimited, binary, user-defined data types, predefined data types, RGB, BMP, more  
**Maximum data size:** Limited only by hardware  
**Exportable visuals:** Yes  
**Visualization of data via intranet/Internet:** Yes, using HTML, VRML, Java, import/export of GIF/JPEG files, ASCII/binary data reading from URLs, CGI integration  
**Setup, configuration or programming required:** None  
**Customer support:** Contact vendor  
**Maintenance fees:** Based on percentage of license/purchase price  
**Site licensing:** Yes, contact vendor for pricing.  
**Price:** Pricing is dependent on license options.



## Powerful Print Server

by Simson L. Garfinkel

*HP's LaserJet 6MP and JetDirect EX Plus partner for an excellent personal or group printing solution.*

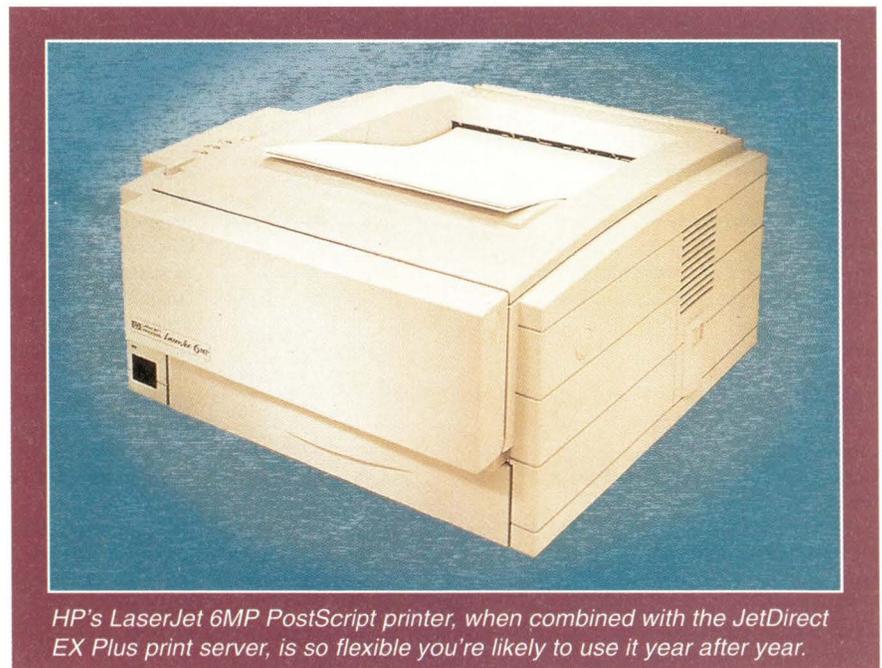
**A**lthough it's aimed at the Apple Computer Inc. Macintosh market, Hewlett-Packard Co.'s LaserJet 6MP is an excellent PostScript printer that is equally at home with UNIX systems, Microsoft Corp. Windows 95 workstations, or even hand-held PDAs like the Apple Newton. Combined with HP's low-cost print server, the JetDirect EX Plus, this printer can even support clients running Novell Inc. NetWare, Windows for Workgroups 3.11, and IBM OS/2. In fact, the 6MP/EX Plus combination is so flexible that this is a printer you're likely to use year after year—long after you've thrown away your current generation of computers and operating systems.

Weighing just 22.5 pounds, the 6MP is a compact 600-dpi printer that is rated at 8 pages per minute (ppm), 12,000 pages per month. The printer has two paper trays: one on the bottom that can handle 250 pages, and a fold-out tray that can handle stacked envelopes, letterheads, single sheets, Rolodex cards and practically anything else up to its limit of legal-size paper. Two paper paths allow you to send the paper to the stacker on top or feed paper straight through to prevent curling and bending.

The printer has two parallel interfaces—a standard IEEE 1284-B and the smaller IEEE 1284-C—as well as an 8-pin mini-DIN connector used for Apple LocalTalk networks. On the front of the printer, there's a high-speed infrared port that lets you print from IR-equipped laptops and PDAs without the bother of connecting wires.

Thankfully, HP hasn't gone overboard on controls. The printer's spartan interface has just two buttons and five lights. The buttons reset the printer and self-test. The lights signal power, paper jam and activity. The printer also has two out-of-paper indicators, one for each paper tray.

HP's JetDirect EX Plus is the second half of this network printer solution. This little box has a high-speed serial port and two network connectors: one for 10BaseT Ethernet, the other for thin net. On the front are two lights, one for



*HP's LaserJet 6MP PostScript printer, when combined with the JetDirect EX Plus print server, is so flexible you're likely to use it year after year.*

**Figure 1. /etc/printcap Entries for 6MP**

```
6mp_text:lp=:rm=printer1:rp=text:\
        :lf=/var/spool/lpd/printer1_text.log:\
        :sd=/var/spool/lpd/printer1_text:\
6mp_ps:lp=:rm=printer1:rp=raw:\
        :lf=/var/spool/lpd/printer1_raw.log:\
        :sd=/var/spool/lpd/printer1_raw:
```

power, one for activity. There's also a test button that doubles as a reset button if you hold it down while you plug in the unit's external power supply.

## Simple Setup

Setting up this printer is simplicity itself. Just unpack, pop in the toner cartridge and fill the paper tray. The printer's small footprint makes it an easy fit on top of a file cabinet or in the corner of a large desk. Next, unpack the JetDirect and plug it into the printer's parallel port using the cable provided. Plug both the JetDirect and the printer into the wall, and plug the JetDirect into your LAN.

You can print to the JetDirect immediately after you hook it up if you want to use Apple's EtherTalk protocol. Most users, though, will want to configure the JetDirect. HP's included software runs on SunOS, Solaris and HP-UX, as well as Windows for Workgroups, Windows 95/NT, Mac OS, Novell NetWare and IBM OS/2 LAN Server. HP's software locates the printer using a network broadcast; you then assign the printer a name and an IP address.

If you don't like graphical interfaces, you can also configure the printer using BOOTP, RARP, DHCP, SNMP or by connecting to the printer's telnet server. The printer can log its status using SNMP traps or the standard UNIX Syslog facility. The JetDirect defines multiprotocol flexibility!

The whole configuration process takes about three minutes, after which the printer is ready to accept print jobs from any host on your network. (In the interest of security, you can also restrict printing to certain hosts.) If you want to print from a UNIX system, you'll need to add two entries to your `/etc/printcap` file—one for printing

text files, the other for printing PostScript files. My entries are shown in Figure 1.

## Using the Printer

The 6MP's print quality is stunning. Unlike 300-dpi printers that were popular for more than a decade, I had no problem distinguishing punctuation marks or seeing the elegant serifs on my fonts. In fact, I could actually read 3-point text without using a magnifying glass. With a magnifying glass, I could read 2-point text without any difficulty—the o's were still open circles, and I could still tell the difference between periods and commas.

Printing in hot sticky weather, I had roughly one paper jam every 1,000 pages printing with quality paper. Using post-consumer recycled paper, jams jumped to one every 250 pages or so.

The printer is silent when it is in standby mode, and instantly turns on—getting the first page out in less than 14 seconds (even if nobody has printed to the machine in more than a day). And I found that HP's claimed 8 ppm is accurate—even when those pages contain complicated graphics and many font changes.

If money is tight, you can save \$250 by ordering HP's 6Pse printer instead of the 6MP. This printer is identical to the 6MP but lacks the Macintosh port and PostScript, instead insisting that you send it pages using HP's PCL language. The good news is that a lot of programs support PCL, and the 6Pse is upwards-compatible with HP's LaserJet 1, 2, 3, 4 and 5. And if you really need PostScript, there's always GhostScript, a PostScript interpreter that's freely downloadable over the Internet and comes with some versions of UNIX.

For an extraordinary low-cost net-

work printer, combine HP's 6Lse, a 6-ppm machine, with the JetDirect EX Plus. This printer is only rated at 8,000 pages per month and lacks PostScript and the second print tray. On the other hand, it's great for an office on a budget.

Meanwhile, if your printing needs are intense, you can purchase HP's JetDirect EX Plus 3, which can handle three printers. Combined with three HP 6MPs, this lets you put together a three-headed printing cluster for \$3,496. Personally, though, I would rather buy three JetDirect EX units and put the printers in different locations around the office. -->

## HP LaserJet 6 Series

### Company

Hewlett-Packard Co.  
3000 Hanover St.  
Palo Alto, CA 94304

### Telephone

(800) 752-0900

### WWW

<http://www.hp.com>

### Best Feature

Spectacular print quality.

### Worst Feature

Can't think of one.

### Price

6Lse: \$399 (6 ppm)  
6Pse: \$799 (8 ppm,  
2 parallel ports,  
infrared)  
6MP: \$949 (8 ppm,  
3 ports, Mac, PC  
and PostScript)

## HP JetDirect EX Plus Print Server

### Best Feature

Ease of setup.

### Worst Feature

Would be nice if it could be powered from printer.

### Price

\$349 (AppleTalk, Novell,  
LAN Manager, UNIX lpd)

Circle 159

# RS/Magazine

## Columns

**75 Q&AIX** by Jim Fox  
**Virtual Windows**

Try the fwm window manager if you're interested in one or more virtual desktops.

**78 Datagrams** by John S. Quarterman  
**Essential Tools**

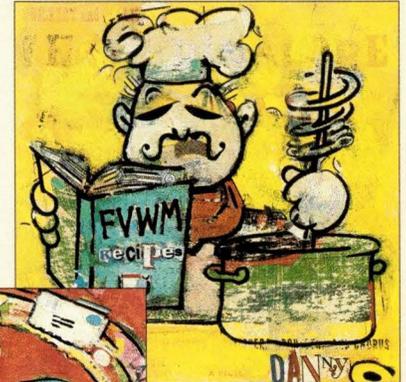
Amazingly enough, many users remain unfamiliar with these indispensable tools.

**81 AIXtensions** by Jim DeRoest  
**Wandering Mail - IMAP Revisited**

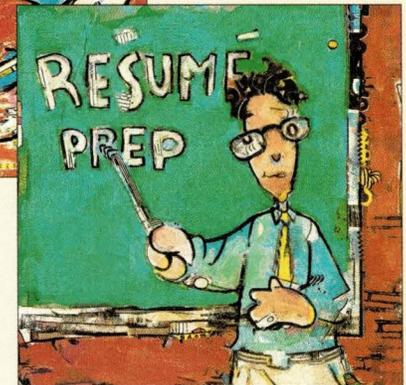
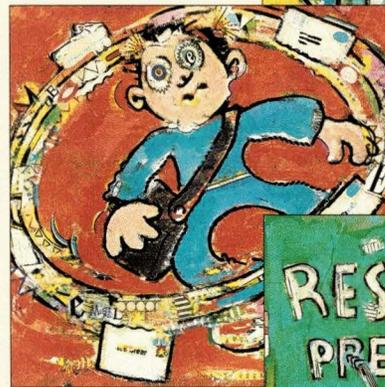
Netscape and Microsoft have made things easier for mobile computers by including IMAP in their products.

**84 Work** by Jeffreys Copeland and Haemer  
**Your Résumé, Part 1**

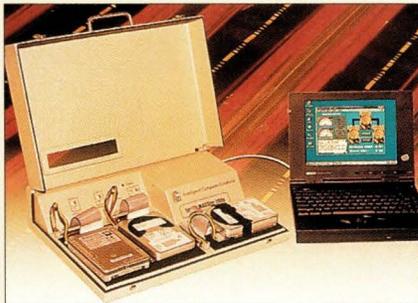
A handy macro package for formatting résumés.



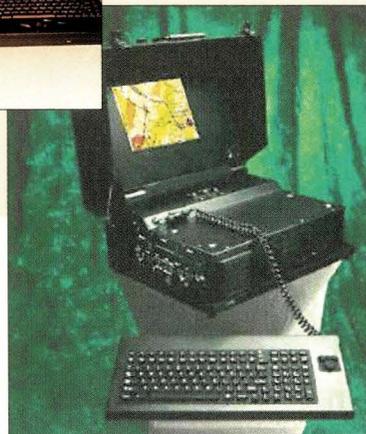
Columns illustrated by DANIEL C. O'CONNOR



Read our Web site <http://www.cpg.com>



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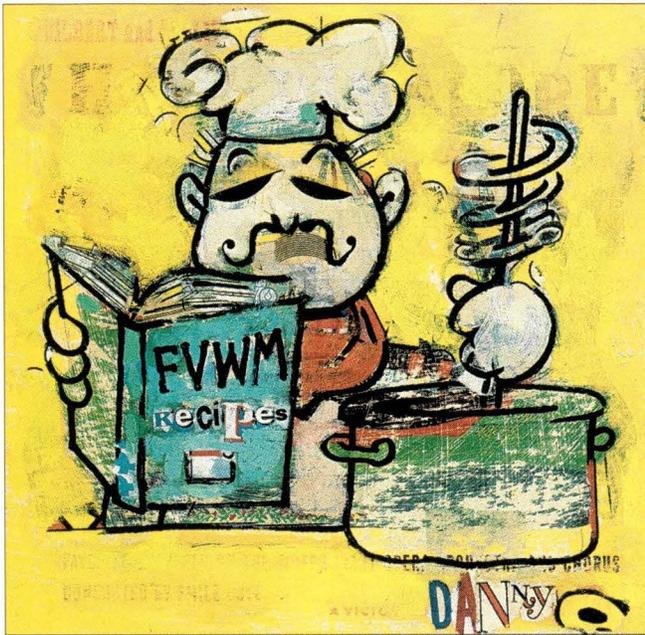


## Departments

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Fed UNIX 97 — Washington, DC

Bonus Distribution of the December Issue:  
Internet World — New York, NY



## Virtual Windows

*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.*

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

**Q:** While visiting another workplace, I saw an AIX system that appeared to be running Motif but seemed to have multiple screens. By pushing function keys, the programmer was able to instantly get rid of all the windows and bring up a completely new set. I wasn't able to get any more details. Have you heard of this? ▲▲

Peter Gamus  
 Northwest Research Inc.

**A:** What you saw was probably the fwm window manager. It's a descendant of the popular twm window manager that comes with the X distribution from the Massachusetts Institute of Technology, Cambridge, MA. To me, fwm (F-word-of-your-choice Virtual Window Manager) looks more like Windows 95 than Motif, but it can be customized to such an extent that it can probably mimic anybody's look and feel. It is free.

fwm provides one or more virtual desktops, which are each much larger than your screen. The desktops are divided into a matrix of screen-size pages. A pager tool displays a small picture of the entire set of desktops and pages and allows you to easily move windows and the mouse from one page to

another. See Figure 1 for an example pager. It shows two virtual desktops, each composed of six pages. Each page contains a miniature representation of the actual screen view.

Within a virtual desktop, windows and the mouse move around in a natural manner. Sliding a window off the screen moves it onto an adjoining page. Moving the mouse off the screen moves it into an adjoining page—and your screen view as well. The desktops are more independent and discrete. Windows won't automatically slide from one to the next. You can flag some windows to be "sticky" and stay visible as you move your screen view about the virtual pages. This is handy for a clock, for example. You don't want to have a separate clock on each page.

The practical effect of this virtual world is that you tend to destroy or iconify windows less often. You can now just move them to another virtual page or desktop.

fwm has some other nice features:

- It allows you to put up to 10 buttons at the top of each window—in the titlebar. You can decorate these buttons with little pictures (xpm pixmaps) and configure them to do almost anything.
- It provides a nice compromise between window focus policies. You can set some

**Figure 1. Example Pager Tool**



windows to click-to-focus and others to focus-follows-mouse. I like to use the latter for `xterm` and the former for everything else.

- It allows runtime extensions (modules) that permit almost limitless flexibility.

## Getting fvwm

Check out the official fvwm Web site, <http://www.hpc.uh.edu/fvwm/>, for up-to-date information on the current version of fvwm and where to find it. If you don't use the Web, Figure 2 includes two FTP sites where the latest versions are maintained. The University of Houston site also has beta code for future releases. If you don't like FTP or HTTP, you might look for a Linux CD. fvwm comes with most Linux distributions.

Notice that the program name is actually `fvwm2` (to distinguish it from the original version). The name was changed because the initialization files are not compatible.

Before building fvwm, make sure you have the xpm library. This is what X programs use to display color pictures and icons, which are very cool. If you have the `/usr/lib/libXpm.a` file, then you have xpm; otherwise get a copy via FTP from <ftp.x.org> in the `contrib/libraries` directory. Check the README file first, but xpm builds and installs easily on most systems. Use these commands:

```
# xmkmf -a
# make
# make install
```

Now you're ready to build fvwm. Edit the `Fvwm.tmp1` file for your local options. In particular, be sure to set the `HasXpm` definition to `YES`. Make and install the `fvwm2` program with these commands:

```
xmkmf
make MakeFiles
make
make install
```

fvwm reads a personal configuration file (`~/.fvwm2rc`) when it starts. Use this file to set options, define menus, buttons, window decorations and mouse actions.

There are example configuration files provided with the distribution. Use these as examples rather than templates. One

problem is that some new features (pixmap, for example) were added after the examples were written. You'll be better off in the long run if you read the `fvwm2` man page, examine the example `rc` files, and then write your own `.fvwm2rc` file.

Here are some configuration commands of note:

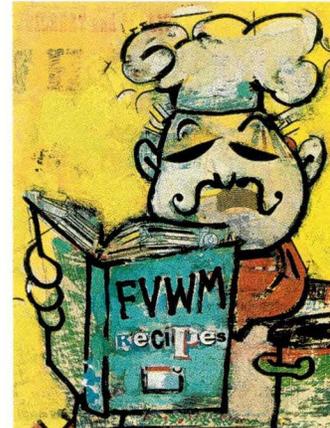
- `DesktopSize m x n` – This determines how many virtual pages make up a desktop. *m* is the width of the desktop in pages, and *n* is the height.

- `ButtonStyle n Pixmap name.xpm` – This attaches a pixmap to one of the titlebar buttons. I think pictures make much nicer buttons than bars or lines

so I use them for all my buttons. The distribution comes with lots of miniature pixmaps just right for button decorations.

- The `Style` command allows you to customize individual windows or groups of windows. Use this for all your settings. For example: `Style "*Term" NoIcon` prohibits all `xterms` from showing up as icons. They will, however, still appear in window lists.

- `InitFunction` – Include here all functions you want to run when fvwm starts. I put a couple of modules here: `FvwmPager`, which displays the miniature desktop as in Figure 1; and `FvwmWinList`, which lists all windows. For the most part, I use this list in lieu of icons.



## Related Tools

I often like different window manager parameters, depending on my screen size, color depth or communication speed, all of which can change if I log in from somewhere other than my office. fvwm provides a couple of ways to customize `rc` files dynamically. One uses `cpp` to preprocess the file, the other uses the macro program `M4`. Either will do the job.

**Figure 2. Useful fvwm Sites**

- <http://www.hpc.uh.edu/fvwm>  
Official fvwm Web site hosted by the University of Houston

fvwm FTP sites:

- <ftp://ftp.hpc.uh.edu/pub/fvwm/>
- <ftp://sunsite.unc.edu/pub/Linux/X11/window-managers/>

Don't want to program your own `rc` file? You might try the `dotfile` generator. It is an X program by Jesper Pedersen of Denmark that will interactively generate a `.fvwm2rc` file for you. Just fill in the blanks, check the boxes, fill out the forms, and there's your `rc` file. This is perhaps the best way to get started. Check out the Web page at <http://www.imada.ou.dk/~blackie/dotfile/>.

Want a monitor that's 5,000 pixels wide and 3,000 pixels high? With fvwm you've got one, and you don't have to spend a fortune on new hardware! ➡

# Daily Times

Special Edition

## IN TODAY'S NEWS...

- Aspen Finalist in Ernst & Young Entrepreneur of the Year Award PG 2
- IBM®RS/6000™ Is Chess Champion PG 2
- Data Protection Available from ADSM PG 3
- Aspen Offers High Availability Benefits with HACMP PG 5
- Detroit is Newest Aspen Office PG 5

## IBM®AIX® 3.2.x Users Need to Upgrade to 4.x

By Bill Stevens

After December 31, 1997, IBM will no longer support older AIX versions 3.2.x. According to Stephan Moen, Vice-President of Information Technology, Aspen is ready to upgrade all AIX 3.2.x users to the latest version of AIX 4.x. "This is just one of the many system integration services that Aspen offers," commented Moen.

As the system integrator to the AIX user community, Aspen Consulting is a full service firm handling all aspects of the RS/6000 and AIX. Aspen consultants are experts working with IBM RS/6000™SP™, Storage Systems, HACMP, Tivoli®,

SEE UPGRADE, PAGE 5

## Martian Pathfinder Mission A Success

*IBM®RS/6000™ Capabilities Make It All Possible*

By Linda Smith  
DAILY TIMES NEWS SERVICE

This month's landing on Mars captured the imagination. It would not be the computer technology on board the Pathfinder.

The new budget, using off the shelf businesses. Developed in less than the vehicle to carry the Sojourner meteorologic communicate back to earth withstand taking landing on un deploy its scie direct the exper the mission to closest in comp

The flight is based on a version of IBM's RS/6000 technology and the first commercially based processor to travel into deep space. Since software development was critical to the success of the mission, using known and successful technology was key to saving money and time to allow

Can We Be Of Service to You?

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SEE PATHFINDER, BACK PAGE

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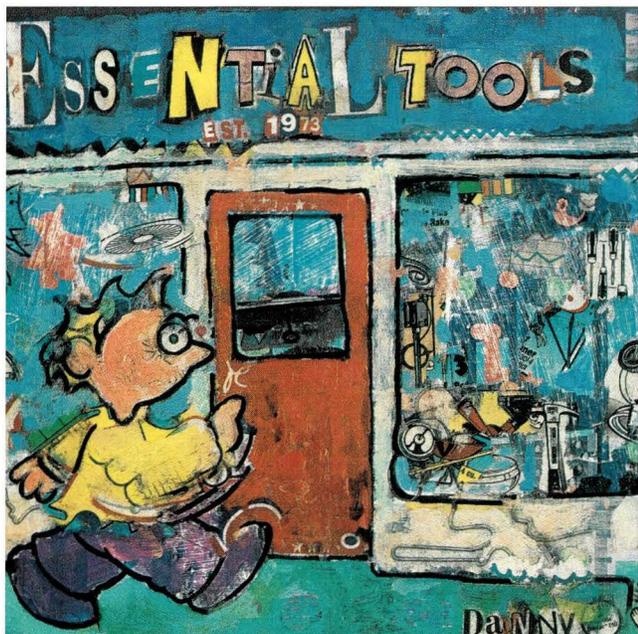


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# Datagrams

by John S. Quarterman



## Essential Tools

*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](mailto:jsq@mids.org), by voice at (512) 451-7602 or by fax at (512) 452-0127.*

**W**ell, I don't know about you, but I'm tired of politics and would like a vacation. So this month's column is technical for a change, more or less. There's some company policy involved.

For those of you who like politics, don't worry; there's plenty more in store. We are living in interesting times for the Internet, in the sense of the Chinese curse, and also in the sense of a surfeit of success. So there will be more columns about the politics of free speech, of cryptography, of spamming, of security, of registration services, of governance bodies and so on.

We have our own shop here at MIDS, small but mighty, and we run it as we like. Why else be in business for oneself? The nature of the business is that we deal with various related firms and their shops. Often, when I start to set up a piece of software or collect some data inside another shop, I discover a key piece of software is missing. Usually I wonder, "Surely I'm wrong. There's no way they could do without this." But often it's not a simple matter of a missing search `PATH` element; the key software facility really isn't there. Even stranger, I get puzzled looks and letters of bemusement when I mention it.

### Specific Users for Specific Tasks

Ever since Multics, if not before, there have been two schools of thought about secure access. One school is Multics rings of security, each ring providing more access to fewer people. The other is superuser access, which gives access to do anything.

The extreme of that latter school is traditional MS-DOS security, which is no security at all; the user, of which there is basically only one, can do anything at all to anything at all. That's OK if the user never makes mistakes and really is the *only* user. In the real world that is seldom the case, especially on UNIX systems. I note that even Windows 95 now expects a user login as soon as the system is configured for network access.

But there are still plenty of things that require more than normal user permissions: setting up new users, setting up network access, configuring new file systems, formatting disks, the list is frighteningly long.

UNIX groups answer many of these issues. Groups for program installation, source code read and write access, Web servers and so on can address a lot of daily access needs. UNIX groups are, for that matter, a special case of Multics rings, with

the three rings being the owner of a file, the group of a file and everybody else.

But setting up such groups requires supergroup access, which is another way of saying superuser access. And not all systems administration tasks are tied to the file system; network access, again, is such a case. So there is still a need for a ring above the owner of a file.

The designers of UNIX (hi, Ken and Dennis) designed superuser, or root, access for this purpose. Root is so high above the three file system access rings it's almost orthogonal. It's actually not true that root can do anything; for example, even root cannot write on a directory as a plain file. But root can one way or another do just about anything; for example, root can rename and re-create the directory.

But typical UNIX installations have multiple systems administrators and multiple systems root passwords. Do you make the root password different on each machine? Then, each administrator will have a written list of root passwords, which is easily lost or stolen. Do you make the root password the same on each machine? Then, any cracker who gets that password can do anything on any machine.

Shared passwords are in general a bad idea, and the root password is the worst and most prevalent kind of shared password. And anyone who has the root password is tempted to become root and stay that way, because it's a pain to have to look up and retype the root password each time you want to do something as root. This might be OK for people who never make mistakes, but real systems administrators do, and as root a simple mistake such as `rm *` can easily be magnified to a disaster.

Fortunately, our brothers and sisters at the University of Colorado have given thought to this problem and have spawned `sudo`. What `sudo` does is give root access to specific users for specific tasks, one at a time. For more information on `sudo` and how to get it, see <http://www.cs.colorado.edu/~millert/sudo/>.

There are several advantages of `sudo`:

- No need to remember the root password anymore. It asks for *your* password. And it only asks for it if you haven't used `sudo` in the last five minutes (or whatever interval is set).
- No need to stay root. If you want to do something else as root, just use `sudo` again.
- Everything done as root is logged. It's easy to discourage those who tend to stay root. It's easy to see who did what as root and find out what got broken when, and fix it.

Why isn't such an invaluable tool used more widely? I don't know. Maybe not enough people know about it.

## TCP Wrappers

Several moons ago, I sent a draft of a book chapter to a certain founder of the Internet for review. I discovered by accident that he had stuck a copy in an anonymous FTP server for secondary review by several people. The secondary review was fine, but if I could stumble across it by accident, who else might? Similarly, while I was helping write the 4.3BSD book, at one point I was transferring it from Berkeley to my machine, and this involved putting it briefly on a machine that had heavy network access. It was only there for a couple of hours, but that

was enough for me to receive a message from somebody I didn't know in another country thanking me for the book and asking if it could be redistributed. Both of these incidents occurred before the Web boom of 1994, back when the Internet was less than one-tenth the size it is now.

Moral: Anybody who puts computers on the Internet and doesn't take minimal security precautions is a fool. Given millions of Internet users (about 50 million as of June 1997), it only takes a tiny fraction of a percentage of bad apples to go beyond legitimate access to cracking.

Almost all UNIX systems are distributed with the `rlogin` and `rsh` programs and protocols, which were designed for a much more trusting research and academic Internet. Those programs basically believe domain names without question, even though a cracker only has to take over one domain server to fake domain names. The solution to this problem came from the Netherlands: `tcpd`, or TCP Wrappers. This package is recommended by the Computer Emergency Response Team (CERT) and is even distributed from the CERT FTP server, [ftp://ftp.cert.org/pub/tools/tcp\\_wrappers/](ftp://ftp.cert.org/pub/tools/tcp_wrappers/).

What does `tcpd` do? First, it double-checks domain names by doing reverse DNS lookups on the IP address found from a forward of the domain name, and closes the connection if the forward and reverse lookups don't match. Second, it permits denying or allowing access by any combination of domain names, IP addresses or, in many cases, usernames. Third, it permits setting traps, which are arbitrary shell commands, on arbitrary Boolean conditions. Fourth, it logs all connections, successful or not. This is amazing functionality for such a simple program, and worth installing just for the first feature.

## Source Code Control

It never ceases to amaze me how many shops have multiple programmers working on a project with no form of source code control. So if a programmer makes a mistake, there's no simple way to determine when the change happened, exactly what it was, who did it or why they did it. Many people make copies of files under variant file names for this purpose, which leads to cluttered directories and difficulty in figuring out which file name has which change. Many programmers don't save old copies at all, so the only backup copies are on backup tapes. Because backup tapes are normally made on a daily basis, any changes made more quickly than that are lost and, for that matter, changes made weeks or months ago can be hard to retrieve.

Now if software to deal with these problems were hard to come by, I would find such procedures easier to understand. But almost every UNIX system comes with at least one of two perfectly good source code control systems: SCCS or RCS.

The oldest and possibly the most widespread source code control system for UNIX is called just that: Source Code Control System, or SCCS for short. It was developed at AT&T a long time ago and still works perfectly well. Because it consists of so many little commands, SCCS is perhaps easier to use with the Berkeley front end for it, called `sccs`.

You may have to add an element to your search path environment variable, `PATH`, to find this stuff; for example, it may be in `/usr/ccs/bin`. It's worth that small effort.

To put a file under SCCS control, do this:

```
sccs create filename
```

To check a file out for editing, do this:

```
sccs edit filename
```

While you've got it checked out, nobody else can check it out, so programmer collisions are avoided.

To check a file back in, do this:

```
sccs delget filename
```

It takes a while for people to remember to check files back in, but it's a habit easily learned.

With SCCS you can also set the major or minor revision level, do `diffs` between revision levels, and even merge different revisions. Most important, you can retrieve any revision ever made to a file. Each revision also has a time stamp, the username of the person who made the change and a brief comment by that person. So if you need to track down a bug, you can find exactly where, when and by whom the last or any previous change was made. I can't count the times I've seen this ability save large amounts of programmer time.

## Revision Control System

SCCS is owned by AT&T and has certain restrictions on redistribution. For that and other reasons, another package was written by Walter F. Tichy to perform similar functions. He called it RCS, for Revision Control System.

To put a file under RCS control, do this:

```
ci -u filename
```

To check out a file for editing, do this:

```
co -l filename
```

To check a file back in, do this:

```
ci -u filename
```

With RCS you can also set revisions, extract any previous revision and so on. Which of RCS or SCCS people prefer is a matter of taste, just like text editors or GUIs. Both do the job.

## Support Ticket Software

Even a pure engineering department gets requests from outside and needs to track them somehow. An Internet service provider or other operation that has customer support is driven by such requests. Yet many such organizations have no organized method of tracking requests. I don't understand how they survive.

There are numerous trouble ticket packages out there. I'll just mention three here. The basic method is to have an electronic mail alias, such as `support@mid.s.org`, that people

can send requests to. The type of request depends on the organization. It could be sales orders, bug reports, enhancement requests, whatever. The alias goes to software that assigns a ticket number, distributes the message to a list of people who need to deal with the problem and logs the message. All messages associated with a given ticket number can be retrieved at any time by any of the staff on the list. New messages about the same item can be filed in the same place by sending another message to the same alias with the ticket number in the `Subject:` header, which is most easily accomplished by replying to a message that already has such a header.

There are numerous other bells and whistles, such as priority per ticket item, but the above is the basic idea, and it's enough to obsolete a lot of paper scribbles and prevent a lot of lost items.

The most common UNIX ticket system may be the `req` software, which is available from <http://www.ccs.neu.edu/software/ccs/req/>. Unfortunately, this package doesn't seem to be getting a lot of development, and there are many interesting things that could be done to it that haven't gotten done. Nonetheless, this is the package we use.

A more recent package of the same general sort, but with some new features such as the ability to limit who gets follow-on mail about a ticket item, is the RUST Mail System, which is available via <http://www.cs.utah.edu/~ruefenac/rust/>. This one has also seen slow development, but it looks very promising.

I've seen another package called the Remedy Action Request System, which is very GUI-oriented and has features for almost every purpose. I haven't used it personally, but it seems popular in large shops. Unlike `req` and RUST, which are supported by graduate students, Remedy is a commercial product and is available from <http://www.remedy.com/products/ars.htm>.

## rdist, ssh Are Indispensable

Twice I've gone on about `rdist` at full column length. I reiterate that if you're distributing code across machines that are not in the same local environment, such as external Web servers on an ISP or at a different company office, `rdist` is indispensable. It's available at <ftp://ftp.usc.edu/pub/rdist/rdist.tar.gz>.

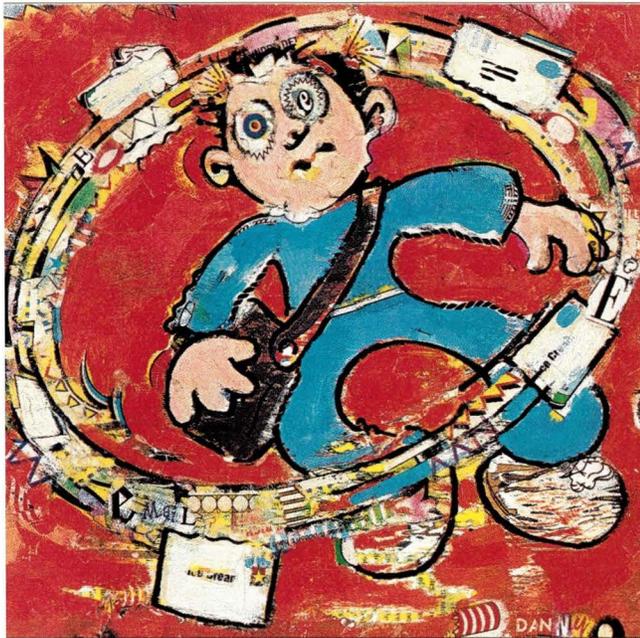
It's also worth pointing out that most of the work on `rdist` since the original version that shipped with 4.2BSD was performed by Michael Cooper, formerly `mcooper@usc.edu`, now `MCooper@MagniComp.Com`. He says: "This should not be taken to belittle the many people who have contributed ideas and suggestions, many of whom also supplied code which is now in `rdist`. Without the help of these folks, `rdist` would not be nearly as good as it is."

I've also devoted a whole column to `ssh`, the Secure Shell, so suffice it to say that if you want secure interactive connectivity and file transfers across heterogeneous networks, `ssh` is a big win. For availability, see <http://www.cs.hut.fi/ssh/>.

I use the packages discussed in this column every day. They seem too obvious to me to be the subject of a column, or they would, if I did not continually encounter groups of programmers, systems administrators or support people who don't use them. So, I recommend all of these packages. ➡

# AIXtensions

by Jim DeRoest



## Wandering Mail – IMAP Revisited

*Jim DeRoest has been involved (for better or worse) with IBM UNIX offerings from the IX/370 days, through PC/IX, AIX RT, AIX PS/2, AIX/370, PAIX, AIX/ESA and AIX V3. He is employed as an assistant director supporting academic and research computing at the University of Washington, and is the author of AIX for RS/6000—System and Administration Guide (McGraw-Hill). He plays a mean set of drums for the country gospel band Return. Email: deroest@cac.washington.edu.*

**T**he two 800-pound gorillas on the Internet block have been very busy marketing their latest and greatest Web clients to the network masses—these being Netscape Communications Corp. with Communicator 4 and Microsoft Corp. with Internet Explorer 4 (IE4). Each Web-o-matic browser includes everything you need to slice, dice and julienne almost any network data type to satisfy your information appetite. Not just for HTML anymore, Communicator and IE4 include a range of groupware, collaboration and messaging tools. No need to meet face to face, just schedule and hold a company meeting via your browser. While conferencing in cyberspace, you'll have access to all your support data through the same browser interface—email folders, address books, newsgroups and Web sites. Very cool!

There's just one small catch. (Isn't there always?) What if you're one of the mobile computer junkies that use a half-dozen different workstations during the course of your day? How do you keep your email folders, address books, Web bookmarks, certificates and configuration preferences synchronized across all those machines? Unless you are very careful, you'll quickly end up with different client states on each machine. This can hap-

pen even when you access common information servers from each client machine. For example, suppose you save a number of email messages into a folder on your laptop while out of the office. Being thrifty when it comes to disk space, you delete these messages from your inbox on the mail server. Later, you're back in the office and find that you need one of those messages but you've left your laptop at home. What do you do now?

### Distributed Mail

I've focused on email in the above example because this is one of the most irritating problems for mobile computer users. Mail folders always seem to be somewhere other than on the machine you are using. The good news is that both Netscape and Microsoft have made this situation a bit easier to manage by including Internet Message Access Protocol (IMAP) in their browser mail clients and mail server products. The same is true for other vendor email offerings, such as Lotus Development Corp.'s Domino Mail server and client, Sun Microsystems Inc.'s Solstice Internet Mail Server and Digital Equipment Corp.'s Alta-vista Mail. In most of these implementations, IMAP coexists with continued support of Post Office Protocol (POP). This gives users

a choice of either service type or, more importantly, a migration path from POP to IMAP. There are some convincing reasons for the latter, as we will see below. Let's take a look at both POP and IMAP to see how IMAP can assist in collocating your email inbox and folders on a single server.

## Post Office Protocol

One of the oldest and best-known interoperable solutions to the distributed mail problem is Post Office Protocol. POP mail clients connect to a POP server, which is the repository for incoming mail. The client downloads the entire contents of the email inbox onto the client machine, where the inbox is processed by the local client. POP works very well for those users who tend to use a single workstation for mail processing with a fast network connection to a mail server. If you operate your email from a number of workstations, you may end up scattering your inbox folders among these machines.

The simplest solution to this dilemma is to store your folders on portable media that can be used on all of the machines you regularly use for mail. You can also leave a copy of your inbox on the mail server rather than deleting after download. This solves the problem of retaining access to your complete inbox, but you're still going to have to delete the contents at some point and coordinate this among all your client machines.

## Internet Message Access Protocol

IMAP was introduced at Stanford University in 1986. It was designed as a follow-on to POP to address the issues of shared access, resource localization

and low-bandwidth connections to a remote mail server. IMAP is a client/server protocol similar to Network News Transport Protocol (NNTP). Its current incarnation is defined by the IMAP Version 4, Revision 1 specification, RFC 2060. Basically, the IMAP protocol provides a mechanism that enables mail clients to transfer mail header information or individual mail messages between the client and a mail server. Destination mail folders may reside on either the local client or the mail server.

Mail clients and servers that adhere to the IMAP4 specification can interoperate in one of three modes. IMAP online mode provides an environment where all folders are stored and managed on the mail server. This mode of operation is best suited to those users who move around among many client computers. Your mail is available no matter where you are working because it always resides on the server.

Offline mode allows IMAP to mimic POP by transferring the complete inbox from the server down to the client. This feature would be useful when you are traveling and don't have access to your site's network. However, IMAP4 goes one step further by providing a disconnected mode. When running in disconnected mode, you download your inbox contents onto the local client. Local operations on the inbox and folders are recorded and then replayed to synchronize the client state with the server when you reconnect. This capability is documented in RFC 1733 "Distributed Electronic Mail Models in IMAP4." There are a growing number of mail clients that support disconnected mode. These include Communicator 4, Sun Internet Mail Client, A.T.I.S.' AtisMail, Comm-touch Software Inc.'s Pronto97, Siren

Software Corp.'s Siren Mail Client, Star Division's StarOffice and Orange-soft Inc.'s Winbiff. Other IMAP facilities include string search, folder sharing, folder subscriptions, Usenet access and managing attachments.

## IMAP/POP Coexistence

IMAP and POP can coexist in the same client/server environment. Most of the IMAP-compliant servers described thus far also support POP and can share access to mail folders. Note that this assumes the mail delivery service uses a folder format that is understood by your IMAP and POP servers. Often, the delivery service is integrated with IMAP and POP support, so this will not be a problem. If the delivery mechanism is a separate service, as in the case of UNIX `sendmail`, there are a number of mail delivery routines available that optimize folder format to improve IMAP and POP server performance.

An example is the MBX (mail box) format developed by Mark Crispin, a software engineer at the University of Washington, Seattle. MBX format does not require a complete folder rewrite for updates. Similar systems have also been developed at Carnegie Mellon University, Pittsburgh, PA, as part of its Project Cyrus. In the Washington configuration, POP and IMAP servers running on a cluster of IBM Corp. RS/6000 Model 250 and E30 processors support remote client access to 65,000 users. The cluster of 30 processors averages 5,000 concurrent connections during prime shifts and transfers 500,000 messages per day. To simplify mail client configuration, users identify their IMAP or POP mail server using a per-user domain name. The custom domain name service maps the per-user

### Table 1. Useful IMAP and ACAP Resources

- <http://www.imap.org>
- <http://www.washington.edu/imap/>
- <ftp://ftp.cac.washington.edu>
- <http://weber.u.washington.edu/~deroest/slides/imap/>
- <http://andrew2.andrew.cmu.edu/cyrus/acap/>
- <http://andrew2.andrew.cmu.edu/cyrus/cyrus/>
- <http://www.ema.org>
- <http://www.imc.org>

The IMAP Connection  
University of Washington IMAP Information Center  
University of Washington IMAP ftp archive site  
IMAP POP Cluster  
ACAP Home Page  
Carnegie Mellon University Project Cyrus  
Electronic Messaging Association  
Internet Mail Consortium

domain name to the IP address of the server that maintains the user's inbox and folder collection. For example, user "sally" identifies her POP and IMAP server as

sally.deskmail.washington.edu

## Pine and C-Client

If you are interested in experimenting with IMAP, I suggest you obtain a copy of the UNIX IMAP server and Pine client. Both software packages are freely available from the University of Washington ftp archive listed in Table 1. The Pine mail client provides a simple hot-keyed menu interface for processing both local delivered and IMAP-managed mail boxes. Local mail queue support allows Pine to work in non-IMAP environments like other popular mail clients. Pine's goal is to provide a basic "meat and potatoes" interface to electronic mail processing. Message composition is facilitated through the use of a basic editing tool called Pico.

You can also choose your own text editor along with a number of other user preferences, such as spelling checker, via local and global configuration files. Other mail processing features such as custom sorting message indexes, tagging messages for batch operation, tailoring message header displays and managing MIME attachments are available for power mail users. An IMAP API library called the C-client is also available from the University of Washington ftp archive site, which can be used to integrate IMAP support into existing mail user agents.

## Application Configuration Access Protocol

Both Microsoft and Netscape have provided facilities for managing configuration profiles in multiuser environments. This assists in keeping general client preferences synchronized between users and machines. It doesn't address the problem of collocating other state-full information like address books, newsrc files and so on. A possible solution is the Application Configuration Access Protocol (ACAP), which defines a means for clients to remotely access configuration data located on one or

more remote servers. ACAP has its roots in the Internet Message Support Protocol (IMSP) and has replaced IMSP based on enhancements, which evolved out of the Internet Engineering Task Force (IETF) draft process.

From time to time, ACAP is confused with or is described as a competing protocol with the Lightweight Directory Access Protocol (LDAP). ACAP is not intended to be a directory service, but rather to work with directory services like LDAP to manage contact information in address books. There has been some discussion directed at extending LDAP to provide similar configuration functions, but not within the current specification. The vendor community has expressed interest in ACAP. Many participated in the ACAP working group meetings. Vendor representatives at the March 1997 ACAP meeting held in Pittsburgh, PA, included Sun, IBM, Microsoft, Qualcomm Inc., Esys Corp. and Cyrus International Inc. Although the ACAP

specification is still in its inception, a fair amount of design development experience has been gained from the previous IMSP implementations like the one done in Project Cyrus at Carnegie Mellon University. For more information on ACAP, see Table 1.

Protocols like IMAP have made significant headway in providing a means for managing mail in a distributed environment. Much more work still needs to be done to provide similar capabilities for sharing access to bookmarks, certificate caches, digital wallets and other browser state data. My crystal ball predicts that these features will be forthcoming as Communicator and IE4 make their way onto the desktop. I recommend that you take a look at IMAP even if you already have an existing POP infrastructure. IMAP may not be for everyone, but it does offer solutions for collocating folders for mobile users and in addressing scalability issues for large user communities. →



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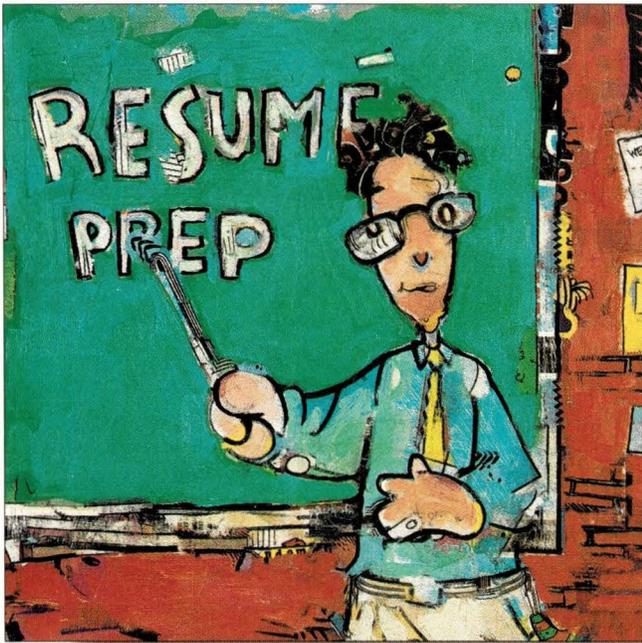
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## Your Résumé, Part 1

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(copeland@alumni.caltech.edu) is at Softway Systems Inc. in Boulder, CO, working on UNIX internationalization. He spends his spare time raising children and 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.

**W**e had intended this month to discuss the joint Internet Engineering Task Force/Printer Working Group (IETF/PWG) project to develop the Internet Printing Protocol (IPP). While the IETF only recognizes the contributions of individuals, the protocol is being watched with interest by staff from companies like Hewlett-Packard Co., IBM Corp., Lexmark International Inc., Microsoft Corp. and QMS Inc., so we have every reason to believe that it will be well received. (If you're interested in IPP, look at <http://www.pwg.org/ipp>.)

However, earlier in the month some colleagues came to us and said: "Quick! What do you have for formatting résumés!?"

"Ha!," we said (since all conversations between engineers are punctuated by exclamation points). "Have we got a macro package for you?" And now, we'll share it with you, too.

Before we start, we need to address the important question: "How many accents are there in resume, anyway?" It depends. We've usually seen it with one, but our friend Dick Dunn claims that either two (as in *résumé*) or none (as in *resume*) is proper, even though our edition of *Webster's* also allows one, like one of us has used for years. So, with a tip of

the hat to Dick, we'll use two. As always, you're welcome to change the software.

Also, before we start, we'll remind you to proofread your résumé carefully. Vital documents are sometimes so vital that they develop their own typographic errors when you're not looking. Also, get outside referees: We review each other's résumés, and every so often we get someone else to do it. If you've got a friend you trust in the human resources department of a company like the one you're targeting your résumé for, ask them. Ask managers you've worked for in the past with whom you're still on good terms. You're often too close to the contents of your own résumé to review it critically.

As always, we'll be formatting our documents in `troff`, rather than one of those newfangled what-you-see-is-what-you-get word processor things—we may be computer-literate, but we're Luddites at heart.

We'll warn you ahead of time that we're going to assume some `troff` knowledge, but here we go....

### Design Issues

We'll begin by thinking through what we need to put on the résumé. In general, we want to mark up the résumé structurally—that

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is, in terms of the items in the résumé (here's the job title, here are the dates I worked there)—instead of using typographic markup (this word is in italic, this one has a larger point size). This will allow us to change the format of our résumé later by just changing the macros.

On the other hand, we certainly need to identify some things as being in italics, and some in bold, so let's do those macros first, as they're pretty simple.

```
.de i
\f2\$\1\fP
..
.de b
\f3\$\1\fP
..
.de c
\f6\$\1\fP\$\2
..
.fp 6 C
```

We'll assume that we've got an italic font mounted on position 2, and a bold on position 3. As a matter of good troff form, we try to refer to the fonts by their position rather than their names. This means that we can change the fonts without changing every reference to them. We've also included a macro for computer type in Courier. This allows us to include things like `http://www.alumni.caltech.edu/~copeland/work.html`. Notice that we mount the Courier font immediately after we define the `c` macro, so the two are physically together in the macro package.

Next, we'll need to specify the markup for paragraphs. We want to be able to use three kinds of paragraphs: normal block, indented and hanging paragraphs. Our normal résumé style is to use block paragraphs at the beginning of a job description, indented paragraphs within job descriptions and hanging paragraphs for publications.

```
.de PP
.br
..
.de IP \" indented paragraph
.ti +2m
..
.de HP \" hanging paragraph
.ti -2m
..
```

Notice that we're using `.ti` directives, but we don't say what we're doing the temporary indent from. We'll deal with that in the setup.

Another thing we might need is nested bullet lists. In our résumé, we use them for the executive summary page. (Why include an executive summary? Because it allows us to put all the relevant buzzwords on a single page to make life easy for the clerk in the human resources department.) If we were using the `-mm` macro package, we'd use `.DL` dash lists nested within `.BL` bullet lists.

```
.de BU \" bullet list item for summary
.sp .66v
.ti -2m
\ (bu\0\c
..
.de DA \" dashed list item for summary
.sp .25v
.ti -1m
\ (em\0\c
..
.de SB \" item line for summary
.ti +2m
..
```

Again, we're assuming some global page indent in the setup for the lists, but we'll address that later.

## Mr. Manager and Dr. Technical

Next, we need to handle a special case, to prevent special cases: support for two versions of our résumé, one with a technical focus, and one for a management position.

```
.de TE \" technical resume content line
.if \nB [[\f2tech:\f1
.if \w@\$\1@ \{\
. ie \nB \[\$1]]
. el .if \nT \[\$1
.\}
.if !\w@\$\1@ .if !\nT .if !\nB .ig VE
..
.de MG \" management resume content line
.if \nB [[\f2mgt:\f1
.if \w@\$\1@ .if !\nT \{\
. ie \nB \[\$1]]
. el \[\$1
.\}
.if !\w@\$\1@ .if \nT .if !\nB .ig VE
..
.de VE \" version end
.ie \w@\$\1@ \[\$1\f1
.el .if \nB ]]\f1
..
.if \nB .nr D 1
.if \nB .nr T 0
```

This assumes that when we want to work on the technical version, we invoke troff with a line like `troff -rT1 resume`. We've set this up to allow us to work on a "both" version for editing purposes with something like `troff -rB1 resume`. Setting `B` implies that `T` is unset, and `D` (for draft) is set. By turning off `T`, we make the processing for the "both" version a little easier. Also, we may want to do some special processing if we're printing a draft, which the "both" version definitely is.

It's important to note that we've set this up like the `-mm` italic and bold macros. We can invoke the macro with

```
.TE "a technical thing I did"
```

## Work

or use TE/VE and MG/VE pairs to bracket targeted text, like

```
.TE
a long technical
thing that I did
.VE
```

We're doing the latter by making careful use of the `troff ig` directive, buried beneath a chain of `ifs`. (You can easily modify this trick for separate waiter and cook résumés, or developer and tester résumés, if you want.)

Because we're doing this in a bottom-up fashion, next we'll think about the way we'd format each new job. Let's assume we call the macro with a line like this

```
.NJ 11/94#present "Sr MTS" "QMS" "Boulder, CO"
```

That is, we want the dates of the job, the title, the company and location as arguments. Why would we use a pound sign instead of a dash in the dates? Depending on how we arrange the output of the macro, we want to avoid breaking the date across lines if we can help it, because `troff` will break at a hyphen if it can. We can use the `tr` directive to change the pound sign into a dash after the hyphenation and fill is completed. So

```
.de NJ \" new job
.\" takes dates, job title, company, location
.in 0
.sp .66v
.tr #-
.if \\w@\\$2@ \\$2.
.ie \\w@\\$4@ \\$3, \\$4 (\\$1):
.el \\$3 (\\$1):
.in
.tr --
..
```

Notice that we've taken special care about the punctuation in cases where we may be missing one or more arguments. This allows our résumés to have jobs like

```
.NJ 5/75#6/79 "Teaching Assistant" "Caltech" ""
```

Also, as with our paragraph and list macros, we're assuming a base page indent, and we set our job line firmly against the left margin. Of course, we can always change the formatting of the job lead-in without changing the structure of all the `NJ` macros we used in our résumé text.

### New Pages, Last Pages

Now we need to look at our least favorite `troff` thing: the macro to handle the top of the page. It's generally a messy process because the macro is invoked by the bottom of page trap, and we need to do some swapping of environments to prevent the line that caused the page spill from being inadvertently printed.

```
.de BP\" top of page macro
'ev 1
'br
'bp
'sp |.5i
'ps 10
'if \\n%>2 \\{
' t1 |\\f3R@\\o@e\\'@sum\\o@e\\'@/\\*(Jf\\fP (continued)|\\
|\\f6\\*(J@\\fP|
' if !\\nA 't1 |\\*(A1, \\*(A2|\\*(A3|
'\\}
'if \\nD 't1 'draft: \\*(PD''
'ps
'sp |1i
'ev
..
```

What are all those hieroglyphs in the `t1` lines in the page header? We'll define some strings for our names and addresses, `Jf` contains Jeff's full name, `J@` will have Jeff's email address, and then `A1`, `A2` and `A3` for his street address, city and phone number, respectively. That data will appear throughout the résumé, and so defining them as strings means that when we move it's not so much of a hassle.

In any event, our top of page processing does the following: On each page after the second (the first page will be the execu-

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tive summary, the second is the beginning of our résumé proper, and we don't want a page header on it, just our name, centered) we put our name on the left side, our email address on the right (in Courier). On the next line, we put our address and phone number, but we can suppress this by setting the A number register on the command line.

Let's digress for a moment about form. It's good practice to put your address on each page of your résumé. Pages can get separated, and we want to make life easy for the clerks who are processing it. However, if you send your résumé to an agency, they'll want to strip your address because they want inquiries to go through them, and you've just saved the clerk in their filing department the trouble.

If we've set the D number register, we're printing a draft, and we put the date string PD at the top of the page, too. We're setting the whole page header in 10 point and then reverting to the original point size. (Do we need to revert? We may not, but we can never remember whether the point size is in the environment or not, so we make the switch to the original point size explicit.)

Let's use this macro immediately, so that we have the macro and the trap physically together in the source:

```
.if t .wh -1i BP
.if n .rm BP
.if n .pl 1
```

Notice that we're really only using this for troff. In nroff, we set the page length to one line so that we never get a real page break. Why? Because the nroff version of our résumé is going to be used mostly for email, and page breaks in email are annoying. (Actually, we'll also use nroff to generate the HTML version, but let's come back to that.)

We also want an "end" macro. This will allow us to print a footer at the bottom of the last page, with the date or other tag information.

```
.de EM
.ch BP \" remove the end page trap
.sp |\\n(.pu-.5i
.tl '\\\\*(PD'
..
.em EM
```

We should also define the date string we print on the draft version and in the footer. Notice we append a t or m so we can tell whether we've printed the technical or management version.

```
.\" printed date
.ds PD \\n(mo/\\n(dy/\\n(yr
.ie \\nT .as PD t
.el .as PD m
```

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Another structural macro we need is a section header, for things like "Education" and "Publications."

```
.de SC \" begin section
.in 0
.sp 1v
.i "\\$1"
.in +4m
.br
.ns
..
```

We've used our previously defined italic macro here. The only odd thing to note is the `ns` directive, which prevents explicit spacing until we've printed a line of text. This means that the space we generate in the `NJ` macro gets ignored immediately after

```
.SC Experience
```

The last thing we need to supply is a macro to produce a fancy block at the top of the first, executive summary page.

```
.de PH \" 1st page title block
.ce 5
\f3\"(JF\f1
```

```
\*(A1
\*(A2
.sp .2v
\*(A3
.ps -1
.c \*(J@ " " mailto:\*(J@
.ps
..
```

Notice: name in bold, address strung out below in roman, followed by phone and email, with each line centered.

## Out of Space, Out of Time

We're not quite done with the base-level résumé macros, but we're out of space for this month's column. Next time, we'll finish up the last little bit of the macros—mostly page setup and some string definitions—and proceed to discuss how to produce an HTML résumé.

One quick note, however, Nachum Dershowitz and Edward M. Reingold's book on calendar processing, *Calendrical Calculations* (Cambridge, ISBN 0-521-56474-3), is finally in print. We've been touting their calendar work, first from *Software-Practice and Experience*, and now in this book, in our column for some time. We just got our copy of the book today.

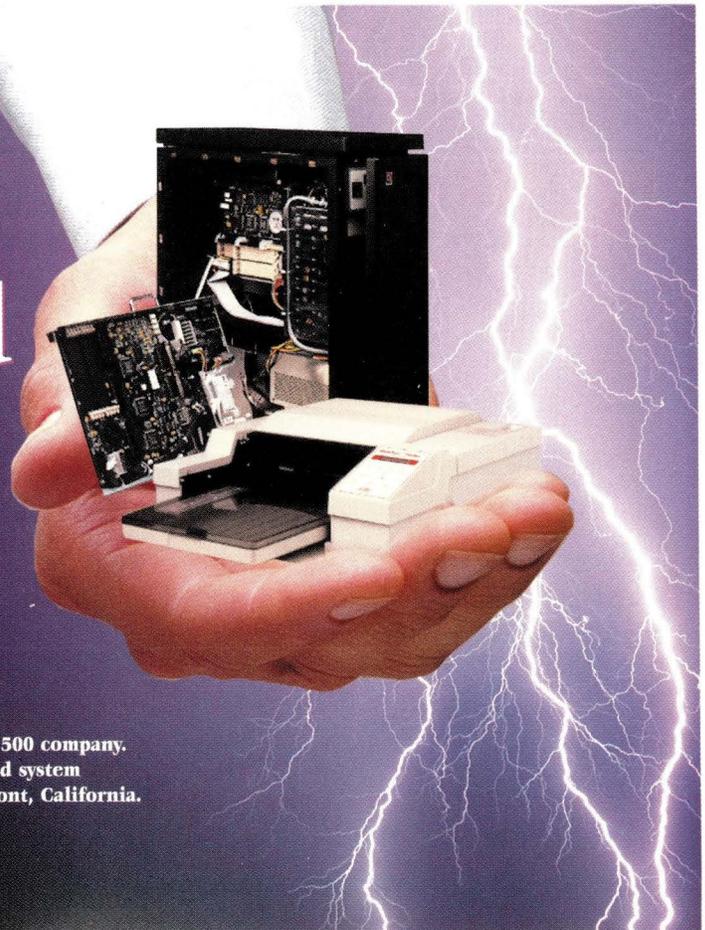
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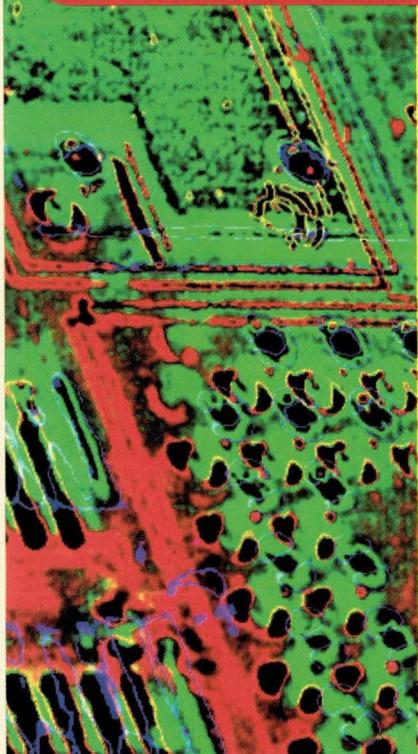
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In addition to the The Cage, users should also look out for The Policy Cage, for implementing secure management policies; and The Enterprise

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4410 El Camino Real, Ste. 107

Los Altos, CA 94022

<http://www.digitivity.com>

Circle 101

## Link Object Database Products

Iona Technologies has introduced the Orbix Database Adapter Framework (ODAF), a software toolkit designed for independent software vendors (ISVs). ODAF is said to enable the creation of adapters that link object database products to Orbix, Iona's object request broker.

According to Iona, CORBA applications require some objects that they

create to live longer than the application itself and thus become "persistent objects." ODAF creates adapters that allow these "persistent objects" to be stored in a database. ODAF is a framework comprising a set of specialized classes that allows database vendors and users to create Orbix+Database adapters.

ODAF 1.0 is available on Solaris and Windows NT. Developer kits are free, and server runtime licenses are configuration-dependent.

### Iona Technologies Inc.

60 Aberdeen Ave.

Cambridge, MA 02139

<http://www.iona.com>

Circle 102

## Ultra-Compatible Embedded Computing

Themis Computer has put the power of the UltraSPARC processor on a VMEbus single-board computer. Called USP-1 VME64 Engine, the unit ships with either a 167-MHz or 200-MHz

## Ultra SCSI Solid-State Disk Out

Imperial Technology has announced MegaRam-4000, which it claims is the first Ultra SCSI solid-state disk for the Sun marketplace. With it, users can benefit from improved reliability, data retention and performance.

MegaRam-4000 features an internal 100-MB/s bandwidth to service up to six independent Ultra SCSI ports, each of which are capable of transferring data at 40 MB/s.



The Ultra SCSI ports can be connected to multiple hosts or to different ports on the same host. In addition, MegaRam-4000 can be configured with up to 4 GB of storage space.

Solid-state technology is designed to improve system performance. As such, MegaRam-4000 features an access time of 0.035 msec, about 300 times faster than conventional disks, according to the company.

MegaRam-4000 is compatible with earlier SCSI interface protocols. The company says users not yet running Ultra SCSI can still benefit from the disk's performance. For added reliability, MegaRam features redundant AC inputs, power supplies, batteries and a proprietary multi-byte error correction capability to protect data integrity. Patrol diagnostics continuously run in the background, monitoring batteries, power supplies and so on. An internal uninterruptible power supply is included to prevent data from being lost in the event of a power outage.

MegaRam-4000 is available in 19-inch rack-mount configurations and is priced from \$25,000.

### Imperial Technology Inc.

2305 Utah Ave.

El Segundo, CA 90245

<http://www.imperialtech.com>

Circle 100

## New Products

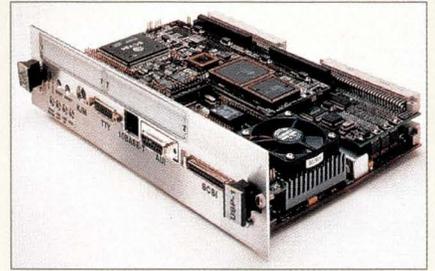
UltraSPARC 1 CPU and is aimed at the telecommunications, federal systems, medical imaging and traditional VME embedded processing markets.

In addition to the UltraSPARC chip, the USP-1 uses Sun Microsystems' Support Chip Set, which provides UltraSPARC bus control between the UPA interconnect, SBus and other bus connectors. It also has Ultra 1 I/O ports

and two SBus expansion slots and ships with a port for Solaris 2.5.1.

The USP-1's Ultra architecture takes the form of a two-board 6U VME module—the processor board and the I/O board—and a third VMEbus slot may be used to accommodate one of two optional SBus controllers, Themis says.

Other features include crossbar memory architecture supplying 600-MB/s sus-



tained bandwidth; the Visual Instruction Set (VIS); up to 1 GB of RAM and 1 MB of FLASH memory; dual Ethernet, dual Fast SCSI-2 ports, and two RS-232 or RS-423 ports; and a high-performance VME64 interface.

Pricing for the USP-1 VME64 Engine starts at \$18,660.

**Themis Computer**  
3185 Laurelview Court  
Fremont, CA 94538  
<http://www.themis.com>  
Circle 103

### PowerLink Extends SCSI up to 10km

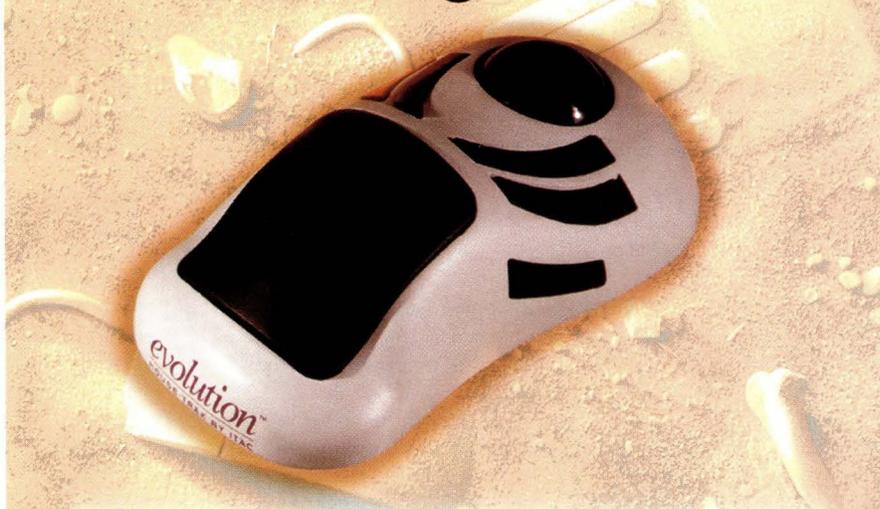
The PowerLink SCSI bus extender from Apcon reportedly adds connection distance to a SCSI bus, as well as other connection and interface options. PowerLink's three extension interfaces support low-cost coaxial cable over 30m, high-performance coax over 200m, multimode fiber-optic interface over 550m and single-mode fiber-optic interface over 10km (optional). It also supports the maximum Ultra SCSI data transmission rate of 40 MB/s, Apcon says



The unit's fiber-optic interface incorporates Apcon's SC optical connectors, which convert SCSI data into a 1.06-Gb/s Fibre Channel serial data stream, transmitted on the fiber-optic interface to a remote PowerLink for conversion to the appropriate SCSI signals.

Fiber-optic open loop protection is also provided to electronically disconnect from the SCSI bus in the event of a power failure. In order to support a wide

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Circle No. 21

## New Products

range of peripherals, PowerLink ships with both narrow and wide SCSI connectors and is available in single-ended or differential SCSI versions. A graphical user interface lets users remotely operate and control the selection of extension interfaces, monitor activity and initiate diagnostics, Apcon says.

The PowerLink external unit, Model ACI-2030, is priced at \$4,000 for the single-ended SCSI version, and \$4,500 for the differential version.

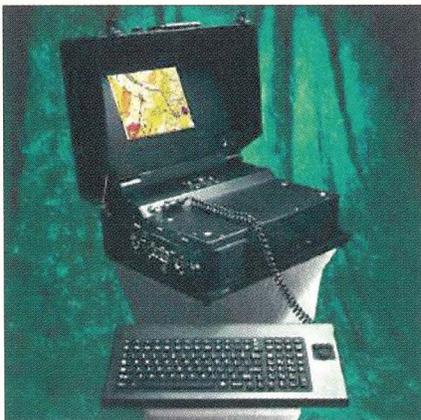
### Apcon Inc.

17938 S.W. Boones Ferry Road  
Portland, OR 97224  
<http://www.apcon.com>

Circle 104

## RDI Offers Ruggedized Workstation

RDI Computer has come out with a ruggedized version of its PowerLite Turbo 170 portable SPARC-based workstation. Powered by the 170-MHz TurboSPARC processor, this workstation incorporates a 12.1-inch high-resolution display, TGX graphics acceleration, up to 9.1 GB of removable hard disk storage, removable keyboard, floppy disk drive, PCMCIA, CD-ROM (optional) and 4mm DAT or 8mm STD, and extensive expansion capability in a self-contained transportable system, RDI says.



Designed to support deployed C<sup>3</sup>I applications and special operations forces (SOF) missions in the field as well as mobile, shipboard and airborne environments, the new PowerLite includes an advanced air cooling system and custom aluminum alloy case. Its components have been toughened and are sealed to survive the shock, vibration,

dust, humidity and temperature variations of tactical environments.

RDI says the PowerLite Turbo 170 provides processing power similar to that of the SPARCstation 20. It is rated at 3.08 SPECint95 and 2.74 SPECfp95. The processor is built with a nine-stage pipeline, 16 KB of instruction cache, 16 KB of data cache and support for up to 512 KB of secondary cache. Standard interfaces include Ethernet, SCSI, two serial ports, one parallel port and audio connections.

The system is available with Solaris 2.5.1 or Solaris 1.1.2 (optional), unmodified to ensure complete binary compatibility. It also supports multiple network protocols and includes RDI's mobile computing software environment, Virtual Workgroup Architecture. The ruggedized PowerLite Turbo 170 comes with a one-year warranty plus telephone, email and fax hot line support.

Contact RDI for pricing information.

### RDI Computer Corp.

2300 Faraday Ave.  
Carlsbad, CA 92008  
<http://www.rdi.com>

Circle 105

## CORBA-Compliant JDBC

A multitier Java Database Connectivity (JDBC) driver introduced by I-Kinetics is said to enable database connectivity in otherwise incompatible environments. Written in 100% Pure Java, the OPENjdbc driver can give database access to any client that supports a Java Virtual Machine (JVM). But, because it relies on IIOP (Internet Inter-Orb Protocol) as its messaging protocol, OPENjdbc allows users to connect to I-Kinetic's DataBroker 5.0, a pure Common Object Request Broker Architecture (CORBA) server, for database access.

OPENjdbc provides support for current and future CORBA services, I-Kinetics says, including events, security, transactions and naming. Native drivers for Oracle Corp. and Sybase Inc. databases ensure high performance, while an Open Database Connectivity (ODBC) driver supplies access to any ODBC-compliant database. In addition, OPENjdbc offers support for data streaming, multithreading, multiple languages and Iona Technologies' CORBA 2.0 Orbix run-

time and IIOP firewall proxy.

Apart from providing an interface to CORBA services and applications, I-Kinetics says the OPENjdbc Interface Definition Language (IDL) supports any language for which an IDL compiler is available, including C, C++, SmallTalk and ADA. This feature, the company says, is useful for extending JDBC capabilities into existing enterprise applications that weren't written in Java.

The OPENjdbc client is available for all Java-enabled platforms. DataBroker 5.0 runs on Solaris, HP-UX and Windows NT. Pricing for OPENjdbc is \$1,995 per server license. Free evaluation copies are available from the company's Web site.

### I-Kinetics Inc.

17 New England Executive Park  
Burlington, MA 01803  
<http://www.ikinetics.com>

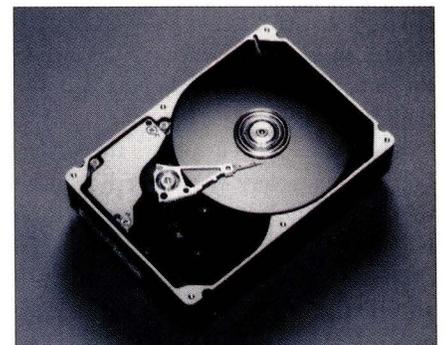
Circle 106

## High-End, High-Capacity Drives Out

Quantum extends its presence in the high-end drive market with the introduction of two high-capacity drives, the Atlas III and the Viking II.

Both models offer the Ultra2 Low Voltage Differential (LVD) SCSI interface, an advancement in parallel SCSI technology, Quantum says. Ultra2 LVD reportedly improves signal integrity, thereby doubling the number of devices that can be connected to the same bus, while supporting cable distances of up to 12m. For customers transitioning to Ultra2 LVD, the new drives are designed to support both Ultra SCSI and Ultra2 LVD SCSI in one product configuration.

The Atlas III series, which includes 4.55-, 9.1- and 18.2-GB formatted



## New Products

capacities, is designed for high-end enterprise computing applications ranging from online transaction processing (OLTP) to data warehousing. The low-power Viking II series, which includes 4.55- and 9.1-GB formatted capacities, is designed to meet the needs of PC servers and workstations, and is ideal for CAD/CAM applications and Inter/intranet service, the company says. Both drives are 3 1/2-inch format.

The Viking II drives are priced at \$595 for 4.5-GB, and at \$895 for 9.1-GB configurations. The Atlas III drives are priced at \$745 for 4.5-GB, \$1,095 for 9.1-GB and \$1,995 for 18.2-GB configurations.

### Quantum Corp.

500 McCarthy Blvd.

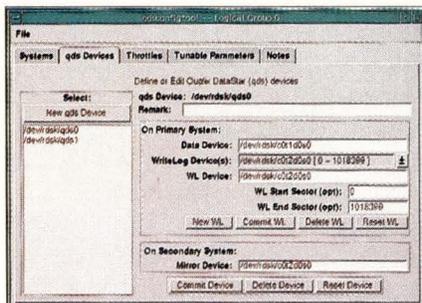
Milpitas, CA 95035

<http://www.quantum.com>

Circle 107

## Data Mirroring Software Speeds Disaster Recovery

The Qualix Group has announced Qualix DataStar, network mirroring software that can reportedly reduce overall data loss, shorten the time it takes to recover from a disaster, and perform off-site backups.



Qualix DataStar is based on an asynchronous replication architecture and captures I/O changes in real time as they occur on the monitored server. These changes are then sent in sequence to servers in another location, whether in the same building or across the country, the company says.

Qualix assures customers that DataStar imposes very little overhead and should not significantly affect application response time or system performance. In the event of a server failure, DataStar will automatically resume mirroring data once the server is back online.

Also, administrators are able to configure the replication speed of the system by time of day. This allows them to maximize network bandwidth during peak usage times and to conserve network resources, Qualix says. Administrators can also trigger DataStar to perform an action, send a message or execute a shell script, for example, once it has determined certain conditions. DataStar can be administered either with a command-line interface, or via a graphical user interface that displays statistical information, the company says.

Qualix DataStar can mirror between a source system and a target system, running either Solaris, AIX or HP-UX. It supports any database, disk, volume manager or file system found on these platforms. DataStar does rely on TCP/IP and, as such, can operate using Ethernet, token-ring or ATM connections. Pricing starts at \$19,950 per pair of servers.

### Qualix Group Inc.

1900 S. Norfolk St., Ste. 224

San Mateo, CA 94403

<http://www.qualix.com>

Circle 108

## SCSI-Based Data Interchange Unit Out

Systems administrators in a quandary over data library interchanges between vendors and formats might consider DataThink's DataXchange Unit (DXU). The SCSI-based unit lets users interchange and access data between any manufacturer's automated tape library and any form of drive, including QIC, 4mm DAT, 8mm, Optical, DLT and CD-ROM, the company says

Two models are available: DXU-3 FlatStor and DXU-9 TowerStor. The DXU-3 supports three storage devices using SCSI-2 single 8-bit narrow connectivity, and has a mean time between failures (MTBF) of 300,000 hours.

The DXU-9 supports up to nine storage devices using SCSI-2 single or dual 16-bit wide connectivity, and has a MTBF of 250,000 hours. Both units can accommodate several combinations of devices, increasing users' accessibility to data and data migration, DataThink says. Drives can be removed while the DXUs are powered on (hot-swapping) for continuous data availability.

DXU pricing starts at \$1,335. Optional storage devices are available from DataThink, starting at \$1,275 each.

### DataThink Inc.

5777 Central Ave.

Boulder, CO 80301

<http://www.DataThink.com>

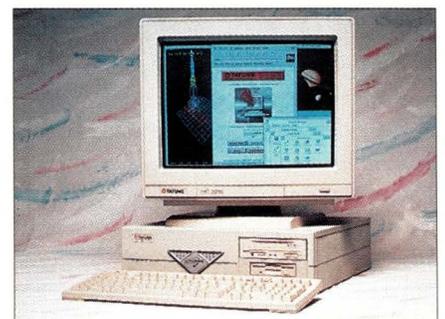
Circle 109

## COMPstations with UltraSPARC Power

Tatung has introduced three workstations: two using 300 MHz of UltraSPARC II processing power, and a 300-MHz single processor workstation, the COMPstation U300E+, offered as an alternative for users who want the processing power but do not require the symmetric multiprocessor (SMP) capabilities of the UltraSPARC II.

The UltraSPARC II-based systems are the COMPstation U2300, with two 300-MHz processors, and the COMPstation U1300, with one 300-MHz processor. Tatung says both systems offer up to 2 GB of memory and feature SMP capabilities. Also, the company says, the U2300 delivers performance of 12.3 SPECint95 and 20.2 SPECfp95, and 219 SPECint\_rate95 and 254.0 SPECfd\_rate95. The single-processor U1300 offers performance of 12.1 SPECint95 and 15.5 SPECfp95, and 110.0 SPECint\_rate95 and 142.0 SPECfp\_rate95.

Standard configurations for the U2300 and U1300 include 128 MB of RAM, a 4-GB hard drive, Solaris (2.5.1 or higher) preinstalled, 2 GB of external cache, a choice of MGX or Turbo GX graphics and a 20-inch color monitor. Other features include 128-bit UPA slot; 64-bit slot for Creator graphics cards; four SBus slots; two serial ports; one parallel port; 100BaseT Ethernet; Fast/Wide SCSI-2; 12-speed CD-ROM;



## New Products

and CD-quality, 16-bit audio capabilities.

The U300E+, while featuring the 300-MHz UltraSPARC processor and four SBus slots, cannot be upgraded beyond one processor. Standard features include Fast/Wide SCSI-2, 100BaseT Ethernet and a choice of MGX or Turbo GX graphics. The company says it offers 1 GB of main memory and 2 MB of external cache standard.

Pricing for the U2300 starts at \$31,320, the U1300 starts at \$22,020 and the U300E+ starts at \$18,850.

### **Tatung Science & Technology Inc.**

1840 McCarthy Blvd.

Milpitas, CA 95035

<http://www.tsti.com>

**Circle 110**

## Off-Site Data Vaulting

Open Microsystems has introduced SafeDistance, a software and service package that allows IBM's Adstar Distributed Storage Manager (ADSM) software to automatically store disaster-recovery backups to an off-site tape library. SafeDistance is positioned as an alternative to having an operator manually oversee the process of storing data to an off-site location, Open Microsystems says.

The remote tape library must be a supported SCSI device that is attached to an AIX-based server running the SafeDistance software, the company says.

Open Microsystems offers services that include assistance and training in planning, installation, configuration and performance tuning. SafeDistance software costs \$10,000.

### **Open Microsystems Inc.**

505 E. Huntland Drive, Ste. 450

Austin, TX 78752

<http://www.openmic.com>

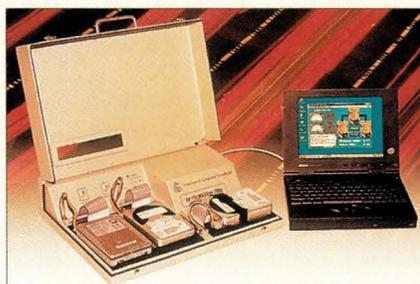
**Circle 111**

## High-Speed Loading Software Unveiled

Image MASSter 200P is a portable, high-speed software loading system from Intelligent Computer Solutions. The 200P reportedly offers systems integrators, value-added resellers, distributors and corporate MIS a means to simultaneously and quickly load software onto two dissimilar drives. For example, Image MASSter 200P will

concurrently load Microsoft Corp. Windows 95 or NT onto two hard drives in less than 60 seconds, the company says. The system requires 8 MB of RAM and can load software onto drives of differing capacity.

The system is roughly the size of a "standard briefcase" and weighs 10½ lbs. Image MASSter 200P connects directly to a desktop or notebook PC via an EPP-compatible parallel port. The system uses a Windows 95-based graphical user interface. In addition to Windows 95 and NT, Image MASSter will load DOS, Mac OS, OS/2, SCO UNIX, NetWare, Solaris, AIX and HP-UX.



The base price is \$1,695. Toolkit options are available for \$295 each. These include specialized software for duplicating specific operating systems and the ability to duplicate only certain parts of the data from the master drive to different size drives during the same software load. Other toolkit options include specialized diagnostics, advanced partitioning and custom options for certain brands of notebook PCs.

### **Intelligent Computer Solutions**

9850 Eton Ave.

Chatsworth, CA 91311

<http://www.ics-iq.com>

**Circle 112**

## Gigabit Ethernet NIC Out

Gigabit network product vendor Essential Communications has released a Gigabit Ethernet network interface card (NIC), which uses the company's JackRabbit chip set for the PCI bus and supplies driver support for Solaris, AIX, Digital UNIX, IRIX, NetBSD, Windows NT and VX Works operating systems.

The single-slot PCI board contains a 32-bit RISC processor to handle Gigabit Ethernet's fast network traffic without placing a burden on the host CPU. The JackRabbit NIC has also been tuned at

the PCI level to maximize the full-duplex throughput of incoming and outgoing network data, the company says.

The JackRabbit NIC costs \$1,995 for UNIX platforms and \$1,495 for Windows NT platforms.

### **Essential Communications**

4374 Alexander Blvd. N.E., Ste. T

Albuquerque, NM 87107

<http://www.esscom.com>

**Circle 113**

## Ultra SCSI RAID Systems

Pacific Micro Data has announced the Mast family of Ultra SCSI RAID storage systems, including the Workgroup 800, Departmental 2400 and Enterprise 4800.

The Workgroup 800 storage system holds up to eight standard 4- or 9-GB 3½-inch Ultra SCSI drives for a capacity of 72 GB. The Departmental 2400 and Enterprise 4800 models hold 24 and 48 standard 4- or 9-GB 3½-inch Ultra SCSI drives, respectively. The 2400 and 4800 are driven by Pacific Micro's Mast Intelligent RAID Module Assembly containing single or dual active/active "failover" RAID controllers with nine channels (up to 512 MB of cache), multiple host connections and single or dual "failover" Web management controllers.

Embedded controllers located within the systems enable systems administrators to remain in direct contact with their RAID storage resources via a direct Ethernet 10BaseT TCP/IP network connection. By embedding the management controllers into the subsystem, it eliminates the need for proprietary OS-specific drivers, the company says. The embedded management controller proactively monitors temperature, fan RPM, drive error thresholds, power supply tolerances, SCSI termination and SCSI bus statistics.

A suite of standard Internet protocols, including a Web HTTP server, SNMP agent, telnet server, SMTP email agent and TCP/IP stack, ensure integration into worldwide networking environments. A "phone home" notification system is said to alert administrators of failures before they occur via SMTP email and SNMP traps. In addition, a Trouble Ticketing feature automatically

## New Products

sends an email message with a snapshot of the RAID system parameters to technical support personnel.

All products in the Mast family run on Solaris, AIX, IRIX, HP-UX, Windows NT, NetWare, Compaq Computer Corp. and Intel Corp. microprocessor-based platforms. All Mast family RAID solutions include a three-year on-site warranty and unlimited seven-day/24-hour, toll-free technical support.

Pricing is dependent on configuration. A Workgroup 800 18-GB RAID 5 solution, for example, with three 9-GB drives, embedded Ultra SCSI RAID controller with 16 MB of cache, Web management controller and on-site service costs \$9,995.

**Pacific Micro Data Inc.**  
16751 Millikan Ave.  
Irvine, CA 92606  
<http://www.pmdraid.com>  
**Circle 114**

### Infrastructure Enables Ultra-Thin Clients

Passport has introduced an application that is said to reduce IT computing costs by decreasing network traffic and, thus, enabling true network computing. With the product, Passport IntRprise, developers can run client/server Java applications across any Java-enabled platform. Network costs are defrayed by running all application logic on the server and using the company's Java Presentation Protocol (JPP) to communicate with the client, Passport says.



Passport IntRprise reportedly allows for complete freedom with databases and middleware. The development environment functions independently of databases, operating systems, windowing systems and the network. As such, it can offer concurrent, direct access to a number of databases, including Oracle, Informix, Sybase, Microsoft Access and

SQL Server, and CA-OpenIngres. Its open architecture is designed to integrate with any number of middleware frameworks, including asynchronous messaging, message-oriented middleware, remote procedure calls, transaction processing monitors and object request brokers, the company says.

Passport IntRprise also supports publish and subscribe capability within its applications. Using the Active Object Repository, modified objects are automatically pushed out to the client as applications are updated. In addition, Passport IntRprise is designed to automatically restart an application should a problem arise. This level of high-availability transaction processing can save organizations a lot of money, Passport says.

The Passport IntRprise development environment is available for Windows 3.1, NT and 95, Open/VMS and various UNIX platforms. Applications developed with it can be deployed on any Java-enabled platform. A single developer's license costs \$8,995.

**Passport Corp.**  
Mack Centre III  
140 E. Ridgewood Ave.  
Paramus, NJ 07652  
<http://www.passportcorp.com>  
**Circle 115**

### Web Server Statistics Shareware Out

UWD has designed a Web statistics package for the Solaris and IRIX UNIX Web server community. Urchin, as it's called, can be used in any Solaris- or IRIX-based enterprise but was designed to be a value-added service for Web-hosting companies to resell to their hosting clients, the company says.

Instead of the traditional ASCII graphs and raw data delivered in an email format, Urchin creates easy-to-read weekly HTML reports with full color graphs and charts and an emailed synopsis of activity. Also, it automatically creates monthly color PostScript reports that can be sent to Web-hosting customers along with their monthly bill.

Urchin includes monthly, daily and hourly reports as well as monthly trends, hosts and domain summaries. It also reports referrals—how people got to a particular site, for example—pages accessed

and browsers and platforms used, the company says.

Urchin is a shareware application and costs \$49 per server. Both the Solaris and IRIX versions include email support and free updates. A free 30-day trial copy is available from the company's Web site.

**UWD Inc.**  
2165 India St.  
San Diego, CA 92101  
<http://www.uwd.com>  
**Circle 116**

### PCI Bus Adapters Unveiled

Confirming its commitment to the Sun marketplace, Performance Technologies has rolled out two products designed for Sun Microsystems Inc.'s SPARCengine Ultra AX motherboard: the PCIbus 10/100 Ethernet adapter and the Intelligent Synchronous Communications adapter.

The PCI560 Intelligent 10/100-Mb Ethernet adapter is designed for Ultra AX platforms running Solaris 2.5.x and Solaris x86 operating systems. This adapter automatically senses whether a network is operating at 10 Mb/s or 100 Mb/s and seamlessly configures the connections into the network while providing maximum Ethernet throughput, Performance Technologies says.

The Intelligent Synchronous Communications adapter, the PCI334, is a four-port Intelligent Wide Area Network adapter capable of sustaining a throughput of more than 2 MB/s, the company says. Performance Technologies' ComLink software works in conjunction with the PCI334 to provide a "plug-and-play" link to all Sun communications protocols, including X.25, SNA 3270, PPP, Frame Relay and IP. Interfaces supported include RS-442/449, V.35 and RS-232.

**Performance Technologies Inc.**  
315 Science Pkwy.  
Rochester, NY 14620  
<http://www.pt.com>  
**Circle 117**

### Frame Relay Encryptor for Sensitive Information

Information Resource Engineering, a provider of encryption systems, has announced SafeNet/Frame, an advanced encryption product designed to protect the high-speed transmission of sensitive

## New Products

information across frame-relay networks.

SafeNet/Frame offers either DES, a U.S. standard encryption algorithm, or GDS, a proprietary 128-bit algorithm used by the Swiss banking community. A public key process is used for key exchange between units throughout the network, the company says. Also, secret elements, such as encryption keys and setup parameters, are stored in an encrypted form in a tamperproof security token that can be physically and electronically locked. Each token stores 864 master keys and can keep track of up to one million unique, derived session keys, the company says.

SafeNet/Frame joins the company's suite of Internet security products, SafeNet/Enterprise. Some of the features offered as part of SafeNet/Enterprise include user identification, onetime password generation, access control, data encryption and packet authentication.

SafeNet/Frame is a stand-alone product that plugs into a router and is available in three models based on three

throughput speeds: T1, 256 Kb/s and 8 Mb/s. The T1 and 256-Kb/s versions cost \$5,995 each, and the 8-Mb/s model is priced at \$8,295.

**Information Resource Engineering Inc.**  
8029 Corporate Drive  
Baltimore, MD 21236  
<http://www.ire.com>  
**Circle 118**

### A New Era of SPARC Portables

RDI Computer has announced a line of SPARC portables based on the Ultra SPARC chip. According to the company, the new UltraBook is the first SPARC portable to feature performance comparable to contemporary desktop systems, with only a modest price premium for equivalent desktops—30% to 50% over Sun Microsystems Inc.'s midrange Ultra 1 workstation, according RDI.

Previously, RDI says, SPARC portables only appealed to a limited niche market that absolutely required portability. With



the introduction of the powerful, competitively priced UltraBook, however, professionals for whom portability would be beneficial though not essential can consider such a system.

The UltraBook is based on either a single 167-MHz or 200-MHz Ultra SPARC 1 processor and features a 14.1- or 12.1-inch, 1,024-by-768 active matrix

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## New Products

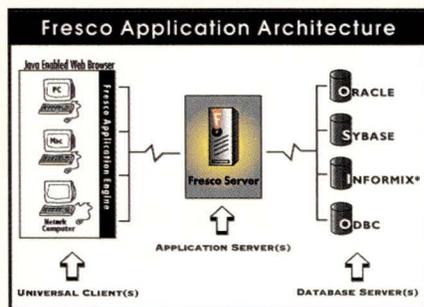
LCD, up to 9 GB of storage, 32 to 512 MB of RAM and Creator Graphics (optional). It weighs 7.4 pounds and features an optional expansion dock for additional disk drives, battery packs, an internal CD-ROM or floppy drive.

Pricing for the UltraBook starts at \$11,995 per single unit.

**RDI Computer Corp.**  
2300 Faraday Ave.  
Carlsbad, CA 92008  
<http://www.rdi.com>  
**Circle 119**

### Build Intranet Database Applications

Infoscape has unveiled Fresco 2.0, a family of products designed for developers deploying Java-based, intranet business applications throughout an enterprise. This latest release of Fresco includes enhanced database transaction management, application publishing, iterative development and plug-and-play support for custom logic components, according to the company.



The enhanced database transaction management gives developers control of multiple database transactions such as inserts, updates, rollbacks and commits. In addition, Fresco 2.0 provides support for complete database transactions through a visual Entity-Relationship (ER) modeling tool.

Also available with Fresco 2.0 is the Fresco Software Developer's Kit (SDK), which allows for Java components to be plugged into application palettes in Fresco Designer for reuse. The component can be either a custom Java component developed in-house or from a third-party vendor, the company says.

Fresco applications can be published to Marimba Inc.'s Castanet channels, Web browsers, or the applications can run as stand-alone applications. Fresco

applications run on the latest versions of the Java Virtual Machine (shipped with JavaSoft's Java Developer's Kit 1.0.2, 1.1.1 and 1.1.2) and on Netscape Communications Corp.'s Communicator, Microsoft Corp.'s Internet Explorer and Sun Microsystems' Hot Java browsers.

Fresco 2.0 is being offered in a Pilot Package priced at \$4,950. It includes two developer seats, a server license for one to 50 users and a database adapter (Oracle, Sybase or ODBC). Fresco Developer costs \$1,495 per seat.

**Infoscape Inc.**  
657 Mission St., Ste. 200  
San Francisco, CA 94105  
<http://www.infoscape.com>  
**Circle 120**

### HR Info on an Intranet

A new software package from Conduit Software is aiming to use the corporate intranet to provide a two-way exchange of employees' human resources information. Called HRConnect, it is designed to improve productivity and ease access to information without requiring the assistance of human resources department staff, Conduit says. HRConnect, for example, is said to allow information such as marital status to be updated by the employee, and then have those changes reflected in all required employee records and pertinent HR databases.

HRConnect consists of eight modules, covering benefits, payroll, personnel, recruiting and staffing, life events, employee education, corporate communications and administration. The benefits module allows an employee to view, input and change information on all company benefit programs, such as 401K, employee stock purchases and medical plans, while the payroll feature allows employees to change information relating to tax deductions, direct deposit, vacation and sick days, the company says.

The personnel module is said to provide the ability to research and evaluate existing employees, create job postings, ease employee transfers and manage the new hire process. The recruiting and staffing module is designed to automate the recruiting process, and the life events module offers employees the ability to update information relating to

retirement, death, birth or marriage.

The other available modules—employee education, corporate communication and administration—provide features for reviewing training packages, disseminating corporate information and accessing company forms. HRConnect employs a security model based on Secure Sockets Layer (SSL) between the browser and the Web server. User types are used to determine access to information.

Conduit Software is offering the complete HRConnect package for \$195,000. The software works in conjunction with an HTML development language or tool set, Windows NT and Solaris, HP-UX, AIX and IRIX servers, and PC and Macintosh client operating systems.

**Conduit Software**  
5000 Peachtree Industrial Blvd.  
Ste. 150  
Norcross, GA 30071  
<http://www.conduitsoft.com>  
**Circle 121**

### Tool to Measure SAP R/3 Performance

The first product in a new category of software has been announced by Luminate Software. The category is application performance management. The product is Luminate for SAP R/3. The goal of the software, according to the company, is to enable MIS managers to manage their enterprisewide SAP R/3 installation from a top-down business perspective.

Luminate says its top-down approach differs from traditional management software—which caters to the needs of technicians by focusing on an individual device's performance—by instead taking a holistic approach. Luminate for SAP R/3 quantifies management-level information and attempts to convey the level of quality of service IT has achieved. Thus, Luminate attempts to record how an end user is perceiving performance; it measures such metrics as response time and overall number of transactions, rather than individual device statistics, the company says.

Luminate for SAP R/3 delivers a host of reports, including summary reports for high-level MIS managers. These reports allow them to analyze trends and

## New Products

patterns perceived in their SAP R/3 systems. Detail reports, for example, present specific information, such as availability and response time, itemized by time period, business unit, application and transaction code. Pricing for Luminate for SAP R/3 starts at \$50,000.

**Luminate Software Corp.**  
1775 Woodside Road  
Redwood City, CA 94061  
<http://www.luminate.com>  
**Circle 122**

### Online Shopping Catalog for UNIX Users

Sun Data Direct (the direct sales group of Sun Data Inc.), with the help of Federal Express VirtualOrder, has launched an online catalog featuring thousands of items in the IBM Corp. RS/6000 and AS/400 and Sun Microsystems Inc. workstation arena. Sun Data says its catalog offers products ranging from complete computer systems to peripherals and parts, including refurbished systems and OEM products.

Customers can shop 24 hours a day, seven days a week. Rentals are also an option with terms offered from one week to five years. Other services include systems integration, migration/rehosting, consulting, LAN/WAN design, imaging and data warehousing.

The Web address for the catalog is <http://catalog.sundata.com>.

**Sun Data Inc.**  
One Sun Court  
Norcross, GA 30092  
**Circle 123**

### Aggregation Software Offers Gigabit Speed

Adaptec has unveiled its Duralink Port Aggregation software. Using IEEE standards, the software reportedly aggregates the bandwidth of standard Fast Ethernet NIC ports into a single, virtual network port, providing multiple gigabit per second data transfer rates. Adaptec says this allows its customers to experience the benefits of Gigabit Ethernet performance and scal-

ability without the cost of buying new infrastructure equipment.

Duralink Port Aggregation software is said to expand server capabilities by alleviating bottlenecks. The software provides standards-based trunking to increase the amount of data going to users, and automatic fault tolerance to increase data availability and uptime.

The product runs exclusively on Adaptec Fast Ethernet PCI NICs. It's bundled at no additional charge with the company's server kit multiport cards, the four-port ANA-6944A and the two-port ANA-6922, and is optional for Adaptec's single-port Fast Ethernet NICs and for stand-alone multiport NICs.

The software is being shipped as an upgrade to simplify installation and configuration, Adaptec says. It costs \$199.

**Adaptec Inc.**  
691 S. Milpitas Blvd.  
Milpitas, CA 95035  
<http://www.adaptec.com>  
**Circle 124**

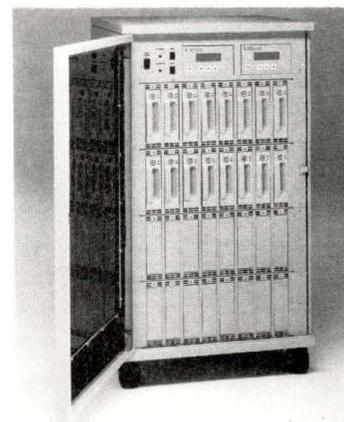
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**Dallas Office:**  
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Suite 115  
Dallas, Texas 75234  
1-800-218-9123

Circle No. 45

## New Products

### Proxima Offers Single Sign-On Option

Proxima is a single sign-on product from Memco Software, maker of information security products such as SeOS Secured. Proxima's role is to eliminate the end user's frustration at having to log on multiple times, to streamline administration and to provide enhanced security overall, the company says.

Proxima consists of two applications: Proxima SSO and Proxima Manager. Proxima SSO reportedly provides users with a consistent desktop from which

they can sign on via a single ID to any authorized, centralized application. An SSO server component acts as a central repository for the resources. Supported authentication methods include smart cards, tokens, tickets and application passwords. Proxima also secures its network traffic so that simple text passwords cannot be detected, Memco says.

The Proxima Manager, licensed from EagleEye Control Software, is based on that company's MultiPlatform Control-SA product. Running on a wide variety of operating systems, Proxima Manager maintains the requisite accounts and

permissions for each user across each application in the Proxima system.

Proxima SSO runs on SunOS, Solaris, AIX and HP-UX, and supports Windows 3.1, 95 and NT clients. Proxima Manager supports most major client/server systems, mainframes and network operating systems (e.g., Novell NetWare and NT). Contact Memco Software for pricing information.

**Memco Software Inc.**  
12 E. 49th St., 32nd Floor  
New York, NY 10017  
<http://www.memco.com>  
**Circle 125**

### Upgrades, Enhancements, Additions...

■ According to Legato, it is much easier to manage a large number of different clients across a network with NetWorker 5.0 for UNIX. Storage devices distributed across the enterprise can be managed as if they were attached locally. Indices, which are centrally stored, have the ability to span file systems, which, the company says, will increase the NetWorker server's overall availability. NetWorker 5.0 is also localized for non-English sites; specific foreign language versions of NetWorker will begin to appear by the end of the year. Pricing for the updated NetWorker is \$3,000, available for Solaris, AIX and HP-UX platforms running backup, archive and hierarchical storage management. **Legato Systems Inc.**, 3210 Porter Drive, Palo Alto, CA 94304, <http://www.legato.com>. **Circle 126**

■ Innovative Routines International's Cosort 6.0, a general-purpose sort program for off-line database reorganization and loads, downsized mainframe batch jobs and data warehouse transformations, is now available as a parallelized application on SMP platforms, including the Sun Ultra Enterprise line. Also, Cosort 6.0 features Year 2000 conversions through date field expansions and comparisons. Pricing for Cosort 6.0 ranges from \$2,000 to \$20,000, based on the hardware type and the CPU count. **Innovative Routines International Inc.**, 1775 W. Hibiscus Blvd., Ste. 200, Melbourne, FL 32901, <http://www.iri.com>. **Circle 127**

■ Cygnus Solutions, a maker of cross-platform development tools for 32- and 64-bit microprocessors, has announced Source-Navigator 3.3.1, the latest release of its source code browsing and editing tool. The multiplatform, multilanguage source code comprehension tool now has added functionality for projects exceeding one million lines of code, the company says. Projects in C, C++, Java, Tcl and FORTRAN are visible with Source-Navigator without requiring changes to developers' methodologies or software management systems. In addition, this latest release is said to be customizable with a scriptable API that allows integration into other source code processes, such as configuration management, documentation and testing. Source-Navigator 3.3.1 is available on CD-ROM or can be downloaded from the company's Web site. It operates on Solaris 2.3+, AIX 4.1, HP-UX 10.10, Linux, IRIX 5.3 and 6.2, and Windows NT. Pricing starts at \$3,000. **Cygnus Solutions**, 1325 Chesapeake Terrace, Sunnyvale, CA 94089, <http://www.cygnus.com>. **Circle 128**

■ IBM has extended its Network Printer Management (NPM) software so that it supports Java clients, which lets printer administrators remotely install, configure and monitor network printers using standard-issue Web browsers. Any printer that supports the Simple Network Management Protocol (SNMP) can be managed with NPM; these include the Lexmark Optra N\*\* and the HP LaserJet5Si\*\*\*. NPM, which runs off a Web server, supports the Windows NT and OS/2 versions of IBM Internet Connection Secure Server, Netscape Communications Corp.'s Enterprise Server and Microsoft Corp.'s Internet Information Server. UNIX versions of the NPM server are scheduled for release by the end of the year. A free demonstration copy of NPM can be downloaded from <http://www.printers.ibm.com/npm.html>. **IBM Corp.**, contact local sales office. **Circle 129**

■ Central Data's line of I/O expansion products, including its scsiTerminal Servers, scsiModem Servers, EtherLite Modem Servers and EtherLite Port Servers, now support Solaris 2.5.1 on Intel x86 platforms. Central Data I/O products already supported the SPARC and Windows NT platforms. **Central Data Corp.**, 1602 Newton Drive, Champaign, IL 61821, <http://www.cd.com>. **Circle 130**

■ Itac Systems has announced a new version of its Mouse-Trak trackball device, evolution Mouse-Trak, which includes preprogrammed keys to perform the most common functions of conventional three-button mice, including primary click, primary double-click, primary drag, auxiliary click and right click. Like its predecessor, evolution Mouse-Trak features an instant speed control key, which lets users roll around the screen by leaps and bounds, the company says. There are no special drivers to install so users truly just plug and play. In addition, users can reprogram the device for left-handed use or to reassign functions from one key to another, all from the keypad. evolution Mouse-Trak is available for PS/2 and Sun-compatible interfaces and lists for \$199. **Itac Systems Inc.**, 3113 Benton St., Garland, TX 75042, <http://www.mousetrak.com>. **Circle 131**



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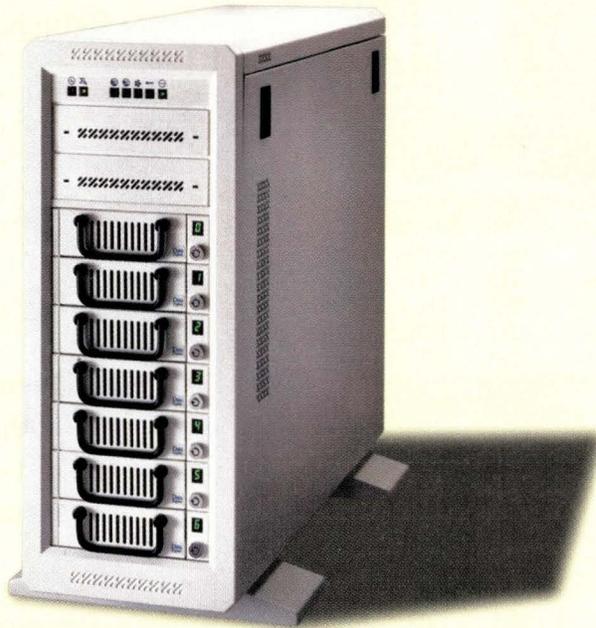
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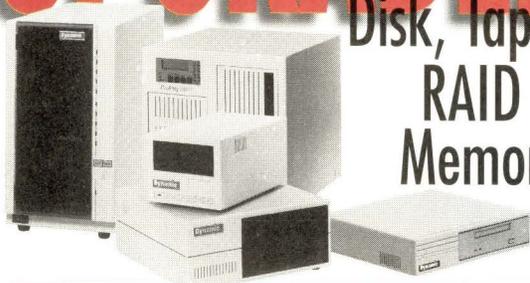
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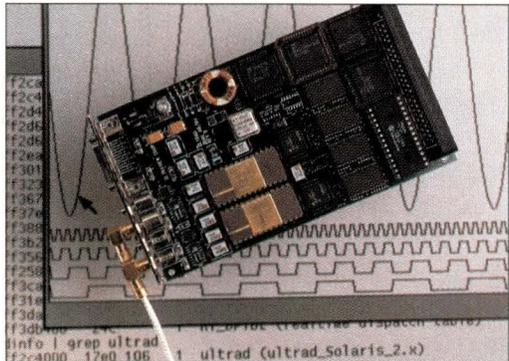
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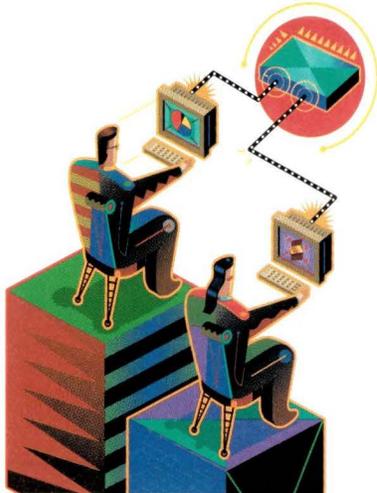
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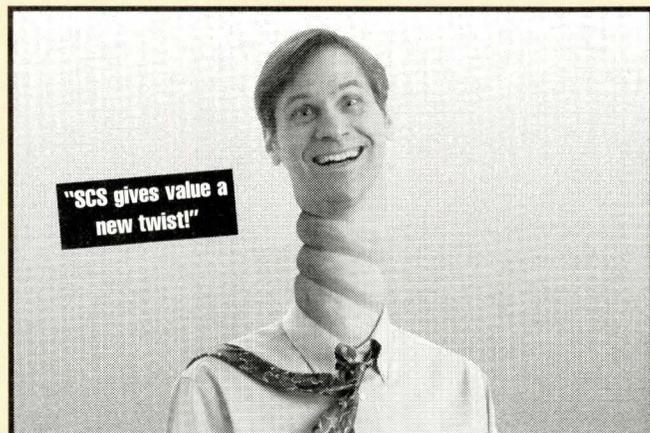
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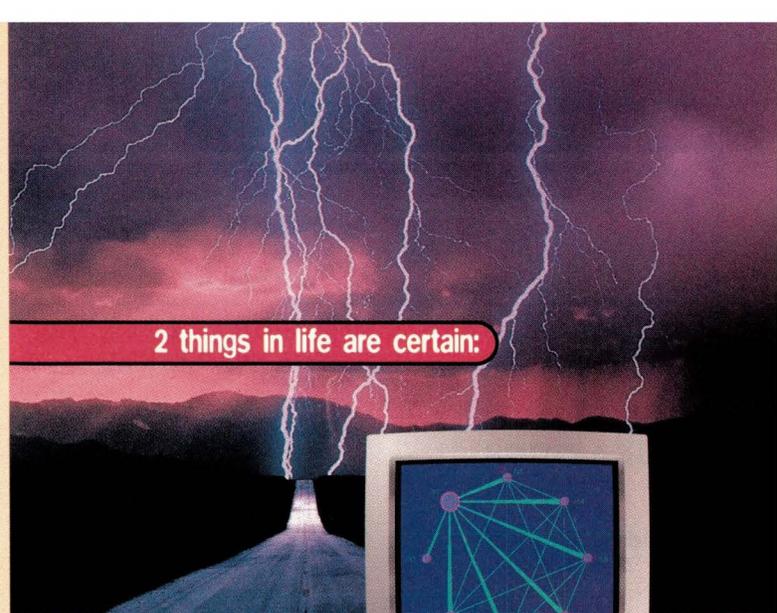
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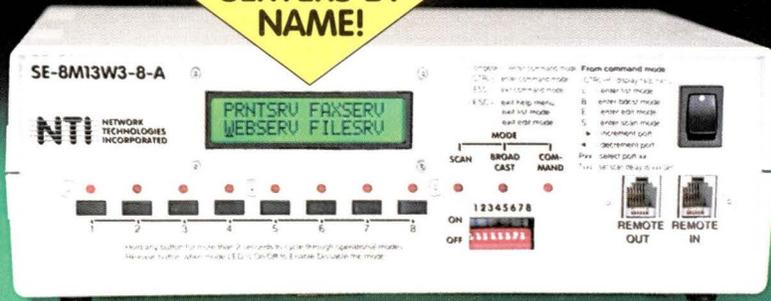
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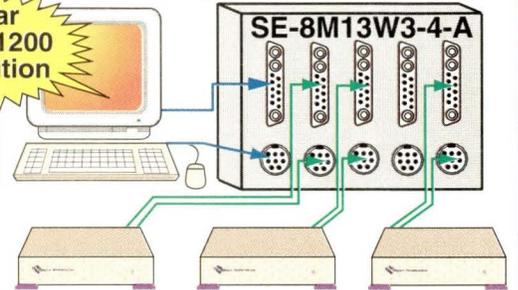


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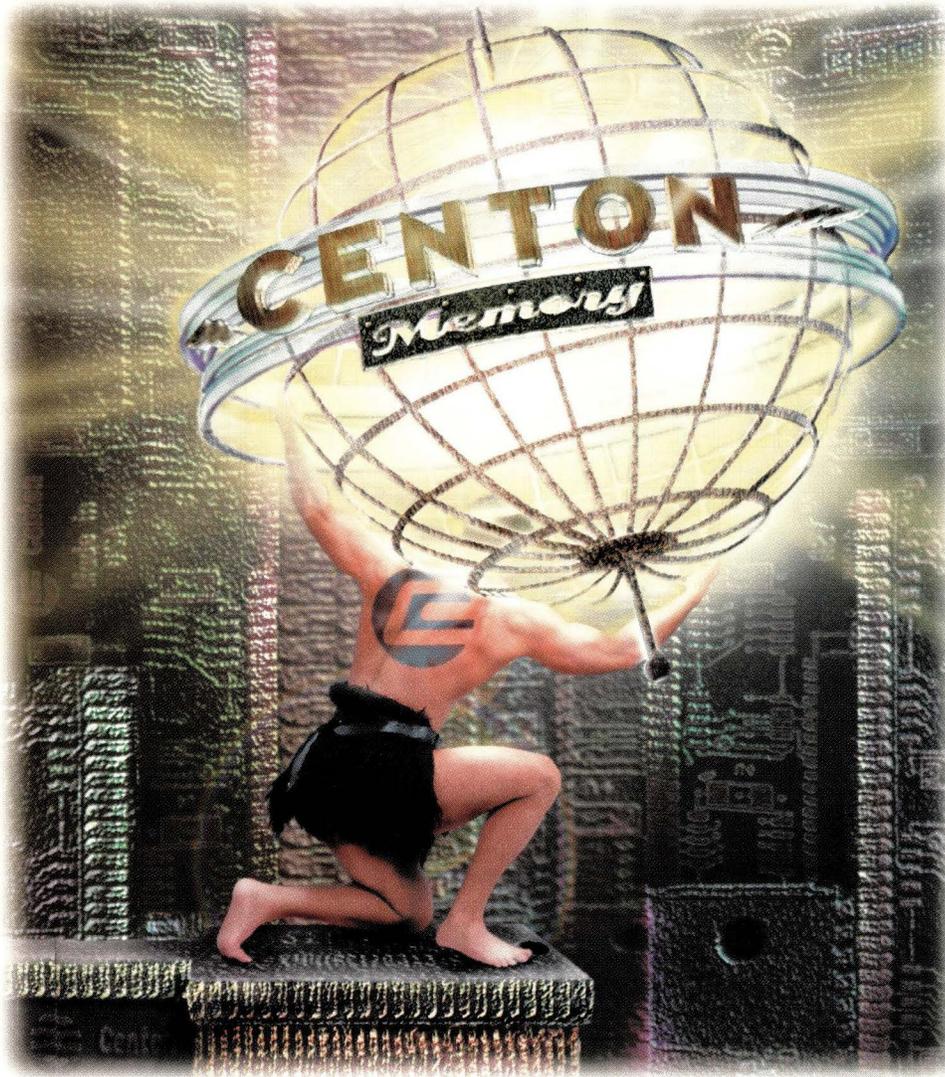
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