

# SUN EXPERT

Serving the UNIX Client/Server Network

NOVEMBER 1996 Vol. 7 No. 11 \$5.50

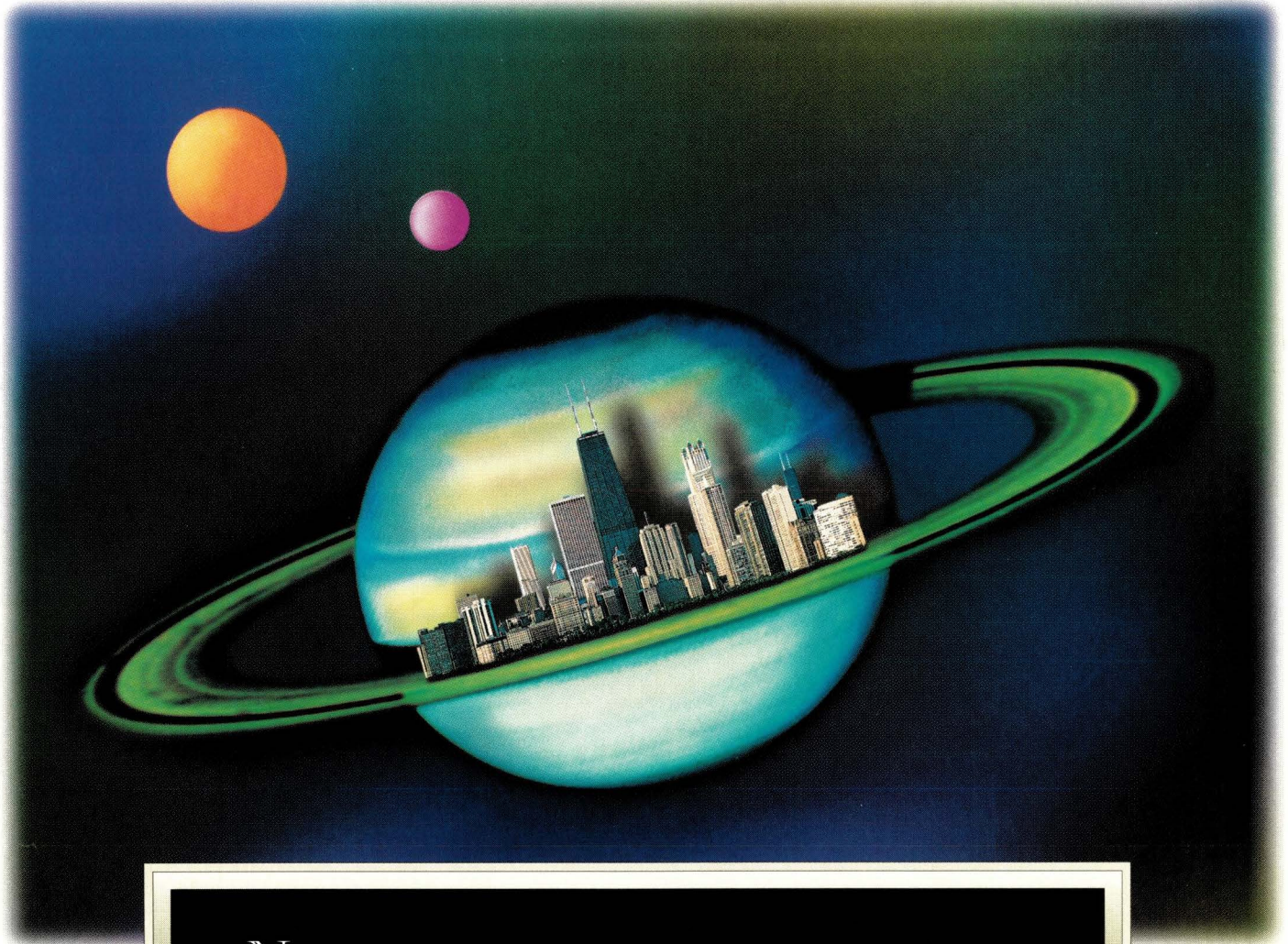


## New Garb for X Terminals



Survey: X-Ready Network Computers

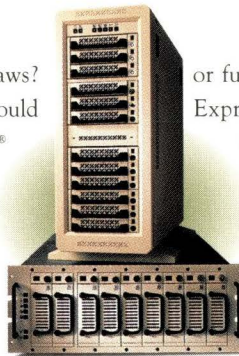
SunNet Manager



**NO MATTER WHAT HAPPENS BETWEEN NOW  
AND THE YEAR 2003, OUR STORAGE  
ENCLOSURES WILL STILL BE UNDER WARRANTY.**



Cell phone implants? Intergalactic zoning laws? There's no telling what the next seven years could bring. But one thing's for sure: Your Kingston® storage enclosures will still be under warranty. These rugged and reliable storage systems were designed for some of the most demanding environments—even the space shuttle. Plus, we offer the longest warranty in the industry. The Kingston Data Silo® DS500 tower or rack-mount enclosure can house 3.5-inch and 5.25-inch half-



or full-height SCSI peripheral devices. Our Data Express® removable drive enclosures, integrated into our DS500 chassis, provide a variety of customized enclosures for up to 12 removable, hot-swappable SCSI devices. Of course, Kingston storage products are compatible with all major platforms. Want more information? Give us a call at (800) 435-3973, or you can send us e-mail at [storage@kingston.com](mailto:storage@kingston.com).



**Kingston**  
TECHNOLOGY

For more information, call us at (800) 435-3973  Visit our Web site: <http://www.kingston.com/ses.htm>

Kingston Technology Company, 17600 Newhope Street, Fountain Valley, CA 92708 USA, (714) 438-1850, Fax (714) 438-1847. © 1996 Kingston Technology Company. All rights reserved. Kingston, Data Silo, and Data Express are registered trademarks and Computing Without Limits is a trademark of Kingston Technology Company.

Circle No. 24 on Inquiry Card



# SM-arch<sup>®</sup> In a class by itself.

If you think backup and retrieval systems are all the same, think again. Only SM-arch provides a complete distributed backup solution with single-point control for any heterogeneous network. And nothing beats SM-arch for fast, flexible file retrieval.

In fact, SM-arch is rated the #1 backup and retrieval system for today's complex, enterprise-wide networks.

So stop comparing apples to oranges in backup and retrieval systems. You don't make that mistake when it comes to other critical network decisions. We invite you to take a look at SM-arch. Feature by feature, you'll discover that it's in a class by itself.

SM-arch and SM-archNT. Your valuable corporate data requires the very best.

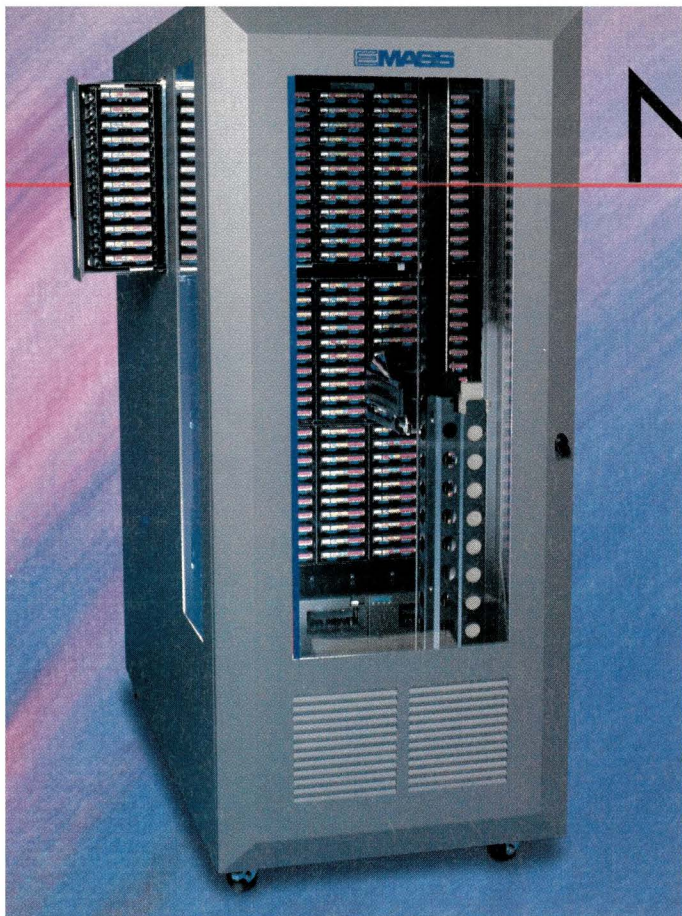


Software Moguls, Inc.

World Headquarters 612.932.6738 ■ e-mail [info@moguls.com](mailto:info@moguls.com) ■ European Sales office (49) 2266 4356 ■ URL <http://www.moguls.com>



Circle No. 39 on Inquiry Card



# New!

## THE MOST POWERFUL AUTOMATED ARCHIVE IN OPEN SYSTEMS. PERIOD.



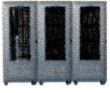
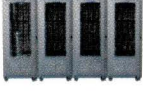
Introducing the EMASS AML/S automated tape library. Its modular design allows your data storage to grow with your application. You can economically configure the best storage solution today, and as your application becomes more demanding, expand capacity and data throughput tomorrow.

The AML/S automates the most advanced tape technologies available: DLT™ at 35 GB per cartridge and 5 MB/sec. transfer rate, as well as EMASS 8590 (IBM 3590 technology) at 10 GB per cartridge and 9 MB/sec. transfer rate.

The AML/S is perfect for storage-hungry applications. It is supported by the industry-leading AMASS™ software. With AMASS the AML/S is presented as a single UNIX file system under one mount point compatible with NFS. Applications simply read and write files to the AML/S as if it were a large magnetic disk. And, the AML/S supports leading third-party application software. Imagine automated network backup at nearly 500 GB per hour!

The EMASS combination of the fastest SCSI library, the leading tape recording technologies and the high performance AMASS software delivers the most powerful automated archive in open systems today. **Period.**

Available world-wide from leading resellers.

		Maximum Cartridges	Uncompressed Capacity with DLT	Maximum Drives	Aggregate Data Throughput with 8590
Base AML/S		158	5.5 TB	4	36 MB/sec
Add One Expansion Module		368	12.9 TB	8	72 MB/sec
Add Two Expansion Modules		578	20.3 TB	12	108 MB/sec
Add Three Expansion Modules		788	27.6 TB	16	144 MB/sec

How powerful?  
Call us 1-800-653-6277

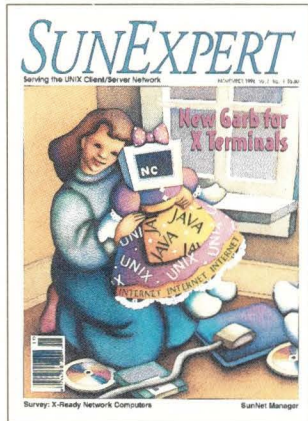
[inquiry@emass.com](mailto:inquiry@emass.com) • <http://www.emass.com>



Circle No. 15 on Inquiry Card

## FEATURES

- 36 **New Garb for X Terminals** – Can X terminal vendors boost sales by dressing terminals in the latest network computing fashions?  
John S. Webster
- 50 **Survey: X-Ready Network Computers** – A sampling of the major network computer vendors and their wares. Maureen McKeon
- 58 **SunNet Manager as Sysadmin Helper** – The story of how a group of systems administrators monitor, maintain and troubleshoot a mixed bag of computers and network devices. Jim Boyle



Cover illustration by  
Rebecca Ruegger

## NEWS

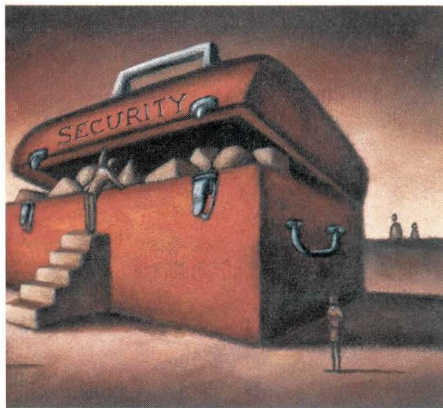
- 6 Includes: **Sun Unwraps Server Clusters; Sun Serves PBS, WilTech Broadcast Venture; SGI Replaces Indy, Lowers the Price; Sun, Apple Join Forces to Ease Networking Woes; Sun Expands Distribution Channel with Ingram.**

## COLUMNS

- 16 **Ask Mr. Protocol – Mr. Protocol Has Tea** – The Brits have a mobile phone standard, GSM, that has to be seen to be believed.  
Michael O'Brien
- 22 **UNIX Basics – Locks on Files** – File locking allows us to write programs so that only one process can access a file at any one time.  
Peter Collinson
- 30 **I/O opener – Nifty Hardware** – Reciprocating saws and other computer gear.  
Richard Morin
- 34 **Systems Administration – Your Security Tool Chest** – More than a few good security tools.  
S. Lee Henry

## DEPARTMENTS

- |   |           |    |                      |
|---|-----------|----|----------------------|
| 4 | Editorial | 66 | New Products         |
|   |           | 75 | The SunExpert Market |



Page 34

### SUNEXPERT

serves the UNIX workstation environment, emphasizing Sun, SPARC and Sun-compatible systems.

*SUNEXPERT* Magazine (ISSN 1053-9239) is published monthly by Computer Publishing Group, 320 Washington St., Brookline, MA 02146. Telephone (617) 739-7001. Periodicals Postage Rates paid at Boston, MA, and at additional mailing offices. Posted under Canadian IPM #0235873. This publication is free to qualified subscribers as determined by the publisher. Subscription rates are \$60 per year in the United States, and \$95 (surface mail) and \$150 (air mail) outside the United States. Subscription requests can be sent to: Circulation Department, *SUNEXPERT* Magazine, 320 Washington St., Brookline, MA 02146 or electronically mailed to: [circ@cpg.com](mailto:circ@cpg.com).

POSTMASTER, please send all address changes to *SUNEXPERT* Magazine, Circulation Department, 320 Washington St., Brookline, MA 02146. Please allow 6-8 weeks for change of address. Include your old address as well as new—enclosing, if possible, an address label from a recent issue. All rights reserved. © Copyright 1996, Computer Publishing Group. No part of this publication may be transmitted or reproduced in any form by any means without permission in writing from the publisher.

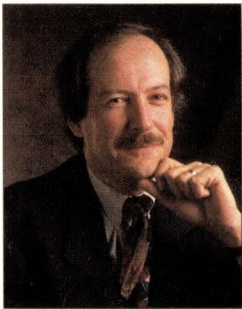
Material for publication should be sent to the attention of: Doug Pryor at the above address or electronically mailed to: [dpryor@cpg.com](mailto:dpryor@cpg.com). Letters sent to the publication become the property of the publication and are assumed to be intended for publication and may be used so. *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.

# Editorial

## Paradigm Rift

Can we have a show of hands? Everyone planning to install NCs or JavaStations please raise your right hand. Better yet, can you drop me a line at [dpryor@cpg.com](mailto:dpryor@cpg.com). And if you would be so kind, please explain your rationale in a sentence or two.

If you take a look at this month's cover story, "New Garb for X



Terminals," by John S. Webster, you'll see that a mad dash is on to stake out some niche or other in the network computer market. Almost all the familiar X terminal vendors are scrambling to claim NC Reference compliance. Take a look at Maureen McKeon's survey, "X-Ready Network Computers," on Page 50. As Webster says, "Now that the corporate network is becoming increasingly intertwined

with the Internet to form a company's intranet, the utility of having one device to access those services alongside network applications becomes more and more obvious."

Certainly it's obvious. What's not clear is how to get there.

The argument that NCs, or very thin clients, can be installed and administered at a fraction of the cost of traditional PCs and UNIX clients assumes that vast development resources can be shifted willy-nilly from the day-to-day work that has to continue. It assumes that software developers want to be and can be retrained in the twinkling of a CIO's or CEO's eye. Factor in the cost of retraining users, administrators and developers with the costs of investing in network infrastructure, with the cost of revamping applications. ... Well, you get the picture.

I certainly don't want to be just a naysayer. The potential is so great. But it seems to me that there are a lot of rose-colored glasses being used these days. Unless I end up being very surprised at how fast the network computer catches on, it seems today like the sound of one hand clapping. I would very much like to hear your views.

*Doug Pryor*

## SUNEXPERT

Serving the UNIX Client/Server Network

NOVEMBER 1996 VOL. 7 No. 11

<b>Publisher</b>	S. HENRY SACKS <a href="mailto:shs@cpg.com">shs@cpg.com</a>
<b>Editor-in-Chief</b>	DOUGLAS PRYOR <a href="mailto:dpryor@cpg.com">dpryor@cpg.com</a>
<b>Managing Editor</b>	LISA GUISBOND <a href="mailto:lisa@cpg.com">lisa@cpg.com</a>
<b>Senior Editor</b>	JOHN S. WEBSTER <a href="mailto:johnw@cpg.com">johnw@cpg.com</a>
<b>Technical Editors</b>	IAN WESTMACOTT <a href="mailto:ianw@cpg.com">ianw@cpg.com</a>  RICHARD MORIN <a href="mailto:rdm@cpg.com">rdm@cpg.com</a>
<b>Contributing Editors</b>	CHRISTINE CASATELLI <a href="mailto:cmc@cpg.com">cmc@cpg.com</a>  MARK SEIDEN  MICHAEL JAY TUCKER  SIMSON L. GARFINKEL
<b>Research Editor</b>	MAUREEN MCKEON <a href="mailto:mm@cpg.com">mm@cpg.com</a>
<b>Staff Editor</b>	ALEX SIMEONIDES <a href="mailto:alex@cpg.com">alex@cpg.com</a>
<b>Production Editor</b>	LISA BUCHER <a href="mailto:lisab@cpg.com">lisab@cpg.com</a>
<b>Marketing Manager</b>	SUSAN R. SACKS <a href="mailto:srs@cpg.com">srs@cpg.com</a>
<b>Art/Production Director</b>	JOHN W. KELLEY JR. <a href="mailto:jwk@cpg.com">jwk@cpg.com</a>
<b>Senior Designer</b>	JERRY COGLIANO <a href="mailto:jerry@cpg.com">jerry@cpg.com</a>
<b>Designer</b>	BRAD DILLMAN <a href="mailto:bdillman@cpg.com">bdillman@cpg.com</a>
<b>Production Assistant</b>	JOSEPH MACDONOUGH <a href="mailto:joem@cpg.com">joem@cpg.com</a>
<b>Circulation Director</b>	DEBORAH MOORE <a href="mailto:dm@cpg.com">dm@cpg.com</a>
<b>Administrative Assistant</b>	TINA JACKSON <a href="mailto:jamal@cpg.com">jamal@cpg.com</a>

### World Wide Web

<http://www.cpg.com>

### EDITORIAL OFFICES

320 Washington Street  
Brookline, MA 02146  
(617) 739-7002



Printed in USA

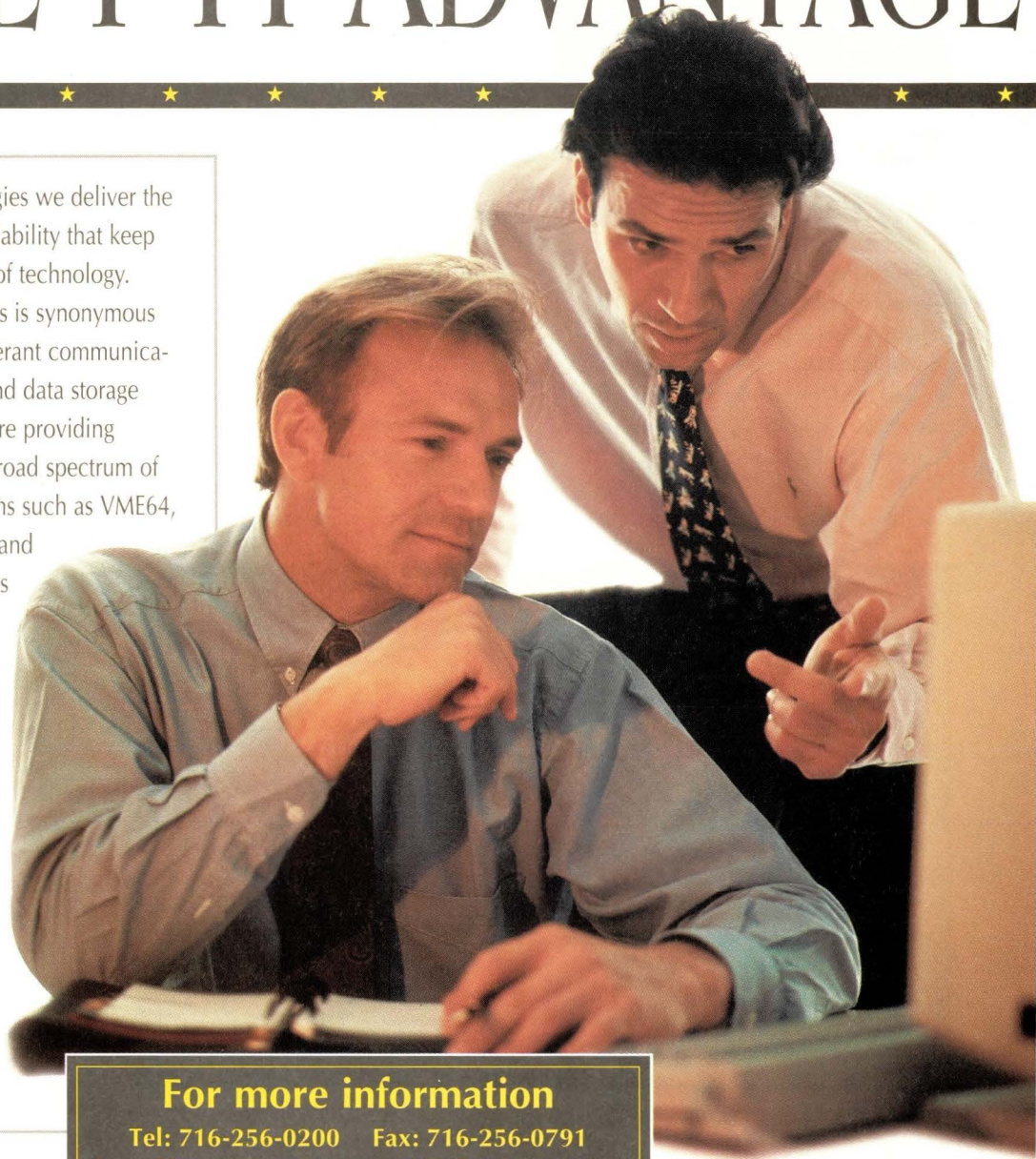


# THE PTI ADVANTAGE

At Performance Technologies we deliver the kind of innovation and dependability that keep our customers at the forefront of technology.

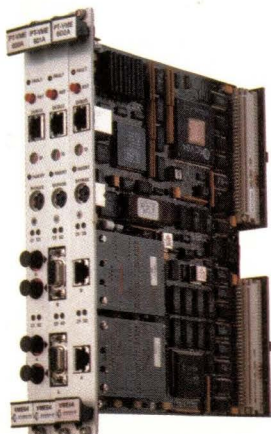
Performance Technologies is synonymous with high-performing, fault tolerant communications, networking, switching and data storage interface system products. We're providing solutions that comply with a broad spectrum of industry standards and platforms such as VME64, SBus and PCI. Major end user and OEM technology manufacturers continue to rely on us for a wide variety of innovative and reliable product alternatives. We're listening to the needs of our customers and we're responding with the results they're asking for. Our success and reputation in the marketplace depend on it.

Performance, Teamwork and Innovation...put the PTI Advantage to work for you.



## For more information

Tel: 716-256-0200 Fax: 716-256-0791  
<http://www.pti.com> E-mail: info@pti.com

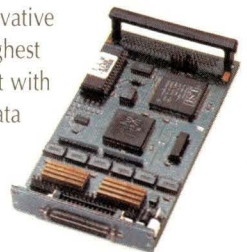


**FDDI**-Leading edge NICs, highest performance, minimal host utilization.

**WAN Connectivity**-Onboard intelligence, fastest data rates and highest overall system performance.



**SCSI**-Innovative design, highest throughput with ensured data integrity.



**PERFORMANCE TECHNOLOGIES, INC**

*Connectivity Solutions for the 21st Century*

Performance Technologies, Inc. 315 Science Parkway Rochester, NY 14620

# NEWS

## Sun Unwraps Server Clusters

Sun Microsystems Computer Co. recently topped off its high-flying Ultra Enterprise Server line with a series of server clusters that the company says are designed for businesses looking for maximum application availability, performance and scalability.

The new clusters, slated to ship this month, are designed as turnkey (inte-

Enterprise Server and Storage Group, broad, binary compatibility across the product line, modular design, mainframe-class I/O performance and optimization for Internet/intranet applications.

"The degree of change and progress over the last year to the Ultra server line has been unbelievable, and business is great," says John Shoemaker, vice president and general manager of the Enterprise Server and Storage Group at SMCC, Palo Alto, CA.

"We think we now have the broadest line in the industry, and in addition, we created the fault-tolerant architecture, which will now be offered across the entire product line."

Server clusters have been labeled difficult to implement because the toolkit approach used by many vendors calls for above-average administrative expertise, Sun says. The new servers, how-

help minimize disruption and provide better availability. The smart clusters feature turnkey data services, including Informix Software Inc. XPS, Oracle Corp. Oracle 7 RDBMS, or Sybase Inc. MPP.

Sun is putting the spotlight on a new memory channel interconnect, called the Sun Cluster Channel, which it claims is the fastest in the industry. The product is said to provide a super-fast connection between nodes for both data transfer and "heartbeat" checks between systems. It is based on the Scalable Cluster Interface, generally considered an industry standard interconnect provided by Dolphin Interconnect Solutions Inc., headquartered in Oslo, Norway.

Also shipping with the server clusters is the highly available version of the BEA Tuxedo transaction monitor, and an Ultra Enterprise Cluster Support Services package from Sun-Service, which includes installation, consulting, operator training and round-the-clock support.

The server clusters will ship in two primary configurations. The Ultra Enterprise High Availability (HA) cluster, a fully redundant hardware and software architecture, offers highly available database (Informix, Oracle or Sybase), Internet and NFS services, including NFS file services. Sun's Solstice HA software is also included. This provides automated fault detection and recovery of the server and data services.

The other choice, called the Ultra Enterprise Parallel Database (PDB) cluster, is tailored for on-line transaction processing, data warehouse and decision support applications.

Regarding data center migration from mainframes, Sun officials point out the importance of providing performance capability that rivals that of mainframes.

"Many organizations are migrating their data centers off the mainframe, so we must support the same performance demands that the mainframe did," Bard says.

Both configurations include two Ultra Enterprise Servers and the Cluster Foundation Package, which has all the connection hardware need-



*Sun's additions to the Ultra Enterprise Server line are designed as turnkey solutions.*

grated hardware and data services software) solutions to help ensure quick deployment of the systems. The line ranges from Ultra Enterprise 2 workgroup clusters to mainframe-caliber Ultra Enterprise 6000 clusters, all offering high reliability, availability, serviceability features.

According to Sun, the line also boasts the industry's fastest memory channel interconnect and, through an exclusive agreement with BEA Systems Inc., Sunnyvale, CA, the BEA Tuxedo transaction monitor.

Sun lists as primary goals of its

ever, use a "smart cluster" concept, wherein Sun preconfigures and composes clusters upon customer purchase for easier deployment.

"The smart clusters of servers were prebuilt, supported and tested by Sun, so they're guaranteed to work. The cluster software architecture provides different probes and tools, and we're adding support for Sybase and Informix," says John Bard, product line manager for Ultra Enterprise Servers.

The servers' recovery mechanisms, which detect potential failures that can be fixed without causing a failover,

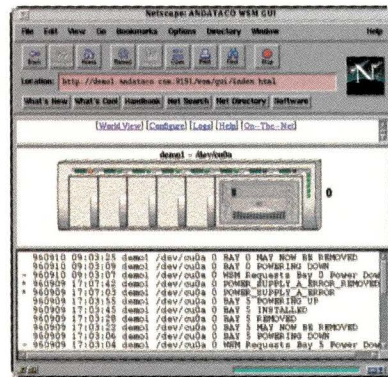


WITH A BLINK OF AN EYE YOUR COMPANY COULD LOSE \$1,000,000



WITH THE BLINK OF A LIGHT YOU COULD SAVE YOUR COMPANY \$1,000,000

Now you can account for the status of your data at all times. ANDATACO's proactive storage management technology informs you of potential problems before they occur. ANDATACO's Enterprise Storage Packaging™ [ESP] monitors all storage devices, fans, power supplies and temperature conditions. ESP is a storage system comprised of:



- RAID and non-RAID systems
- Fault-tolerant components
- Hot-pluggable SCSI devices
- Visual, audible and electronic alarms
- Netscape™ GUI interface
- Cable-less technology
- Desktop, rackmount and tower configurations
- Scalable architecture
- Supports 4mm, 8mm, DLT and disk
- Ultra-SCSI



*Integrate an Axil workstation or server to engineer the ultimate in UNIX performance and SPARC compliant solutions*



Protect your data and take control of your storage environment with a call to ANDATACO at **800-334-9191** or log in: **www.andataco.com**

  
Network Storage Solutions

10140 Mesa Rim Road San Diego, Calif. 92121 619-453-9191 fax: 619-453-9294 e-mail: ESP-axe@andataco.com URL: www.andataco.com

*Enterprise Storage Packaging is a trademark of ANDATACO. All products are registered trademarks or trademarks of their respective companies.*

Circle No. 3 on Inquiry Card

ed to create an Ultra Enterprise Cluster Server from preexisting hardware components. Prices range from under \$100,000 to more than \$1 million, depending on configuration.

Sun also announced a new tape drive offering a great performance advantage over competitive 8mm tape products, the company says. Called the SPARCstorage Library 8/400, the dual-drive, 20-cartridge automated tape storage system can swallow 800 GB of data, compressed. It also has a 10-hour backup window capable of storing 400 GB.

"As the enterprise upgrades their servers they'll want to have the capacity and performance for these databases. They'll be in big trouble if they don't have the capacity for backup," Bard says.

Approaching the terabyte mark in terms of storage capacity, Sun says the drive is a bargain at \$27,000.—*jsw*

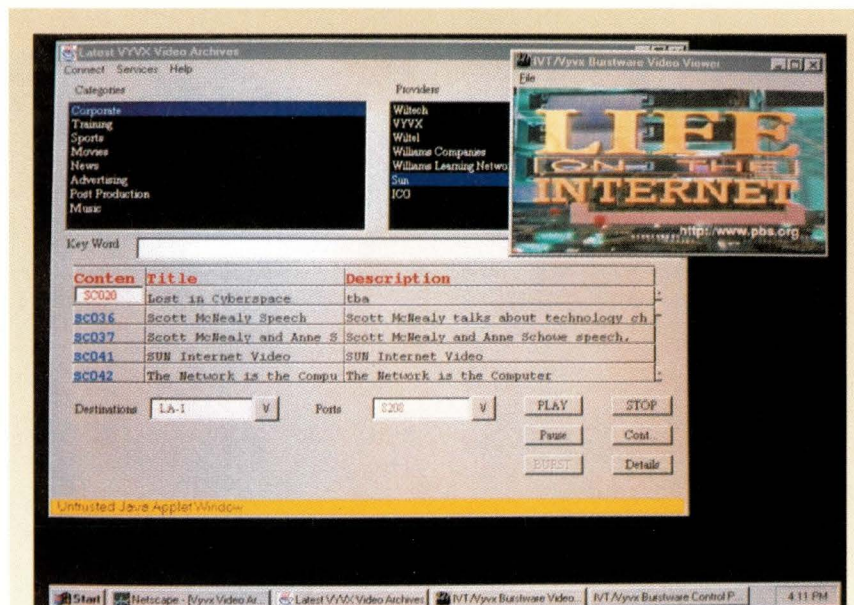
### Sun Serves PBS, WilTech Broadcast Venture

Continuing its efforts to support and align itself with educational and cultural institutions as well as the business realm, Sun has announced that its MediaCenter video servers will be used as the underlying technology behind a joint venture between the Public Broadcasting Service and The Williams Companies, Tulsa, OK.

The cooperative effort, announced in September, is an evolution of the seven-year-old satellite-delivered business education and training program called The Business Channel LLC. It calls for deployment of Sun's MediaCenter 1000E video servers, which Sun calls very scalable and affordable (prices start at \$29,995) platforms for network-based interactive video in the enterprise.

In addition to the 1000E, which has four SuperSPARC+ chips, the server line includes the MediaCenter 5, with a single microSPARC II CPU, and the MediaCenter 20, with two SuperSPARC II CPUs, and features software for managing, distributing and integrating video as a common data type into existing corporate networks, Sun says.

The servers will play a starring role



Sun's MediaCenter video servers are set to play a starring role in PBS broadcasts by delivering The Business Channel programming to the desktops of Fortune 500 executives.

in the PBS broadcasts by delivering The Business Channel programming in the form of interactive video to desktop systems of Fortune 500 executives and managers.

WilTech Group Inc., the Williams Companies subsidiary directly involved in the project, currently uses the servers in a similar pilot project in Houston, TX. Under this new agreement, WilTech will set up the Sun servers in more than 40 U.S. markets where subscribers will be able to access the programming, which includes educational programming, videos, live seminars and videoconferences for a \$1,500 annual fee, and per-program pricing starting at \$50.

Currently, The Business Channel boasts more than 6,000 business subscribers. The on-line, interactive edition is scheduled to debut in July 1997.

The Business Channel was established in 1989 as a satellite-based, business-education initiative of the PBS Adult Learning Service. It serves organizations, including nonprofit institutions, colleges and government agencies. With an infusion of roughly \$20 million from Williams, the next-generation Business Channel will greatly expand its array of business-oriented programming, live seminars, videoconferences and other educational resources, including specialized,

industry-targeted services, according to the announcement.

During a press conference held at the New York Information Technology Center in September to announce the broadened distribution of The Business Channel, Scott McNealy, Sun's chairman, president and chief executive officer, said, "Facing a more complex and competitive global economy in the new millennium, companies are going to need quick and easy access to the latest information and training techniques...Sun believes in the future of distance learning, and we are pleased that Williams has chosen our MediaCenter servers as the technological backbone of [this] venture. The old bricks-and-mortar, university approach to educating employees may not be enough [to keep up anymore]."

WilTech provides information distribution technology used to allow businesses to access The Business Channel. This includes a global fiber-optic and satellite video transmission network, as well as an on-demand video archive server system, supplied by yet another Williams Companies subsidiary, Vyx Inc. (pronounced Vi-vix).

According to PBS, the new venture will provide access to programming at its Web site, <http://www.tbc.pbs.org>, and the planned availability of

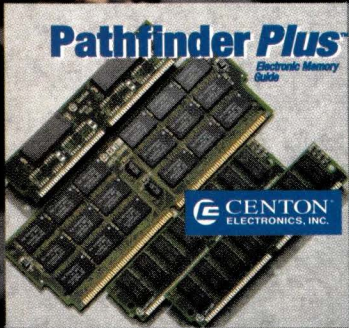


## Before You Travel the Crowded Road of Memory Upgrades, Consider This:

- Centon's experience: we've been in business for over 18 years.
- Centon's selection: we carry over 1,500 different modules.
- Centon's warranty: all products come with a lifetime guarantee.
- Centon's commitment: we're an authorized Apple Developer, Sun Licensee and a partner in IBM's warranty program.

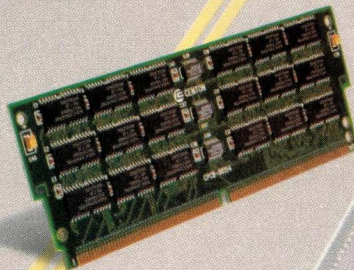
So why not bypass the other memory suppliers? Take the *Memory Expressway* to unparalleled service, aggressive pricing and guaranteed product.

**After all, for memory upgrades, all roads lead to Centon Electronics.**



**Call Centon today to get your free copy of our Electronic Memory Guide disk: "Pathfinder Plus."**

Centon and the Centon logo are registered trademarks of Centon Electronics, Inc. All other brand names and trademarks are property of their respective owners.  
©1996 Centon Electronics, Inc.



*Pictured is a Centon manufactured memory module for the Sun Sparc Series. Call Centon today for pricing and memory configurations for other Sun compatible upgrades.*

**1-800-836-1986**

See us at Comdex Fall 96, Booth #S3381



Centon Electronics, Inc. Irvine, CA (714) 855-9111 Fax (714) 855-6035 <http://www.centon.com>

Proudly distributed by:

1 (800) 255-4489 AmeriQuest  
1 (800) 223-7081 AmeriQuest/Robec



*"Leading The Way In Worldwide Distribution"*

**1 (800) 456-8000**

Circle No. 13 on Inquiry Card

faculty from the Massachusetts Institute of Technology as part of the channel's offerings.

Products from still another Williams subsidiary, Williams Learning Network Inc., which has what it calls the nation's largest CD-ROM and computer-based library of training materials for the chemical, refining, utility and manufacturing industries, will also be made available to The Business Channel LLC subscribers.

Sun's Interactive Services division, which has been around for about two years, supplies the MediaCenter video servers for the venture. The group grew out of a think tank within Sun that strove to bring to market interactive digital television (IDTV) technology, but was shelved due to the lack of extensive broadband delivery networks like ISDN. What it did come up with is a series of products—including the video server software—based on Sun hardware, which provides video

streaming and manipulation over an ATM network, says Pradeesh Baksi, customer program manager at Sun's Interactive Services division.

First announced in October 1995, the servers will be appearing more frequently, says Baksi, as more companies include video technology as a standard part of their enterprise network. Sun sells the servers under OEM agreements, as well as to companies including Toshiba, which will put its label on the hardware in future products.

As for the announcement at hand, "The servers will be used wherever The Business Channel is being used, or will be used. Right now that includes Fortune 500 companies like Federal Express, Chevron, Dow and even here at Sun," Baksi says.

"The focus will be corporations that want to train employees in major metropolitan areas, but also at schools and universities. The key message is that we're building on our strengths in net-

working and enterprise computing to build a bundled video delivery and manipulation solution."—*jsw*

### **SGI Replaces Indy, Lowers the Price**

Silicon Graphics Inc. has unveiled its latest line of personal workstations, the O<sup>2</sup>. With the announcement, SGI effectively put an end to its longtime stagnation in performance relative to other graphics desktops, like Sun Microsystems Computer Co.'s Ultra Creator and Hewlett-Packard Co.'s Visualize.

In terms of price, the O<sup>2</sup> is very competitive. It comes in six configurations, ranging in price from \$5,995 to \$13,995. The low-end O<sup>2</sup> features a 180-MHz R5000 CPU, with a 512-KB secondary cache, 32 MB of RAM, a 1-GB hard drive and costs \$5,995. The high-end O<sup>2</sup> comes with a 180-MHz R10000 CPU, a 1-MB secondary cache, 64 MB of RAM and a 4-GB

## **SUN, APPLE JOIN FORCES TO EASE NETWORKING WOES**

In September, close to a year after Sun Microsystems Inc.'s abortive bid to buy out Apple Computer Inc., the two companies announced at Network+Interop in Atlanta, GA, that they are collaborating on several key development projects. The initiative includes plans for several technologies, including networking, multimedia and component architectures.

For managers of Sun networks, perhaps the most interesting facet of the collaboration will be efforts to integrate and speed up networking between Apple desktops and Sun servers.

At Interop, Sun and Apple demonstrated the progress they've made toward integrating the two environments. Already, Macintosh desktops can function through peer-to-peer connectivity with servers in Solaris environments—previously, this functionality was provided by third-party products like uShare from IPT Inc., San Luis Obispo, CA.

Eventually, users will be able to fully manage an Apple desktop from a Solaris workstation via Solstice network management tools. Plans to include the Apple File Protocol (AFP) in every Solaris server are on the table. Also expected from the alliance are network speed improvements, a common security framework and enhanced file access for Web documents via Sun's WebNFS.

Users should have access to the Mac-enhanced Solaris in "months, not years," says Janpieter Scheerder, president of SunSoft Inc., the Sun division that handles the Solstice product line.

"The thing about Apple is that they do some things very, very well, like multimedia. But they've never been very good at network management," Scheerder says. "That's where we come in." By facilitating networking between the two platforms, the two companies hope to alleviate any reservations systems administrators may have about putting Macs on their network.

In the Internet and multimedia world, the Sun-Apple alliance might also spawn some interesting developments. Beyond the pragmatic networking issues that the two companies promise to iron out are plans to "Java-enable" Apple's multimedia and component architecture technologies.

Specifically, the companies will labor to deliver component interoperability between Sun's Java Beans and Apple's OpenDoc. Also, the JavaMedia API will be enhanced to fully support Apple's QuickTime multimedia format.

The benefits of making Apple OpenDoc and QuickTime Java-aware are fairly clear. In one fell swoop, OpenDoc and QuickTime achieve platform independence, while Java developers can substantially expand the scope of their development projects.

Consider that in 1995, 66% of multimedia authoring tools were sold for the Macintosh platform, according to preliminary data from Joan-Carol Brigham, a research analyst at International Data Corp., the Framingham, MA-based research firm. That, along with the burgeoning interest in platform-independent Web content, suggest that Sun and Apple could make quite a mark on the future of the Web.—*as*

'...Our journey led us to the jewels of the jungle...scanners!''

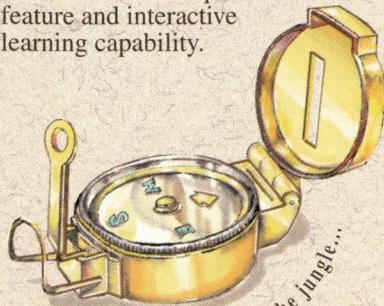


Our trail led us to an unbelievable cachet of riches. Scanners with fantastic capabilities fit for any Sun® Workstation.™ It was then we knew we had discovered the finest document and color imagery in the UNIX jungle. Night was approaching, and we needed to take precautions so we headed back to camp Apunix.  
-to be continued...

### Document Imaging

Whether you are scanning documents, letters, or photographs, we will fulfill your needs with Apunix's scanners. To convert your scanned documents to text on your SPARCstation™ system, Apunix offers the latest and most advanced document recognition software available today.

**CharacterPro™** has both omnifont and trainable technologies in one easy to use package. It can handle character recognition on documents ranging from one page to hundreds of pages. Even correcting and training multipage documents is easy with CharacterPro's unique font review feature and interactive learning capability.



We'll guide you through the jungle...

### OpenScan™

Apunix's award winning software is ideal for both document and color scanning applications. It is both full-featured and easy to use for the novice user so that production scanning is a breeze. The OpenScan software kit consists of a loadable SCSI device driver for Solaris® I.X and 2.X, the OpenScan GUI (Graphical-User Interface) allowing access to all hardware features supported by each scanner, a UNIX-style command line scan program for prototyping or easy integration, the Remote ScanServer Daemon that turns the scanner into a true workgroup device by allowing scanning from remote Sun® Workstations™ and X-Terminals, GammaTool for creating and loading gamma tables into the scanner, and our device independent API (user callable library) for incorporating scanning into your own application. OpenScan supports an extensive list of scanners.

Call for more information on the fine products from Apunix

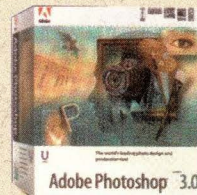
1-800-8APUNIX

**Apunix**

### Color Imaging

Apunix provides the most complete solution for scanning in images on Sun® Workstations.™ Create professional color imagery using Apunix's scanners, OpenScan software and Adobe Photoshop.™ This easy to use combination will provide you with the tools for fast, colorful and creative presentations and desktop publishing. The scanners are also designed to be used for GIS application as well as scientific and medical imaging applications.

\*Adobe Photoshop™ plug-in included.



Available from SunExpress  
US, 1-800-USE-SUNX

Scanners: IS-60, FS-2, JX-330  
Software: OpenScan,  
OpenPaste, CharacterPro

SunExpress Europe  
UK, 0800-89-88-88  
France, 05-90-61-57  
Germany, 01-30-81-61-91  
Holland, 06-022-34-45  
Switzerland, 155-19-26  
Sweden, 020-795-726



9555 Chesapeake Drive, Suite 105, San Diego, CA 92123, (619) 495-9229, Fax: (619) 495-9230 E-mail: sales@apunix.com, Homepage: http://www.apunix.com

Sun, the Sun logo, Sun Microsystems, Sun Workstation, and Solaris are trademarks or registered trademarks of Sun Microsystems, Inc. All SPARC trademarks, including the SCD Compliant Logo, are trademarks or registered trademarks of SPARC International, Inc. SPARCstation is licensed exclusively to Sun Microsystems, Inc. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc. Adobe and Adobe Photoshop are trademarks of Adobe Systems, Inc.

Circle No. 5 on Inquiry Card

hard drive for \$13,995. All systems come standard with a 17-inch color monitor, keyboard and mouse.

The truly compelling aspects of the O<sup>2</sup> are, however, the integrated graphics



*SGI is plugging the integrated graphics features of the O<sup>2</sup>.*

goodies, Silicon says. Even at entry-level pricing, users get S-video and composite video I/O, audio and hardware-accelerated texture and image mapping, the company says.

"It's exciting," says Greg Weiss, research analyst at DH Brown Associates Inc., a technology research firm in Port Chester, NY. "The high-end PC graphics manufacturers have been saying 'Look, we're faster than SGI!' Now they can't say that anymore, and it will take them about a year and a half before they're able to [say it again]."

For Sun watchers, the O<sup>2</sup>'s performance is not as significant as its price. For example, the O<sup>2</sup> with MRE graphics delivers 375K triangles/sec (lit, Gouraud-shaded, Z-buffered). It costs \$7,500. The closest price comparison with a Sun system is a SPARCstation 5 100-MHz, with TurboGX graphics: It costs \$11,040 but is not a 3D system.

Pricing the O<sup>2</sup> in this range is not merely an attempt by SGI to garner market share—although that might have something to do with it—another factor is the Unified Memory Architecture that SGI has adopted, which Weiss says is very inexpensive to manufacture.

The O<sup>2</sup> only has one card—the motherboard—on which the graphics engine is placed. Memory resides in a 2-GB/s memory subsystem, off the board. All system resources (CPU, graphics, video, imaging, compression and I/O) therefore have equal access to available memory. Memory is commodity Synchronous DRAM, and as such, is easily upgradable. The entire system is housed in a large toaster-like tower, with a rear door that opens up for easy serviceability. On the design, "I haven't seen this elegant a design since the Creator came out," Weiss says.

Of course, with this elegant, simple design come some limitations: Upgrading the graphics will be challenging, and the single PCI slot makes for limited expansion capabilities. However, the O<sup>2</sup>'s performance, integrated video and graphics components and price, paired with SGI's good name, should keep SGI in the game for at least the foreseeable future.—*as*

### **Sun Expands Distribution Channel with Ingram**

If good things come in threes, then Sun's addition of Ingram Micro Inc. to its short list of master distributors must qualify as a good thing, at least for expanding corporate access to its enterprise networking, Internet/intranet and server and workstation products.

The announcement was made official at the end of September, and adds Ingram based in Santa Ana, CA, to Access Graphics Inc., Boulder, CO, and Merisel Inc., El Segundo, CA, creating a trio of distributors now meting out Sun hardware and software to VARs worldwide.

Ingram, the world's largest wholesale distributor with sales of \$8.6 billion in 1995, will help Sun establish a stronger presence in the PC market, where Ingram has been focusing its efforts for a long time. The distributor plans to sell Sun SPARC workstations and multiprocessors, Java, Netra Internet software and Netra NFS, and, undoubtedly, Sun's soon-to-be announced Network Computer.

In a prepared statement, Mary

Galvin, Ingram's vice president of VAR sales, said the announcement "brings together the resources of two industry leaders, and has significant strategic implications for Ingram Micro. It clearly indicates incremental revenue opportunities for Ingram Micro's value-added resellers."

Sun no doubt hopes those will be big increments, as the company continues to present itself to the corporate world as an Internet product vendor, as well as a UNIX networking vendor. Sun officials say the Ingram Micro distribution conduit adds a "core competency to the Sun channel and will present major opportunities for the Netra line," according to press material.

As is customary (and required) for Sun's so-called expert-level distributors, Ingram will establish a Sun-dedicated division, which will include Sun-certified and trained field sales representatives, sales engineers and account executives. Sun officials say the team will be exclusively committed to marketing Sun's open network solutions products, as well as recruiting new Sun VARs. Ingram will also establish cross-functional teams, which will be Competency 2000 certified, meaning they match Sun's expert-level sales and technical product training.

Sun officials express optimism and enthusiasm about the addition of a third layer in the heretofore one-on-one game of its master distributors.

"Now that we've signed the contract, we're locked in step with Ingram as the third master reseller. Ingram is investing significant effort in creating a dedicated Sun infrastructure, and we'll be focusing right out of the chute at the Internet and intranet, and networking, where their key resellers are. There will be dedicated sales and business people in Ingram for Sun, and we're just real excited about it," says Bill Cates, Sun spokesman in the company's Dallas office.

Sun and Ingram also say the terms of the contract will prevent the latter from eating away at the customer bases of Merisel and Access.—*jsw* ➡

*Compiled and edited by John S. Webster.*

# Anyone Can Put Terabytes In A Box.



## The Trick Is Getting Them Out.

Today, your mainframe and open systems users demand more than massive storage capacity. They demand massive access — non-stop, fail-safe and lightning-fast. No small trick. Fortunately, Amdahl makes storage systems to satisfy the most demanding mindsets.

Your open systems users won't mind having unprecedented data access. That's what our new LVS 4000 client/server storage family delivers. Performance that scales up with capacity — to a stunning 20,000 I/Os per second at a full terabyte.

Our Spectris™ storage family puts System/390 users' minds at ease with non-stop data delivery. Through batch and on-line processing, even maintenance. 24 x 365, non-stop performance.

Satisfying demanding users is no trick at all. Just go with Amdahl.

**(800) 223-2215. <http://www.amdahl.com>.**

©1996 Amdahl Corporation. Amdahl is a registered trademark and Spectris is a trademark of Amdahl Corporation. All other trademarks are property of their respective owners.

**amdahl**

**Introducing the SPARC™  
hyperSTATION™. Design and  
architecture so advanced...**

**hS30**

A large, golden-brown, triangular object, possibly a piece of hardware or a stylized pyramid, dominates the foreground. It is set against a desert landscape with several smaller pyramids in the background under a blue sky with white clouds. The object has a smooth, slightly textured surface and a dark shadow cast on the sand below it.



# years from now, you'll still marvel at your applications' monumental performance.

## THE SUNOS® AND SOLARIS® SOLUTION.

Just because the Sun is setting on your current operating system, it doesn't mean you're left in the dark. ROSS, the sole supplier of hyperSPARC™ CPUs to the SPARC market worldwide, creates hyperSTATION 20 and hyperSTATION 30—the dawn of a brand new day in SPARC workstation performance. Today, you can have the power you need to run SunOS 4.1.3 SunOS 4.1.4, and Solaris applications at speeds faster than you'd ever imagined possible. And you have the power to maintain that edge in the future.

## THE LONG-TERM SOLUTION.

Our high performance SPARC microprocessor architecture is housed in a new chassis specifically designed for future generations of exactly what ROSS is famous for... multiprocessor upgrades. Shining examples of ROSS' forward-thinking approach, both hyperSTATIONs feature an advanced thermal management system, a stronger power supply, options for a 6X CD-ROM drive, 24-bit 2-D and



3-D graphics accelerator, and enough real estate for up to 6GB of hard disk space.

## EXTENSIBLE, UPGRADEABLE, CONNECTABLE, RATIONAL AND AFFORDABLE.

You can always extend your performance level with our high speed single, dual- or quad-processor upgrades. And you can rest assured that our SPARC-based and UNIX-compliant open systems solutions will provide high connectivity. When you think about it, ROSS hyperSTATIONs are the only way to go if you want to put your company's future on a predictable path for growth—without buying into the high costs and inevitable headaches of moving to alternative platforms.

### INTRODUCING THE HYPERSTATION 20 AND 30.

#### HYPERSTATION 20. MORE SPARC FOR YOUR BUCK.

*hyperSTATION 20 has more features than Sun's SPARCstation 20 for a lot less money. Dual 50 MHz MBUS slots support up to four hyperSPARC processors and up to 512MB of RAM, so you can pick the level of speed you need. And with our 6X CD-ROM drive, ISDN and high performance graphic accelerator options, the hyperSTATION 20 gives you features the competition doesn't even offer.*

#### HYPERSTATION 30. THE MASTER OF SPARCS.

*hyperSTATION 30 is as fast as it gets. It features a new 66 MHz MBUS for high-throughput multiprocessing and a 1GB physical system memory for advanced ECAD and database applications. Combine our current microprocessor speeds from 133 to 166 MHz and ROSS' evolutionary history of advanced hyperSPARC performance, and you'll start—and stay—on the fast track.*

### OTHER MARVELS OF ROSS TECHNOLOGY.

If you're in the market for memory, motherboard upgrades or microprocessor upgrades, from 90 to 166 MHz, we have them. Call us today for specifications and prices!

**CALL 800-ROSS-YES.**

# ROSS

ROSS Technology, Inc.

**CALL 800.ROSS.YES**

5316 Highway 290 West Austin, Texas 78735 800.ROSS.YES International 512.349.3108 FAX 512.349.3101 <http://www.ross.com>

©1996 ROSS Technology, Inc. All rights reserved. ROSS Technology and the ROSS logo are registered trademarks, and hyperSTATION is a trademark of ROSS Technology, Inc. All SPARC trademarks are trademarks or registered trademarks of SPARC International, Inc. hyperSPARC is licensed exclusively to ROSS Technology, Inc. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc. All other product or service names mentioned herein are trademarks of their respective owners.

Circle No. 35 on Inquiry Card

*"GSM is wonderful."*  
—Graeme Sutherland

*"GSM is a very complex standard..."*  
—John Scourias, "Overview of the  
Global Standard for Mobile  
Communications"

*"Oh, turn that thing off."*  
—Someone with something better to do

## Mr. Protocol Has Tea

**Q:** *Why do my friends from overseas keep snickering at me whenever I pull out my cellphone? It's the latest flip-phone from Japan, and it's smaller than a credit card. I think it's pretty neat!*

**A:** Don't worry, they do the same thing every time you turn on the TV, only worse. And it's for the same reason. If you're willing to be second, you get better pickings. Makes Mr. Protocol wonder what's going to happen if the Internet is ever reimplemented.

Here's a mindless exercise for you, Turn on the television set, and count the little bitty horizontal lines. Now, fly to England, settle into your average London flat, pay the television license fee so they don't haul you away while you're busy counting, and count the little bitty lines on one of their sets. You'll come out to 100 more.

Now, every time Zany Zebulon down at the corner TV & Refrigerator Emporium claims that his sets have "more lines of resolution" than anybody else's, he's only partly making it up. Wonderful work with digital filters has enabled today's TV sets to resolve very fine detail along the horizontal axis: upwards of 600 lines in some cases. Not that many signals are capable of actually carrying that sort of resolution. However, in the vertical direction, the United States is

still limited to the same 425 lines that were laid out in the black and white days of the late '40s.

By the time the British got around to specifying what they were going to use for a TV standard, of course, the technology had been pushed that much further. So they got on board with a standard called PAL, which has

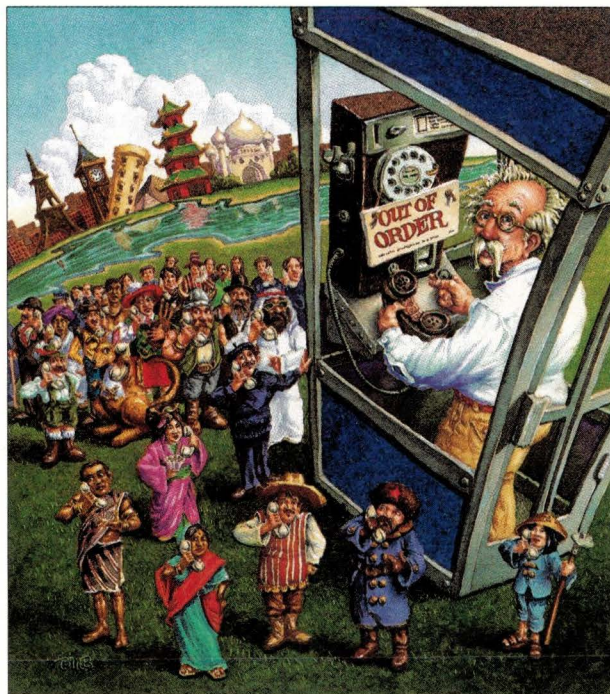
dards, of course: No one's going to buy a new standard unless it's compatible with the old one, which is why the conversion to color didn't change the screen resolution—the signal had to be compatible with the old black and white one. In fact, the new HDTV signal can't be compatible with the old one, but broadcasters will continue to

broadcast both until well into the next millennium.

This problem with standards plagues any mass medium. It plagues the Internet. The most successful application protocol yet developed, HTTP, uses the lower-level protocols in a manner almost opposite to that for which they were designed. The Internet is showing the strain, and will continue to do so, since deploying any changes to TCP or IP is almost impossible at this point.

And it plagues telephones.

Consider the fact that if you measure the voltages used in your wall phone, you'll get very screwy numbers. These numbers reflect the earliest days of telephony, when telephones were battery-powered devices. The voltages of these early batteries are carried forward into today's modern 900-MHz all-digital, all-singing, all-dancing cordless wonders, at least as far as the base unit is concerned. What comes out of the wall is still battery voltage. The only substantive



525 lines of vertical resolution. Today we can do much better than that, but everyone's still watching the same resolution they started with and will continue to do so until High Definition Television (HDTV) is finally rolled out into the marketplace.

It's the old problem with new stan-

change to hit the market in the last 70 years is the replacement of pulse dialing with tone dialing, and that took 40 years to filter through the marketplace. Only now are we beginning to see the services that tone dialing permits.

It's relatively easy to deploy new services back at the telephone central office. The hard part comes in introducing services that require changes to subscriber equipment. Caller ID only has a prayer of succeeding because it does not require everyone to change telephones. It only requires additional equipment for those who wish to use the service.

Now consider cellular telephones. We have 'em, and so does everybody else. What do you think the chances are that your cellphone will work in Europe? Right you are. Zippo. Well, why not?

Mr. Protocol is glad you asked.

Cellular phones in the United States are almost all of a single type, called AMPS, which Mr. Protocol is willing to bet stands for Analog Mobile Phone Service. What this means is that if you tune an FM radio across the relevant part of the radio spectrum, you will pick up phone conversations. You will also be committing a felony, a piece of legislation that ranks right up there with the barn door and the horse and all that, but the point is that the audio for American cellular phone services is good old analog FM.

Now, this is still a considerable improvement over the way mobile phone service started out, which had about 40 channels for an entire city or something like that, and when you got a channel, you kept that channel till you hung up or dropped out of the system by driving too far away.

The whole notion of cellular service allows reuse of frequencies across cells, and cellular phones are "frequency-agile," which means that they can retune themselves to acquire a different cell as they move across town, without dropping a call (unless the new cell is already fully occupied with calls, in which case, ka-BOINK!).

So, what do the English have that we don't, besides *Sandman* creator Neil Gaiman and really good ale?

## Global Mobility

The answer is, same thing as happened with the television standards. They've got a new mobile phone standard, called GSM, which has to be seen to be believed. For one thing, you can pack your bag in London, fly to Perth, take your phone out of the bag, and it will work. Period. You might not, but it will. (Mr. Protocol, having not quite survived the London-to-LA part of his

journey, emphasizes this.)

GSM, which stands for Groupe Special Mobile, is the name of the European standards group that developed a suite of protocols together with a technical specification for doing cellular telephony. They started from the position of the already-deployed American system, and so were able to build upon the shortcomings of that system and make use of digital technology a great

## FREE Multiport Serial Connectivity GUIDE

CLIP AND SAVE - FREE GUIDE!

## What you should know about multiport connectivity for Sun systems

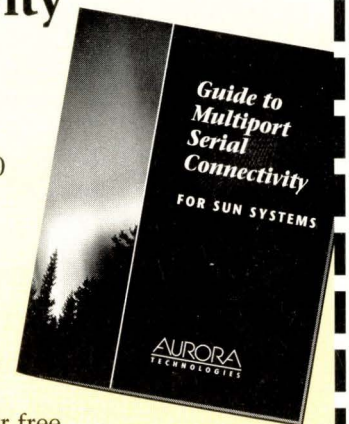
More than 50,000 users rely on Aurora Technologies to meet their asynchronous and synchronous connectivity requirements. Our free handbook provides practical information about:

- Flow control, data buffers, modem support, and electrical interfaces
- SBus versus SCSI versus Ethernet connectivity
- Maximizing throughput and data integrity without burdening CPU or network resources
- Why products with seemingly similar features can provide dramatically different performance

**Contact Aurora for your  
FREE GUIDE today!**

**No obligation—supplies are limited.**

For more information:  
Phone: 617.290.4800 FAX: 617.290.4844  
E-mail: [info@auratek.com](mailto:info@auratek.com)  
URL: <http://www.auratek.com>



**AURORA**  
TECHNOLOGIES

Circle No. 9 on Inquiry Card

deal more sophisticated than was available when AMPS was designed.

The European standard was picked up worldwide, so GSM is now regarded as standing for Global System for Mobile communications. Even in this country, some of the new PCS services are being designed to a derivative of GSM called PCS1900.

Each GSM phone is a mobile digital terminal. Communication with the

local cell site is by means of packets, and each phone is continually aware of a number of factors of which its American cousin is ignorant, having to do with the current state of the system.

GSM divides the radio spectrum into a series of 124 channels, spaced 200 kHz apart. This would seem like plenty of space, but they further divide each channel into time slots. The smallest unit of time is a *burst*. Eight

bursts make up a *frame*, which is the basic unit of channel traffic.

We won't go into the details of how bursts and frames are laid out, nor of how they are mixed up with the channels. Suffice it to say that the phone doesn't stay on a single frequency channel: A "traffic channel" wanders over available frequencies and time slots in a pattern or coding scheme that repeats about every three hours. This has the effect of spreading ambient interference among all users in such a way that it's tolerable for everyone, and also makes interception of a call just about impossible.

Several things fall out in the wash almost immediately.

First, cellular modems are no longer necessary. The GSM phone is a digital device. It is ISDN-compatible, though it cannot carry a full 64-Kb/s B-channel data stream over the radio link because of insufficient bandwidth. Still, it can carry 9,600 baud just fine, either digitally, or, if you are communicating with an audio modem at the other end, via a cellular modem. The point is that if the other end is prepared to speak ISDN, you don't need the modem.

Second, the numbering system for phones is part of the standard and doesn't come from the same pool of numbers as ordinary telephones. Cellular phones are one big reason why so many parts of the United States keep having new area codes carved out of them. Under GSM, cellular phone numbers don't look like ordinary numbers, and are drawn from a different pool. This also helps the cellular network route calls.

Third, not all the channels on the phone are used for speech data. There is another service, called the Short Messaging Service, that allows owners of GSM phones to exchange short alphanumeric text messages between phones, somewhat like a pager. Such messages can also originate from computer users elsewhere in the network. The display on a typical GSM phone is a multiline LCD display, similar to that of an advanced pager, rather than the fairly simple display you find on an AMPS phone.

One reason for the multiline display

## Rent From AT&T Capital

**SUN • HP • SGI  
IBM • RDI**

### AT&T CAPITAL ADVANTAGE

- Large inventory
- Flexible financial options
- Dependable customer support
- Custom configuration

We buy excess inventory

**1 800-257-4415**

[www.attcapital.com/rent](http://www.attcapital.com/rent)

**RENT • RENT-TO-OWN • LEASE • BUY • SELL**

*The AT&T Capital Instrument & Data Services Commitment...*

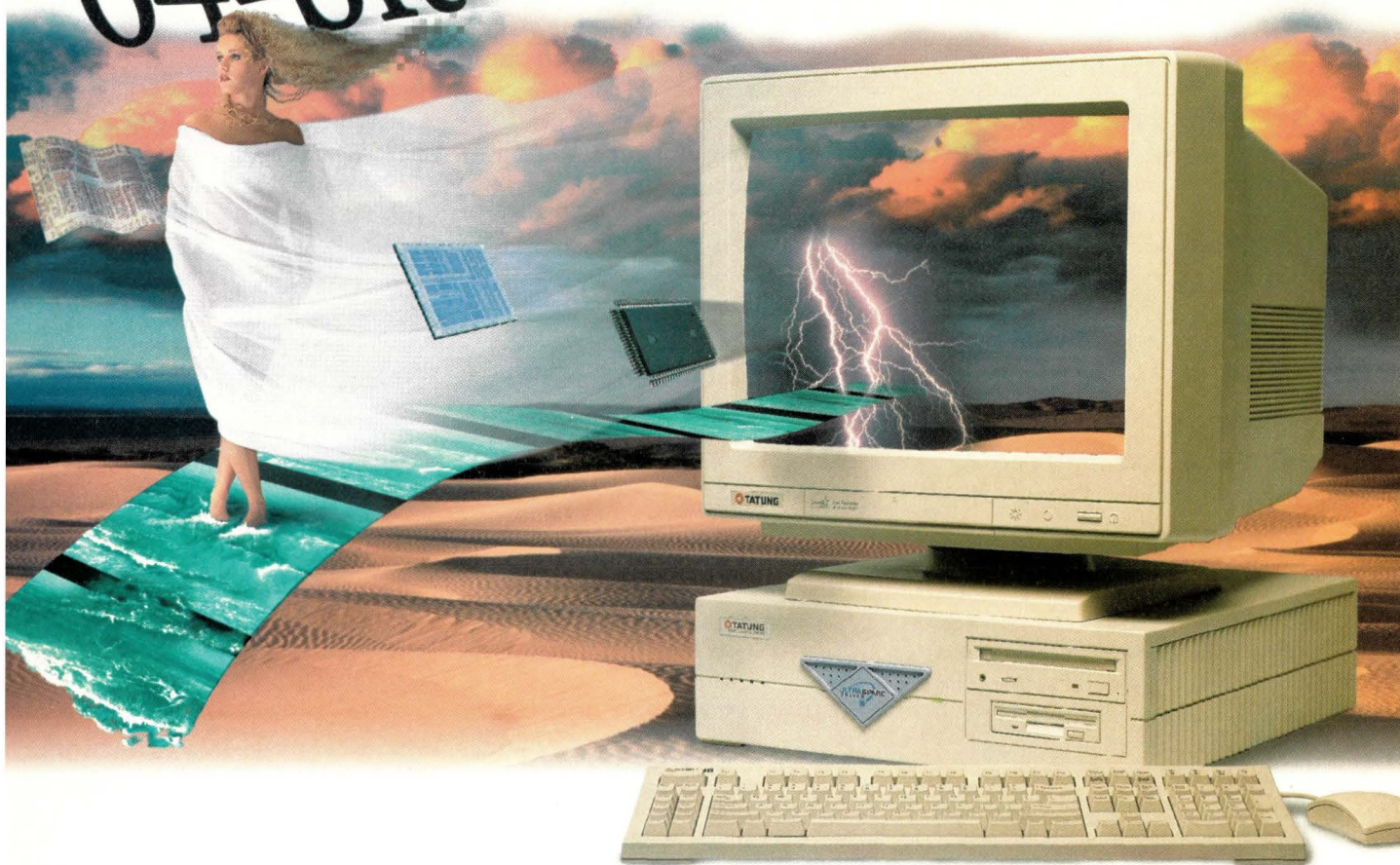
*"To provide you with the latest technology, when you want it,  
for only as long as you need it, at an excellent value."*



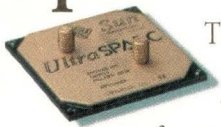
Circle No. 8 on Inquiry Card

COME SEE US  
AT COMDEX  
BOOTH #L3162

# 64-bit UltraSPARC™



## Speed & Performance in the Highest Class



The winds of change are bringing the advanced power of 64-bit UltraSPARC™ to the desktop. Never before has so much performance been neatly tucked into a supercharged fully Sun® compatible workstation from Tatum.

Tatum, the leading manufacturer of Sun compatibles, is proud to announce the COMPstation™ U Series as flagship products in their ever expanding workstation and server line. As with all Tatum workstations, the U Series is designed and manufactured in the U.S.A.



The secret to UltraSPARC's awesome power is the UltraSPARC Port Architecture (UPA) which, combined with other features, makes this a supercomputer class machine on the desktop. UPA offers much higher bandwidth compared with previous bus technologies and combines with the groundbreaking Visual Instruction Set (VIS) to create outstanding performance leaps for Engineering, Multimedia, Commercial and Internet/Intranet applications. Tatum offers quality products, flexible/customized system configurations and superior service and support.



Contact Tatum for Internet/Intranet Server Solutions at 1-800-659-5902.



Tatum's full line of UltraSPARC, SuperSPARC, hyperSPARC, microSPARC workstations and servers

The Intelligent Choice in SPARC Computing Solutions



Phone 1-800-659-5902 • Fax (408) 383-0886  
1-408-383-0988  
email — mkt@tsti.com or <http://www.tsti.com>

©1996 Tatum Science and Technology, Inc.

All trademarks are property of their respective owners.

196GD&A

is that the GSM phone is a superstar at roaming. It can interoperate with any other GSM network anywhere, and the phone continually displays the names of the GSM systems that it is able to hear. In one startling display, Mr. P. observed a GSM phone owner standing on the cliffs of Dover acquire two different GSM systems in France.

This is exactly the sort of international roaming that the members of the European Union need to conduct their business, and they are profoundly thankful for it. It means that they can carry their phones with them everywhere, and they will work with no fuss or bother.

### Calling Costs

Another major benefit is the charges. GSM phone users are only charged for outgoing calls. Incoming calls are charged to the caller. Because GSM numbers are organized out of a different number space, those calling a mobile number have some idea ahead of time what charges will accrue. The GSM user does pay any roaming charges, of course, from his home location to his actual location.

The only even remotely sticky situation comes when a user who is roaming internationally receives an incoming call from someone in a third country. In this case, both parties wind up paying for pieces of an international call, and courtesy dictates that the person with the GSM phone call the other party back to keep international charges down to a single party.

So how much does all this cost? Good question. In Los Angeles, where Mr. Protocol resides, cellular phone charges are among the highest in the country because a very significant fraction (some estimates range as high as 40%) of cellular phone traffic is fraudulent. The digital part of the AMPS signal, identifying the phone and the phone number, is easily intercepted, and phones may be easily reprogrammed to "steal" the cellular airtime of a legitimate subscriber.

With a GSM phone, the phone's own identity module is combined with a key that it obtains from a subscriber-owned Subscriber Identity Module, which uniquely identifies the sub-

scriber as opposed to the phone. This SIM module contains a cryptographic key that is known to the GSM system, and is used in a typical challenge-response manner to encode a challenge message sent by the GSM system to the phone. The GSM system compares the encrypted result with the result expected from the key in its database and authenticates the transaction.

In fact, this key can be used to encrypt all of the packets used in the call, in case of rampant paranoia. The result is a level of piracy so low that

***New PCS services, some of which will be using the GSM derivative PCS1900, may give us even better technologies in the future, at least in urban centers.***

GSM rates in London are actually lower than equivalent cellular phone rates in Los Angeles, despite the much greater capabilities of the GSM system.

Of course, there is not just one GSM provider. There are several, each with its own multitier charging structure, as in the United States. One difference is that there are more than two providers. There are now four, and counting, though two are upstarts building new networks to challenge the two "old-timers."

What about the phones themselves? Well, Mr. Protocol opines that they're chunky little buggers. They don't compare with his triband Icom ham radio handheld, known as the "dark alley radio" for its ability to fell a young steer if properly wielded. But for those whose attachment to the tailored lines of their suits has swelled the chorus of "thinner, thinner, thinner!" the new phones may be a disappointment. Their form factors are what anyone could wish in terms of small size as far as width and height goes, but there is a significant amount

of silicon to be crammed into these things, and the result is that comparing phones of the same generation between GSM and AMPS will leave the GSM phones looking significantly thicker front to back.

Will GSM ever be installed in this country? Good question. AMPS will keep its spectrum for a long time, thanks to the huge installed base of AMPS phones, but if fraud keeps going the way it has been, there may be a backlash. The United States has never been overly sensitive to the technical convenience of others (now there's an understatement) so the pull toward sharing GSM roaming, while strong, will probably be insufficient to overcome inertia in the marketplace.

On the other hand, new PCS services, some of which will be using the GSM derivative PCS1900, may give us even better technologies in the future, at least in urban centers. Mr. Protocol doesn't think the idea of having a portable ISDN line in the pocket is such a shabby one.

For more information about GSM, see <http://ccnga.uwaterloo.ca/~jscouria/GSM/gsmreport.html>

\*\*\*\*\*

Mr. Protocol gratefully acknowledges the help of Mr. Graeme Sutherland in uncovering these marvelous toys. ➡

**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.

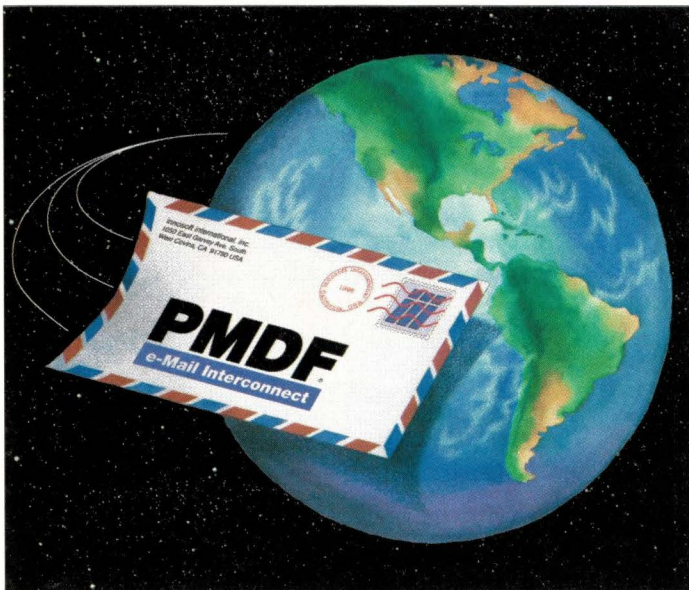
He founded and ran the first nationwide UNIX Users Group Software Distribution Center. He worked at Rand during the glory days of the Rand editor and the MH mail system, helped build CSNET (first at Rand and later at BBN Labs Inc.) and is now working at an aerospace research corporation.

**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).

# Why UNIX System Administrators Need Internet Standards-based E-mail Integration

**The Challenge:** You're tasked with integrating and managing multiple disparate e-mail systems. You need to build a cohesive networked environment that can provide end users with reliable communications over both the LAN and WAN. Your users already like many features of their various mail interfaces, often including robust capabilities for handling binary attachments, and don't want to change — but at the same time they are demanding interconnectivity with other messaging environments without loss of functionality. Your strategy must be soundly based on products that use proven standards-based technologies, can be implemented and managed with minimal overhead, and are backed by unquestionably strong technical support.

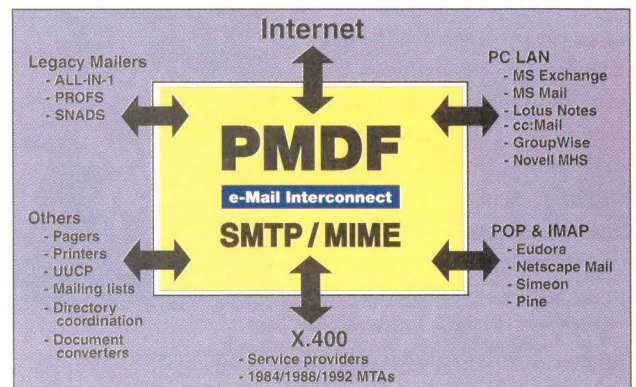
**The Solution:** PMDF® e-Mail Interconnect is an industrial-strength messaging backbone that uses the Internet's MIME standard to integrate complex, message-intensive environments. As a backbone, PMDF avoids the functionality limitations, management headaches, and high costs of individual point-to-point gateways. PMDF delivers on the promise of standards-based products, engineered and rigorously tested to solve real world problems, employing already familiar Internet technologies that take the mystery out of implementing and managing e-mail integration solutions.



## PMDF e-Mail Interconnect

- Protection against security intrusions a major design priority
- Scalable to support tens of thousands of users
- Supports Internet message non-delivery notification standard (NOTARY)
- Multi-threaded servers (SMTP, POP, IMAP) for hi-performance messaging
- Reliably handles all types of binary attachments — only MIME makes this possible
- Proven through years of production use at over 2,200 installed sites worldwide
- Commercially supported by experienced Internet mail system experts — a great resource for helping solve byzantine addressing problems, and much more!

*PMDF for Solaris, PMDF for OpenVMS, or PMDF for Digital UNIX — the choice of platform is yours! In each case, PMDF gives you bullet-proof enterprise-wide mail integration, including interconnectivity among all major e-mail products and protocols.*



Contact the company that has earned a reputation for unsurpassed excellence in e-mail integration technology to arrange a **NO COST 30 day evaluation:**

**1-800-552-5444**

**sales@innosoft.com, <http://www.innosoft.com>**

 **innosoft  
international  
inc.**

PMDF and iii are registered trademarks of Innosoft International, Inc. • 1050 East Garvey Ave. South • West Covina, CA 91790 • (818) 919-3600. All product names are the property of their respective owners.

## Locks on Files

Since its inception, UNIX has been a multiprocessing system. Large numbers of processes run at the same time to get the work of the machine done. They interact with users, access files, send data to the printer, listen for mail from the Internet; the list of tasks goes on and on. All these processes run at the same time on the system, sharing the available resources.

Of course, the apparent parallelism is an illusion managed by the UNIX kernel. It's the job of the kernel to maintain the fiction that things are happening at the same time by allowing each process to be run by the CPU (or CPUs) when the process needs to do something.

In reality, most processes spend their lives waiting for data to appear from a peripheral so they can deal with that data and move onto the next task. Generally, UNIX exploits this "dead" time by handing the CPU to some other process when one process is blocked waiting for data.

To the programmer, the parallelism is mostly invisible. We can, but don't have to, write programs that take advantage of the ability of the kernel to run more than one process at once. However, the parallelism does complicate the lives of programmers in several ways.

First, we do have to write programs with the knowledge that it's possible for several instances of the program to be run simultaneously on the same machine. For example, if a program needs a file for temporary storage of data, then we don't make it use a file name like `/tmp/tmpfile` because if we run several instances of the program, they will all want to write data to the same file.

We will code the program to automatically create a file name that is hopefully unique, trying to use some feature of the system that will provide us with a mechanism to differen-

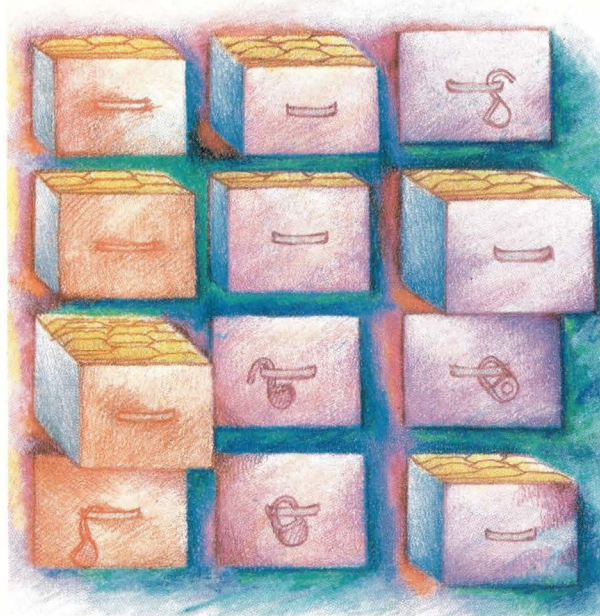
tiate one running instance of the program from another. One way is to include the ID of the process (the PID) in the temporary name because we know that the PID is a unique number on the system when the process is running.

Alternatively, we can use the current time to generate a unique name. It's rare for programs to start on exactly the same second. Even then, we cannot guarantee that the constructed name will be unique and must check that the file we want to create doesn't already exist. If the file does exist, we may be able to delete it or change our attempt at a unique name. What should be done depends on the application.

Parallelism also means that we have to think about the very common situation on UNIX where many processes need to access the same file at the same time. Some processes may want to obtain data from a common file; for example, the file containing the password information for the system. We would like to change the password file from time to time, so we have to ensure that this can happen without disturbing any running processes.

It may seem that it's rare for several processes to want to write to the same file at the same time, but file update by separate parallel processes happens more frequently than you might think. A good example is the email system, which takes mail destined for you and places it in a file in a known place on a disk on your machine—`/var/mail/username` on Solaris. At some time later, you read your mail by examining that file. Life is more complicated than it seems. You can be busy reading mail at exactly the same time as new mail is delivered. New mail may also arrive just when you are changing the email file by deleting some of the items in the file.

We certainly need some method to allow programs to





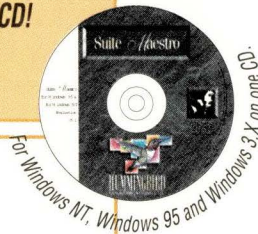
# Suite Maestro

## Ultimate 32-Bit TCP/IP Apps



### Suite Maestro Family: All On One CD!

- Windows NT\* • Windows 95
- Windows 3.X



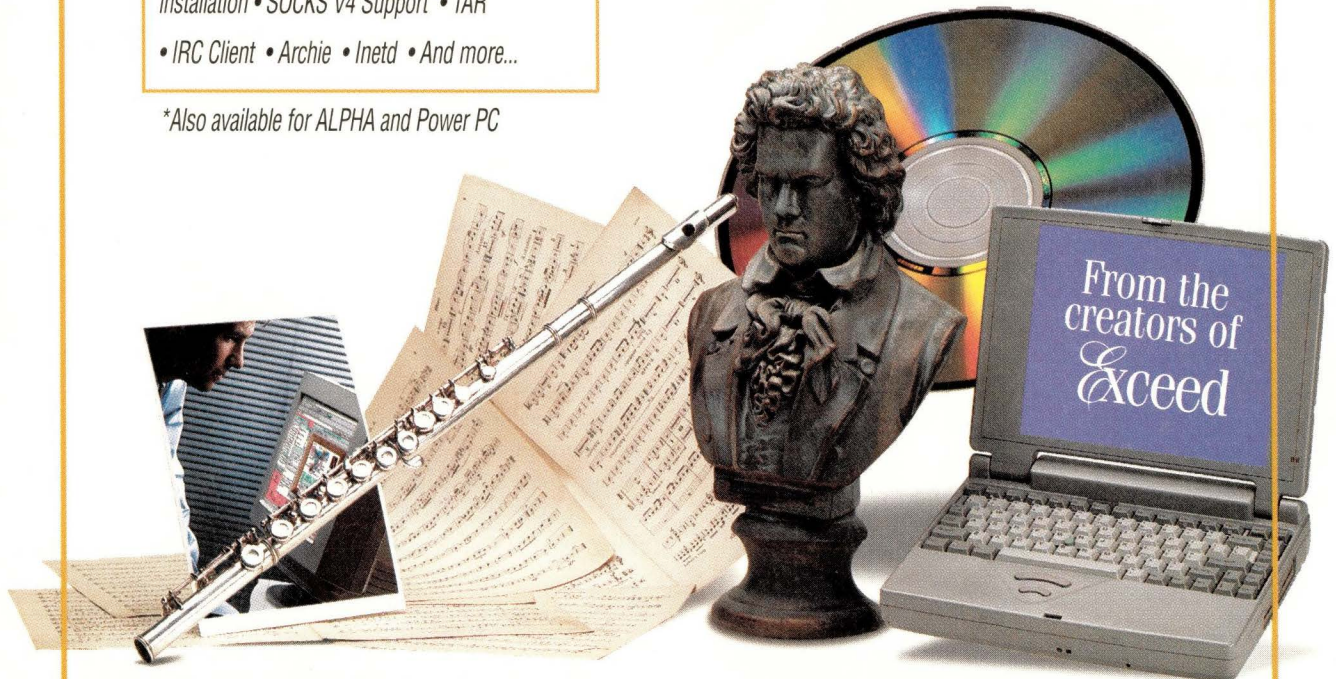
- Telnet with full graphical keyboard remapping, VT320/220 Wyse 50/60, ANSI BBS and SCO ANSI emulations, DDE server / OLE automation
- Columbus - Web Browser, E-mail, Netbook, News, FTP, Gopher and more • Extensive suite of support utilities such as Ping, Finger, Traceroute, LPD and others • Basic, Launch Pad, TN3270, TN5250 • Sconfig- easy, customizable installation • SOCKS V4 Support • TAR
- IRC Client • Archie • Inetd • And more...

\*Also available for ALPHA and Power PC

Hummingbird's new Suite Maestro will help you maximize your investment in all your TCP/IP applications with just one CD. In addition to supporting a migration path for all Windows platforms, Suite Maestro gives you true 32-bit power for Windows NT and Windows 95. On top of that, Suite Maestro offers powerful Internet access tools and enables you to customize your installations with ease. For more information or the name of the reseller nearest you, call **(416) 496-2200** or visit our Web site at [www.hummingbird.com/sem.html](http://www.hummingbird.com/sem.html).



**HUMMINGBIRD**  
COMMUNICATIONS LTD.



1 Sparks Avenue, North York, Ontario, Canada M2H 2W1 • Tel.: (416) 496-2200 Fax: (416) 496-2207 • Offices in: Washington DC, Mountain View CA & Raleigh NC, USA • Geneva, Switzerland • Paris, France • Munich, Germany • Maidenhead, UK  
All brand or product names are trademarks or registered trademarks of their respective companies. ©1996, Hummingbird Communications Ltd. Applications included may vary depending on the PC platform.

Circle No. 19 on Inquiry Card

cooperate when updating mail files, and it's usual to use file-locking techniques to ensure that mail is not lost when the file is being simultaneously updated from several processes.

File locking allows us to write programs so that only one process can access a file (or part of a file) at any one time. All other processes will be forced to wait until the process holding the lock has done its work and releases the lock. Once the lock is freed, all the processes that are waiting for it will be woken up. They will try to get the lock, but only one will succeed. The others will sigh and go back to sleep. Their turn will come.

Programmers try to keep the time that the file is locked to a minimum, so that the processes using the database do not have to wait for long periods. It can be counterintuitive for the user when the program unaccountably and unrepeatably pauses because it is waiting to access a database. When I have written programs, I've always treated file locking as an implementation choice of last resort, to be used sparingly.

In many applications, it's possible to avoid using locks altogether by judicious use of the semantics of the existing system calls that are used to manipulate files.

### Parallel File I/O

Of course, we don't have to worry about reading a file from concurrent processes. If two processes have the same file open for reading, then the kernel will have independent pointers maintaining separate positions in the file where read system calls will next obtain data.

The worry begins when there is a situation where data is written to a file while that data is read by other processes. In many programming situations, we can take advantage of the fact that the read and write system calls for files are atomic. If we make a process move its write pointer to byte 2,048 of a file and write 512 bytes there, then we know that those 512 bytes will appear on the file as a contiguous chunk of data. Once the write system call is started, no other process can access the file until the system call has finished.

If we have another process reading from the file at the same time, then the read call will happen either just before or just after the write call from the writing process. If we ask a reader process to move to byte 2,048 and read 512 bytes, then it will either get the old information or the 512 bytes that were just written by our writer process. The reader will never get a confusing mix of old and new data.

If we have a database consisting of fixed-length records of some known size, then we may not need to do any locking. We can use the atomic nature of the system calls to prevent problems with the database. An example of such a database is the file that stores the time that you last logged in and from where. When you log in, the file is read and the `login` program will print something like this:

```
Last login: Mon Sep 2 09:34:51 from wooded
```

The information is stored on `/var/adm/lastlog`. The file consists of fixed-length records indexed by your user ID (UID). To get the information for printing, the `login` program will move its read pointer to the appropriate point in the file and read your data. A little later, the `login` program will update the file with the new data generated by your new login. Notice that many instances of the `login` program can be running at the same time, and each can be reading and writing to the file.

The data stored in the `lastlog` database is somewhat peculiar. Your record is completely updated every time you log in. Also, the data is not terribly important. It is being stored to give you a chance to spot whether your account has been hacked when someone logs in while you are away from your machine. Both of these factors mean that we are not too worried about possible problems that may occur by simultaneous update of the same record.

It's rare for an application to completely replace all the data in a record. It's more usual for the program to read the record, change some fields and write the record back. The update operation will involve several system calls.

Consider a common situation. We have a file with records that have two data fields, A and B. One process comes along, reads a record and changes field A. At the same time, another process reads the same record and changes field B. We now have two processes holding two different versions of the record: The first process has a new value for A and an old value for B, the second process has an old value for A and a new value for B. If they both try to write the data back to the file at the same time, then we cannot know which data will eventually appear on the file. We do know that it will be incorrect. In this situation, we need to use file

Catches wise-guys  
in the act... and  
yanks them off  
your Web site!



Download a free copy  
from our Web Site!

Haystack Labs, Inc.

Active Security for Open Systems

10713 Hwy 620 North Austin, Texas 78726 512.918.3555 Fax 512.918.1265



WebStalker™

Finally, an automated management tool that patrols **inside** the perimeter of both your internet and intranet Web sites. WebStalker protects the integrity of your Web server 7 days a week, twenty-four hours a day. **More than a firewall**, WebStalker is the only software solution that provides real-time **detection** and **identification** of external and internal attacks. You can tell WebStalker to notify you of intruders through SNMP, pager or email...or simply **have it kick them off**. You get total Web site security, with no strings attached.

Think you know Web site security? Take the **WebStalker Challenge** at <http://www.haystack.com> What can you win? Surf it and see.

DOWNLOAD  
A FREE COPY  
FROM OUR WEB SITE

Circle No. 17 on Inquiry Card

# Power you can depend on.



## Viking Computer

Mr. October. The most prolific power hitter in baseball playoff history. Eighteen playoff home runs--four on consecutive swings in the 1978 World Series. When power was required, Reggie delivered. Too bad you can't put him in your workstation. The next best thing? A Viking memory upgrade--the most effective, easy and economical way to add power to your system. So you can render 3D graphics and use multiple applications at maximum speed. Always dependable, Viking memory is designed, manufactured and tested to meet or exceed OEM specifications, but cost about half the price. So both your workstation and budget will



be big hits. Viking Components. 100% tested. 100% compatible. Lifetime warranty. 24-hour, 7-day per week toll-free tech support. From 8MB to 256MB for DEC, HP, IBM, Sun and most other systems. It's power you can depend on. Call, toll-free, 1-888-4-VIKING for our free workstation product guide today. **Ask for Richard at ext. 359, or Dale at ext. 326.**

**COMDEX** Fall '96  
November 18-22, 1996, Las Vegas, Nevada USA  
Booth No. L572

11 Columbia, Laguna Hills, CA 92656 • Tel: 714-643-7255 or 1-888-4-VIKING Ask for Dale at ext. 326 or Richard at ext. 359 • [www.vikingmem.com](http://www.vikingmem.com)

Circle No. 46 on Inquiry Card

locking to ensure the integrity of data on the file, allowing each process to perform its update actions while locking out the actions of others.

However, this doesn't mean that we need to force all programs using a database to use locks. If we are careful to always write complete records back to the file, the programs that only read the data don't need to use locks, because they will always be presented with coherent data from the file. It's quite common to write programs that use locks on databases to prevent update problems but allow readers to access the database with no locking.

## Maintaining Log Files

Another common application that makes use of atomic writes is the maintenance of log files. A log file can be updated by several processes, each adding their own piece of useful information to the end of the file. Early UNIX systems would code a routine to add data to the end of a log file using some C code like this:

```
/* open file */
fd = open("log", O_WRONLY);
/* seek to the end */
lseek(fd, 0L, SEEK_END);
/* write the data */
write(fd, msg, msglen);
/* close the file */
close(fd);
```

Of course, the actual code would be somewhat more complicated. It would test for the success or failure of the four basic system calls. The code opens the file, positions the file pointer at the end of the file, writes the data using a single system call and closes the file.

If you use this sequence of calls, then you will see the messages appearing at the end of the file, and all will seem to function as predicted. However, it won't work all the time. The weakness is that two processes can simultaneously set the file pointer to the same location at the "end" of the file, and then each execute the `write` system call. One of the processes will succeed in writing data first, carefully placing its data at the end of the file. The second process cannot be aware that the end of the file has now moved and will overwrite the message placed in the file by the first process.

We can cope with this problem by locking, ensuring that the critical section, the `lseek` and `write` calls, is always executed by only one process at a time. But log files are common, and we don't really want to lock them. The 4.2BSD UNIX system overcame the problem by allowing the process to open the file in "append" mode, so all writes to the file are made at the real end of the file. The Berkeley team added a new flag to the `open` system call to specify that the file was to be opened in append mode: You can open a file in append mode by passing a special flag:

```
fd = open(log, O_WRONLY|O_APPEND);
```

The `O_APPEND` tells the system that the file is to be

opened in append mode. What happens now is that file pointer is automatically set to the end of the file in each `write` system call. The `write` call becomes an atomic "seek to end of file and write this." Our logging routine can be:

```
fd = open(log, O_WRONLY|O_APPEND|O_CREAT, 0644);
write(fd, msg, msglen);
close(fd);
```

I have added the `O_CREAT` flag to force the file to be created if it doesn't exist. Again, we have managed to do without locking. Many processes can now write to the log file and use the `write` system call to ensure that their data is written intact.

## Password File Update

There is also a class of applications where it's easy (and perhaps desirable) to enforce the rule that only one process should update the data at any one time. Changing the password file is a good example.

The password file is central to the operation of a UNIX system. On a busy system it is being consulted all the time. Programs use it not only for authentication but also for simple routine operations, like the translation of a UID value that is stored with a file into a printable string. Incidentally, I notice that Solaris 2.5 caches password information in a process called `nscd`, and programs like `ls` talk to that process.

The password file—and its friend, the shadow file, holding encrypted password values—are classical UNIX text databases. Each record is a colon-separated text line, so you need to use line-editing techniques to change it. One way is for a superuser to use the `vipw` program. This takes a copy of the password file (in `/etc/ptmp`) and allows the superuser to edit it using their standard editor taken from the `EDITOR` environment variable. The editor defaults to `vi`, hence the name of the password file editing command. When you exit from the editor, `vipw` makes a syntactic check on the result and if all is well, it uses the `rename` system call to replace the old `/etc/passwd` with the new copy that has been generated.

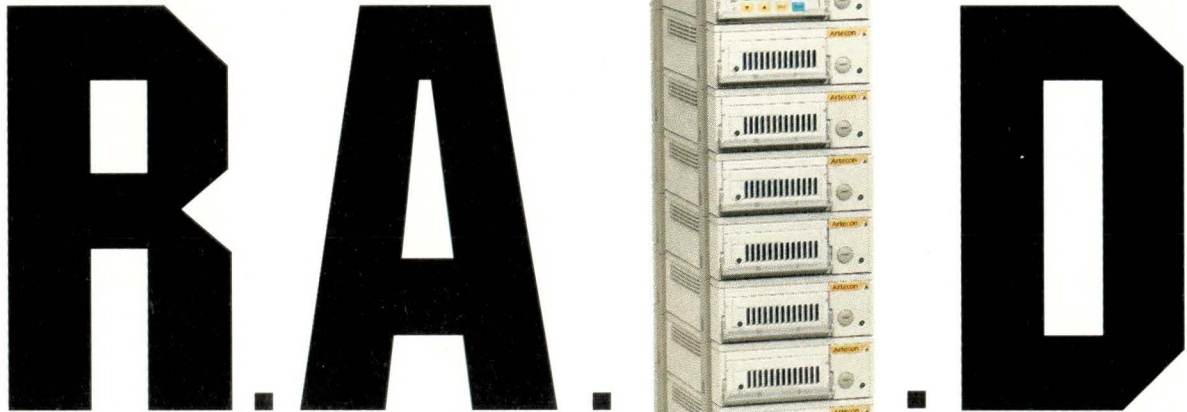
Notice that there's considerable defensive programming here. First, the superuser is not editing the real `/etc/passwd` file, so if there is a disaster with the editor, and we all have those, recovery is immediate. Editing is done on a copy of the original file, and the actual password file is only updated when various checks on the integrity of the data are completed.

Moving the new data from `/etc/ptmp` to `/etc/passwd` could be tricky. After all, we don't want the password file to disappear even for a short period. If it did, then programs that access it would suddenly give inconsistent results. The atomic nature of the `rename` system call ensures that the file doesn't disappear. At one "instant" we have the old data, and after the system call the new data is in place.

There is one further consideration. Let's think about a process that has the `/etc/passwd` open when the `rename` call is executed. The first thing that `rename` does is to delete the old version of the file. It will then `rename` the `ptmp` file to be called `passwd`. However, the old contents of the file will not be expunged from the file system until all the processes

We put the **inexpensive** back in

3-Year  
Controller Warranty



(Redundant Array of *Inexpensive* Disks according to original Berkeley acronym)

Patent #371,768

## LynxStak™ - Maximum performance at a minimum price.

### Inexpensive Cost Per Megabyte.

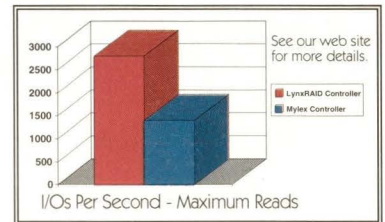
If you need the protection RAID has to offer, but the expense has been holding you back, then Artecon's new desktop LynxStak is your solution. For about the same price as many standard 3.5" drive subsystems, LynxStak gives you all the benefits of RAID. By purchasing the RAID system to fit your needs, you can expand incrementally without the limitations or cost of a pre-configured box. And LynxStak is the only desktop RAID solution that offers the high availability and redundancy once available at the more expensive enterprise level.

### Removable, Redundant and Reliable.

LynxStak gives you the utmost in reliability with features like true hot plug removable disk drives. Independent front-removable power supplies and rear removable cooling fans provide both high availability and easy serviceability. Optional hot plug removable LynxRAID controllers can be configured for dual failover providing you with the extra redundancy needed for mission critical applications. LynxStak supports RAID levels 0, 1, 0+1, 3 or 5 for complete flexibility and optimal performance in your environment.

### Superior Price-Performance.

Don't let the low price of the LynxStak fool you. Exceptional performance and excellent transfer rates are packed into our compact 3.5" form factor. LynxStak outruns the other RAID systems on the market with a 486-DX2 processor resulting in extremely fast transfer rates at all RAID levels. Fast-wide end-to-end interfaces, multiple drive channels and custom ASICs contribute to maximum performance at a minimum price.



### Investment Protection.

With LynxStak, you can incrementally upgrade into the RAID system of your choice as your needs grow. From a single desktop unit to a powerful server configuration, you never sacrifice your original Lynx investment. Desktop RAID systems start at 4GB and can be expanded easily and incrementally to over 100GB. And, LynxStak is compatible with virtually any platform including Sun, HP, SGI, Macintosh and PCs running Windows NT/Windows 95.

**1-800-USA-ARTE**

**<http://www.artecon.com>**

**E-mail: [stakad@artecon.com](mailto:stakad@artecon.com)**

**So call Artecon today and see how we stack up!**

**See Us at Comdex Fall 96, Booth #S7011**

*Enterprising solutions for your enterprise.™*

**Artecon**

PO Box 9000, Carlsbad, CA 92018-9000  
(619)931-5500 FAX (619) 931-5527  
email: [sales@artecon.com](mailto:sales@artecon.com)  
A Member of the Nordic Group of Companies

Nihon Artecon 81-03-5458-8260 ▲ Artecon S.A. France 33-1-6918-1850 ▲ Artecon B.V. 31-53-4832208 ▲ Artecon U.K. 01344 636390

Artecon and the Artecon logo are registered trademarks of Artecon, Inc. All other trademarks are proprietary to their respective manufacturers.

Circle No. 6 on Inquiry Card

that are using it have finished executing. So our process that had the old version of the password file open when the `rename` call happened will continue to see the old data.

Incidentally, if you are a Solaris user, then `vipw` is “deprecated” because it’s in the `/usr/ucb` directory. Also, on my Solaris 2.5 system, the locking techniques used by `vipw` have not been changed to fit in with the more recent mechanism employed by `admintool` and other password editing programs. This is a little naughty of Sun, I feel.

## File Locking

If you start `vipw` twice, you’ll find that the presence of the `/etc/ptmp` editing file is used to prevent the second instance of `vipw` from running. Using a file to prevent multiple occurrences of the same program is a common technique dating back to the earliest UNIX systems. The early kernels did not support file locking, and programmers were forced to improvise, using existing system calls. Lock files were also used to protect critical sections in the code when file access required protection.

The biggest problem with the technique was that lock files could be left lying around if the program crashed and a later invocation of the program would believe that another process was running and owned the file. Because the original owner had died, the lock file was never going to be deleted, and all new invocations of the program would never get the lock until human intervention removed the lock file.

In modern UNIX systems, file locking is implemented in

the kernel. A lock is maintained on an open file by storing locking information with the control data that the kernel retains for the file. The programming interface to the locking mechanism was an area where the POSIX standards team needed to get involved. They had to generate a unified specification because different implementations of file locking had sprung up in the two main UNIX camps, BSD and System V.

POSIX defined that file locking should be done using the `fcntl` system call. Locking may be applied to a user-defined section of an open file, so the mechanism supports record locking. Locks are advisory, meaning that they only work if all the processes accessing the file follow the locking rules. The kernel does not prevent any process from opening a locked file, thus ignoring the locking convention.

Solaris has also inherited the extremely disgusting implementation of mandatory file locking from System V. This utilizes the `setgid` bit on the file. If this bit is set on non-executable file and a locking function is successful, then access to the file is denied for all relevant system calls from any other process. The mechanism is a classic example of market-pushed brain damage.

Locks disappear when the process closes the file, or the process itself terminates. Locks are not passed into a child process when the parent process clones itself by calling `fork`.

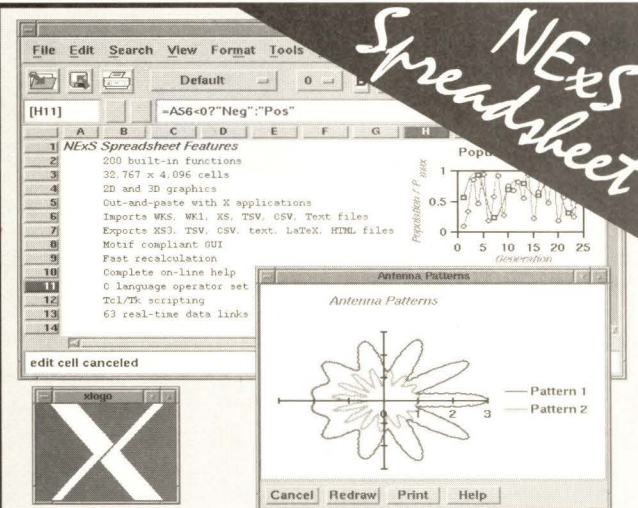
File locks caused a great problem for NFS. The doctrinal philosophy of NFS was that the NFS server does not retain any per-client state for any file that it delivers over the network. This approach does not support file locking, where a process on a client machine on the network can establish a lock on part of a file on the server. Early NFS implementations simply ignored the problem. In fact, the widespread NFS code used in the PC-based derivatives of 4.4BSD does not support locking.

The basic problem is recovery of lock state. What happens when the server goes down? It’s necessary to reestablish locks for remote clients when the server comes back on-line. Sun supports file locking on NFS using a daemon lock manager, `lockd`, running on the NFS server. Recovery of locks is done using the status daemon, `statd`. When the machine restarts, its `statd` process tells all the other `statd` daemons the news that the machine is now running. The `statd` processes on the clients then talk to their own `lockd` daemon, which in turn attempt to reestablish their locks with the server.

## Further Reading

For programming information on file locks, see *Advanced Programming in the UNIX Environment* by W. Richard Stevens and published by Addison-Wesley, ISBN 0-201-56317-7. It’s one of those books that you really need on your bookshelf. ➔

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@cpq.com](mailto:pc@cpq.com).



**FAST** 100% UNIX; no emulators needed!

**FLEXIBLE** Customizable functions and Tcl/Tk.

**POWERFUL** 200 built-in functions and tools.

**CONNECTED** Up to 63 links let NExS share data with other applications over the Internet.

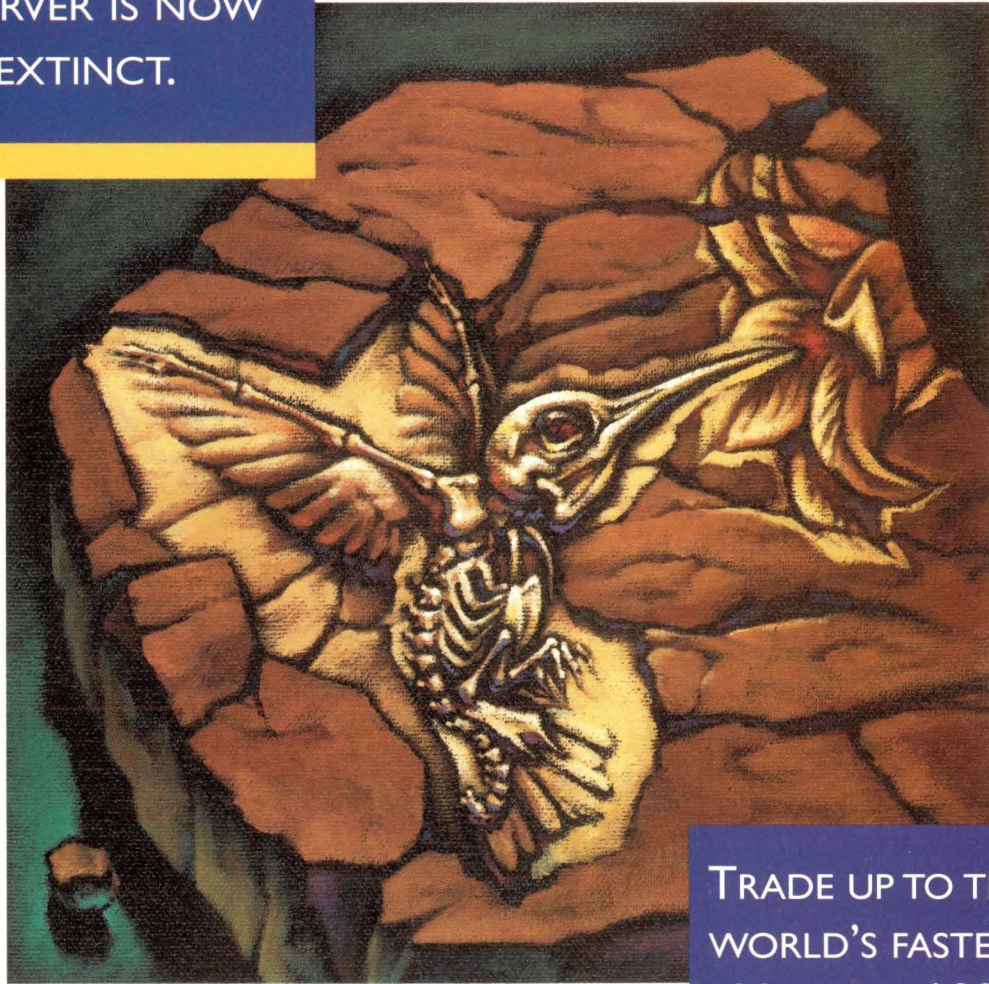
**LOW PRICE** Personal Spreadsheet - \$149  
Professional Spreadsheet - \$249

Download a demo copy of NExS from [www.xess.com](http://www.xess.com)

For Solaris, OSF/1, 800-961-7840  
AIX, HP/UX, Linux 919-387-0076

**XESS**  
Corporation

YOUR CURRENT  
X SERVER IS NOW  
EXTINCT.



TRADE UP TO THE  
WORLD'S FASTEST  
X SERVER. \$98.

**NEW SCO® XVISION® ECLIPSE.  
THE MOST ADVANCED  
PC X SERVER.**

Your current PC X server has fossilized before your eyes. It's been superseded by a competitor that's faster, more powerful, and a whole lot more reasonably priced.

SCO XVision Eclipse is a breakthrough in X servers. A full 32-bit implementation with

unparalleled performance and unique time saving features. Vision Resume allows users to suspend and resume an X session from anywhere on the intranet. SCO® SuperVision™ product

offers centralized management and support with one-stroke file distribution.

**Upgrade today**  
from your current PC X server\*  
**\$98.**

Offer good through 12/31/96

**SCO XVision Eclipse**

- Supports HP-UX®, SunOS®, Sun® Solaris®, IBM® AIX®, SCO® OpenServer®, SCO UnixWare® and many more.
- Designed specifically for Windows® 95 and Windows NT® (3.5 & 4.0).
- Unique time saving Vision Resume technology.
- Powerful Wizards for intuitive host access and configuration.



**SCO**

**1-888-SCO-4YOU**  
[www.sco.com/ad/XVQ197](http://www.sco.com/ad/XVQ197)

\*Proof of replacement required. SCO, The Santa Cruz Operation, the SCO logo, SCO OpenServer and UnixWare are trademarks or registered trademarks of The Santa Cruz Operation, Inc. in the USA and other countries. SuperVision and XVision are trademarks or registered trademarks of VisionWare Limited, a subsidiary of The Santa Cruz Operation, Inc. UNIX is a registered trademark in the United States and other countries, licensed exclusively through X/Open Company Limited. All other brand and product names are or may be trademarks of, and are used to identify products or services of, their respective owners. The Santa Cruz Operation, Inc. reserves the right to change or modify any of the product or service specifications or features described herein without notice. This summary is for information only. SCO makes no express or implied representations or warranties in this summary. ©1996 The Santa Cruz Operation, Inc. All Rights Reserved.

Circle No. 37 on Inquiry Card

## Nifty Hardware

**M**aybe I'm getting jaded, but I am less and less impressed by the offerings at each succeeding UNIX trade show. It's not that the products are poor; quite the opposite, in fact. The products, in general, are well-engineered, reliable and (yawn) more powerful than last year's models.

Unfortunately, it takes more than this to get my interest these days. At the 1996 UniForum, for instance, nearly everyone was showing off disk servers. Even Silicon Graphics Inc., which used to have the best demos around, was showing off a purple relay rack full of tiny 1-GB drives.

Let's face it, once the contest has been reduced to MIPS and megaflops, we might as well go home and read product literature. "Hey, Fred, did you see that Frobozz Industries has a faster disk drive?" "Yeah, looks neat. Are you up for Dim Sum on Sunday?"

So I find it pleasant and satisfying to find that there are still some nifty hardware devices around. Even better, given my limited budget, is the fact that they aren't all that expensive. Let's take a look.

### Real Hardware

If you play Harry Homeowner on evenings and weekends, you probably have a few shelves full of drills, sanders and saws. Do yourself a favor and visit a real tool store (not just the tool department in your local hard-

ware store); you may see some interesting new stuff.

Electrical motor technology has gotten quite a bit better over the last decade or two. Many of the new devices are just as powerful as the old ones, but their lighter weight makes



them less taxing. They also feature variable triggers and other fun stuff.

For the occasional hacking and hewing jobs, I like a reciprocating saw. For grinding off any remaining messes, I use a high-speed 3-inch grinder. My

random orbital sander, which courteously keeps me from leaving gouges, gets brought in to finish things up.

If you are building things to last, spend some money on fasteners. The square-drive stainless-steel screws are strong, easy to drive and won't stain your work over time. If you don't have a good powered screwdriver, get one and save your arm!

*All well and good but what does this have to do with computers?—Editor.* Nothing, just nifty hardware.

### Weather Watchers

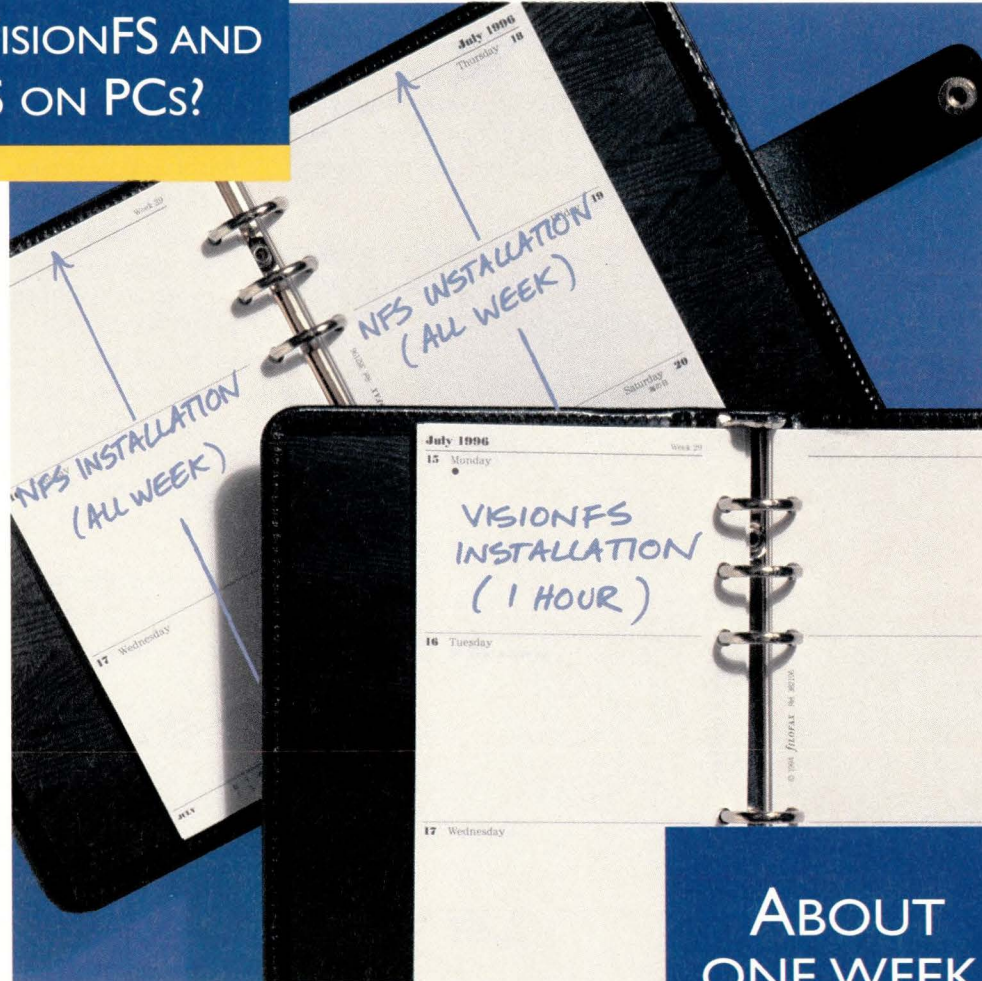
Looking at Edmund Scientific catalogs (<http://www.edsci.com>) and *Scientific American* magazine, I frequently find myself wanting one of those weather stations I see advertised. Unfortunately, the cost has always been too high, in part because it has to have a computer interface.

Recently, however, I broke down and purchased Ultimeter 2000 from Peet Brothers (<http://www.peetbros.com>). This is an economical, yet nicely engineered system. I would recommend it to any home weather hobbyist. The basic system measures indoor and outdoor temperatures, wind speed and direction, and barometric pressure. Optional sensors are available for measuring rainfall and humidity.

The base station has a 2,400-baud RS-232 interface, capable of sending out continuous reports or responding



## WHAT'S THE DIFFERENCE BETWEEN SCO VISIONFS AND NFS ON PCs?



## ABOUT ONE WEEK.

Can you afford a week to install a PC-based NFS® file and print solution on your network? You no longer have to.

SCO® VisionFS™ is server-based. It needs no client installation. Instead of spending 20 minutes on each PC, you spend 10 minutes per server – no matter how many PCs are connected to it. If you have 100 PCs and five servers, you can spend 50 minutes with SCO VisionFS or a whole

week with NFS on PCs. You also save time whenever you upgrade or reconfigure.

SCO VisionFS uses existing networking in Windows® for Workgroups, Windows 95 and Windows NT®. There's no need

### SCO VisionFS

- Server-based—no client installation.
- Supports Microsoft file and print standards.
- Easy to install and administer.
- Supports HP-UX; SunOS; Sun® Solaris; IBM® AIX; DEC® with OSF/I; SCO OpenServer; and SCO® UnixWare®.

to load anything else onto the client. So it's faster than NFS on PCs.

Put yourself a week ahead. Call for your 30-day evaluation of SCO VisionFS or download one from our website.



**1-888-SCO-4YOU**  
[www.sco.com/ad/vfs](http://www.sco.com/ad/vfs)

to outside inquiries. I use the unit in continuous logging mode, letting a small script boil the data down into a compact format. When I have time, I hope to play with display formats on a Web page.

### Call Weighting

Caller ID raises some interesting questions about privacy, politeness and such. Some folks are very nervous

about giving out their telephone numbers to people. I think this is naive. Serious bad guys can find ways of getting phone numbers and even tapping calls; your friends and relatives can't. Besides, if I want to make a really anonymous call, I certainly won't do it from my house.

Some people don't want to answer the phone without first knowing who is calling. This is a bit like installing a

peephole in the front door; it gives the resident a chance to look at visitors before letting them in.

Canta Forda Rancho has adopted this approach, erecting a few small barriers against intrusive calls. We forward all unidentified callers to the answering machine, along with late-night callers who aren't privileged. We also track the numbers of calls we receive, in case we might need them later.

The device we use is called a YoYo. It is a small, inexpensive (\$135), programmable device that attaches to the ADB port of a Macintosh or to the serial port of a Windows 95 PC. It screens and tracks calls, dials, generates custom "rings" and generally helps us manage the phone. YoYo is made by Big Island Communications (<http://www.big-island.com>) and is available through many Mac and PC catalogs.

### Data Storage Bargains

Disk storage devices are an incredible bargain these days. With a bit of searching, prices around \$100 a gigabyte are quite possible. As proof, I point you toward the Iomega Jaz drive and deals from places like the Corporate Systems Center (<http://www.corpsys.com>).

The Jaz is a hard disk drive with a small removable cartridge—about the size of a single pack of playing cards. The cartridge comes in 500-MB and 1-GB versions, at around \$60 and \$100, respectively. The drive and a 1-GB starter cartridge can be obtained for \$450 if you look around a bit.

The Jaz has quite reasonable performance numbers, offers built-in termination and arbitrary ID settings, and uses a (Sun-style) 50-pin Micro-D SCSI connector. What are you waiting for?

If you're looking for a lot of hard disk space at a really great price, consider getting a remaindered full-size 5-inch hard drive. Despite many users' demands for smaller (3-inch and smaller) drives, there is still a demand for large capacity disk drives. At this writing, the top of the line is about 9 GB.

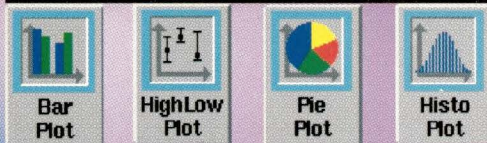
Soon, however, the next generation will appear, leaving the current high-end drives behind. Too big and heavy to please the office market, not powerful enough for the high-end server crowd, these drives will languish on

## THE WIDGET LIBRARY EVERY DEVELOPER NEEDS

### Geometry Managers and Containers



### Business/Scientific Graphs



### Resource Editors/Controls



Take charge of the appearance of your Motif applications with EnhancementPak™ a rich, intuitive set of 27 versatile, well-tested and supported widgets that let you create powerful GUI applications with ease and speed.

### The ICS EnhancementPak offers:

- 27 rich Motif widgets
- Windows®-like look-and-feel
- Integration with ICS' Builder Xcessory™ and other popular builders
- Proven in hundreds of large-scale projects

**800.683.5023**



Integrated Computer Solutions

201 Broadway  
Cambridge, MA 02139

617/621-0060  
Fax: 617/621-9555

To get a free 30-day evaluation or learn about EnhancementPak call us or visit our web site.

e-mail: [info@ics.com](mailto:info@ics.com)  
WWW: <http://www.ics.com/>

EnhancementPak is a trademark of ICS, Inc. ©1996 All other trademarks are the property of their respective companies.

Circle No. 21 on Inquiry Card

the disk makers' shelves.

Eventually, they will be sold to outlets such as the Corporate Systems Center, and folks like me will snap them up. Lately, I've been buying ST43400N drives. These are nice drives (10-msec access time, 2,900-MB, 5,400 rpm, AV-compliant, SCSI-2). But, because they are last year's model, CSC can sell them for \$339 each.

### Text Scanning by Hand

I'm not a very fast typist and I really despise data entry. I am therefore happy to report that there is a pretty sanitary way to get around this kind of effort. Image Recognition Integrated Systems (<http://www.irisusa.com>) calls the IRISPen a "pen-size OCR scanner." Actually, it's a bit large and lumpy to be used as a pen, but it is quite comfortable as a hand-operated scanner.

On a Mac, the IRISPen acts like a second keyboard: scanned text is dropped into whichever application is "active."

This even works with X-based rlogin sessions, allowing me to scan text

straight into vi. And because I get to decide which text to scan, I don't have to edit the scanned text to discard unwanted or disordered items. Très cool!

Although the device *does* have a bit of a learning curve, I was able to

**Lately, I've been buying ST43400N drives. These are nice drives. But, because they are last year's model, CSC can sell them for \$339 each.**

become reasonably proficient with it in just a few minutes. With practice, my speed and error rate improved to quite acceptable levels.

The IRISPen isn't cheap, but the pricing is not at all unreasonable. There are versions for MacOS (serial

port, \$279) and Windows (parallel port, \$249). If you need this sort of thing, the price and learning curve will be well-rewarded.

### Digital Snapshots

There are a good number of inexpensive digital cameras being made these days. I have a QuickTake camera (Apple Computer Inc., <http://www.apple.com>) and a couple of QuickCams (Connectix, <http://www.connectix.com>) in both monochrome and color versions. If you are putting together Web pages, these devices are invaluable. You can also use the QuickCam to play with videophone technology. Fun stuff. →

Richard Morin operates Prime Time Freeware ([ptf@cfc1.com](mailto:ptf@cfc1.com)), which publishes mixed-media (book/CD-ROM) freeware collections. He also consults and writes on UNIX-related topics. He may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at [rdm@cfc1.com](mailto:rdm@cfc1.com).

### RAID SUBSYSTEM FROM UNI SOLUTION, INC.

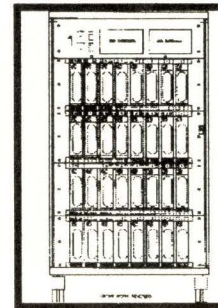
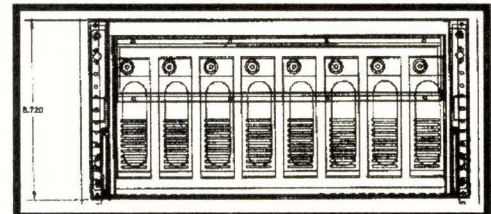
Uni Solution has designed an exceptionally modular, flexible and expandable RAID subsystem. You can change components by simply snapping in devices, fans and power supplies without ever having to power down the system.

- \* Formatted capacity from 4 GB to 112 GB
- \* 32-bit RISC CPU-based System Architecture
- \* Up to 2800 IOPS and 36MB/sec sustained throughput
- \* Up to 512 MB of R/W cache for maximum performance
- \* Hardware-based RAID levels 0, 1, 0+1, 4 and 5
- \* Hot Swap ("Replace Under Power") Capabilities
- \* Redundant Hot-Swap Cooling & Power
- \* Disks can be removed and replaced in any order
- \* Transparent operation - no software driver
- \* Multi-platforms including Sun, DEC, HP, SGI and Novell

For current pricing and more information call 1-713-552-0505.

### DISK STORAGE AND DISK SUBSYSTEM

With formatted capacity ranging from 500 MB to 9 GB, average seek times as fast as 8 msec, and a full five year warranty, our drives offer an exceptionally fast, reliable, and affordable storage solutions for your workstations. We will format, label, partition and test every disk drive that we sell. We can also provide custom disk enclosures (desktop, tower, or rackmount) to meet your requirements and complement your existing systems.



Hard Drives  
Tape Drives  
Optical Drives  
Memory SIMMs  
RAID Subsystem

**For All Your Workstation & Storage Needs**



→ Toll Free Support  
→ 30 Day Money Back Guarantee  
email: [unisol@ix.netcom.com](mailto:unisol@ix.netcom.com)

**Uni Solution, Inc. 1-800-552-4UNI**

Circle No. 45 on Inquiry Card

## Your Security Tool Chest

**L**ooking for tools to help you secure your network? There is an absolute wealth of software available today to help secure and protect your systems. So much software, in fact, that one of the hardest things might well be figuring out which tools to use. You are likely to find everything you ever wanted to know about security and more—maybe far more—just by running a search using your Web browser. And you'll find more tools than you'll ever have time to try.

It is a good idea to be a little cautious about where you get your tools because it is not at all unlikely that you will stumble upon some impostors out there built by unscrupulous individuals who believe themselves clever for creating them.

Let's investigate one great Web site that I've run into and look at some tools that are highly recommended.

### Nice Information Here

One of the best sites I've encountered is <http://www.alw.nih.gov/Security>. This is a good site if you want extremely useful descriptions of tools for just about every aspect of computer security, along with papers, FAQs and advisories. Though I'm sure there are many sites that provide summaries and security tools, this is about the best organized I've encountered.

There are 10 categories used at this site. Each is described here.

- **Frequently Asked Questions (FAQ)**—A FAQ is a summary document that describes a particular topic in a question and answer format. FAQs are written by knowledgeable people and generally provide both introductory (e.g., What is ...?) and more advanced (e.g., How does this work with ...?) topics. At the National Institutes of Health site, you will find everything

**letters**—These ezines provide fairly timely information on system security.

- **Groups and organizations**—Computer security organizations that exist to provide users with information.
- **Mailing lists**—Email lists that consist of a dialogue on a number of security-related issues.
- **Newsgroups**—Newsgroups that provide information on some area of computer security. Some are more focused and timely than others.

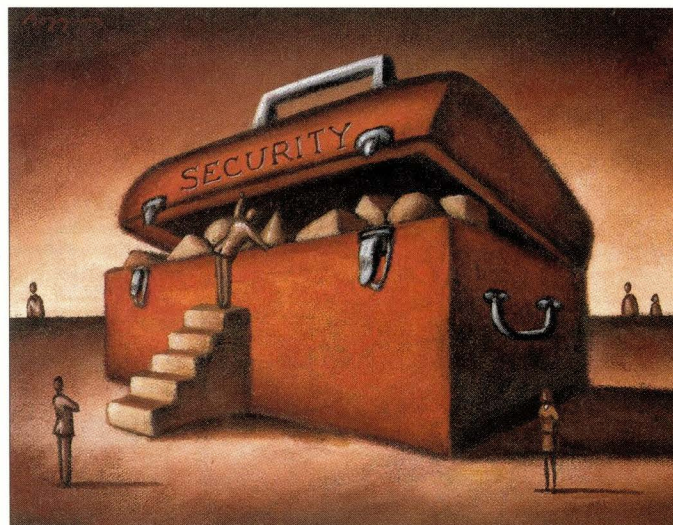
- **Programs**—A great synopsis of tools available to improve security of a system or network, broken into the following areas:
  - authentication and encryption
  - firewall
  - network and network monitoring
  - system enhancement
  - system monitoring

- **Request for comments (RFCs) on computer and network security**—Documents detailing proposed computer and network security standards.

- **World Wide Web sites**—Other WWW sites that contain or point to further useful information about system and network security.

### A Sampling of the Best

In the area of authentication and encryption, you should consider having both Pretty Good Privacy, or PGP (some versions are export restricted), and One-time Passwords In Everything,



from basic computer security to discussions on Java security.

- **Advisories**—Advisories provide information about security vulnerabilities along with ways to remove or reduce the threat.

- **Documents related to security**—Most of these are extremely good. Some are a little dated but still contain many useful insights and suggestions.

- **Electronic magazines and news-**

or OPIE, on hand.

PGP is a good tool for enhancing privacy on your systems. Even if your employer and the government aren't making your users' privacy important, you can provide a way for your users to have a practical level of privacy. PGP is a widely used tool for performing public key encryption and managing the associated keys.

OPIE is a one-time password system. Even if you don't want to go to this level of security now, you might consider having this tool on hand in the event of a break-in so that you can thwart anyone trying to use stolen passwords.

Two of the tools that are used with or to create a firewall are SOCKS and TCP Wrappers. SOCKS allows a number of Internet services (e.g., gopher, ftp and telnet) to be used through a firewall. TCP Wrappers provides access control for a number of services that do not provide any control themselves. You can restrict who can use the `finger` command, for example, by host. It also provides logging information on wrapped services that can be used to monitor their usage.

For network and network monitoring programs, take a look at SATAN, Courtney and ISS (there is both a free and a commercial version). SATAN looks for a known set of security flaws. Courtney looks for evidence that SATAN is being used against you (and requires `tcpdump`). ISS checks a range of IP addresses for known security problems in sendmail, NFS, anonymous ftp, etc.

System enhancement programs include the old standards like crack, which tries to crack passwords (and should be run at nonbusy times) and portmapper, which reduces the vulnerabilities of portmapper and disallows proxy access. Replacing sendmail with the recommended version is an all-time must. The sendmail program is probably the singularly most vulnerable piece of software in UNIX.

System monitoring programs include tools like COPS, which looks for security problems on a single UNIX system, and Tripwire, which watches for changes in binaries. Tiger is similar to COPS and has a number of additional features worth looking into.

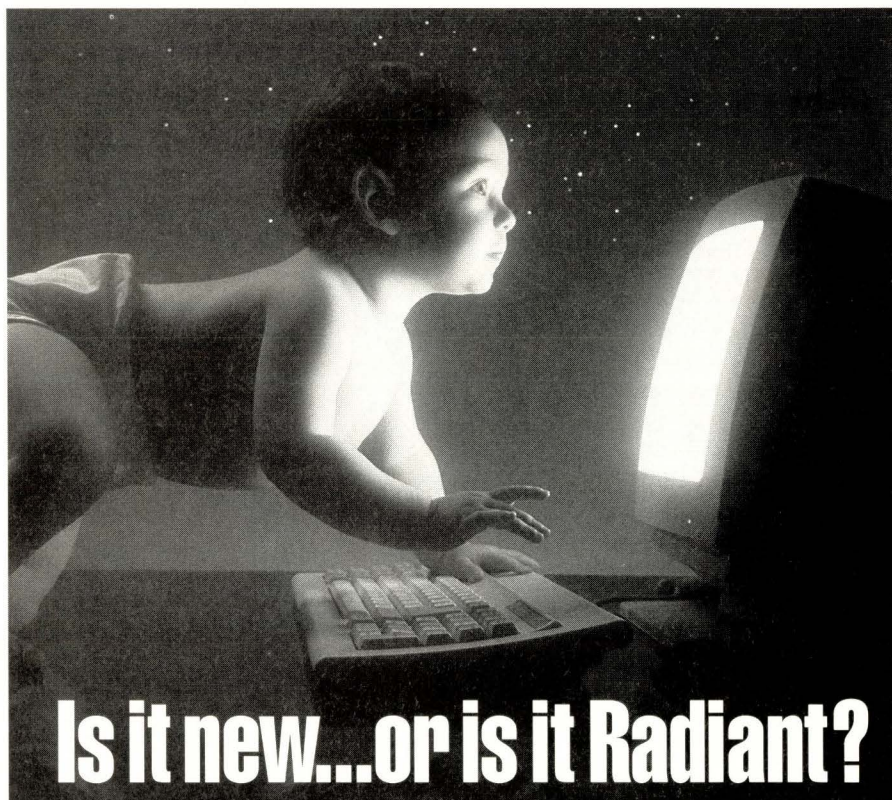
Don't forget the `aset` tool in Solaris, which can monitor and improve system security by running a check at one of three levels you select.

### Ask Yourself

What tools do you have to enhance and monitor security? Do you use them routinely? Could you use them effectively with little notice? Don't let the plethora of available tools keep

you from getting and using some of the best. →

S. Lee "slee" Henry is on the board of directors of the Sun User Group and is a UNIX and networking consultant at TASC in Reston, VA. She is also a part-time adjunct professor teaching graduate classes in computer security.



## Is it new...or is it Radiant?

### The only difference is the price!

Now you can breathe new life into your operating budget with repowered equipment from Radiant. Because Radiant delivers the same powerful performance you get from new—for a lot less money.

And we do it with hyper speed. "Immediate delivery" gets you on-line in no time, with a top quality system that looks and performs exactly like new.

Even our warranty is as good—or better—than brand spanking new. With an overnight replacement guarantee—for *absolutely any reason*. And on-site technical support any time that you need it.

Only the price brings the difference to light—up to 50% less than new!

So take a giant step up to Radiant new... and milk the difference for all its worth!

 **Radiant**  
Resources, Inc.

**Repowered Computers  
For The Next Generation**

15 Southwood Drive, Morris Plains, NJ 07950  
201-984-2120 FAX-201-984-1464  
sales@radiant-resources.com

**Call Toll-Free—800-500-7675**

Your Leading Provider of Repowered Computer Equipment • Sun • Sun Compatible • Hewlett-Packard

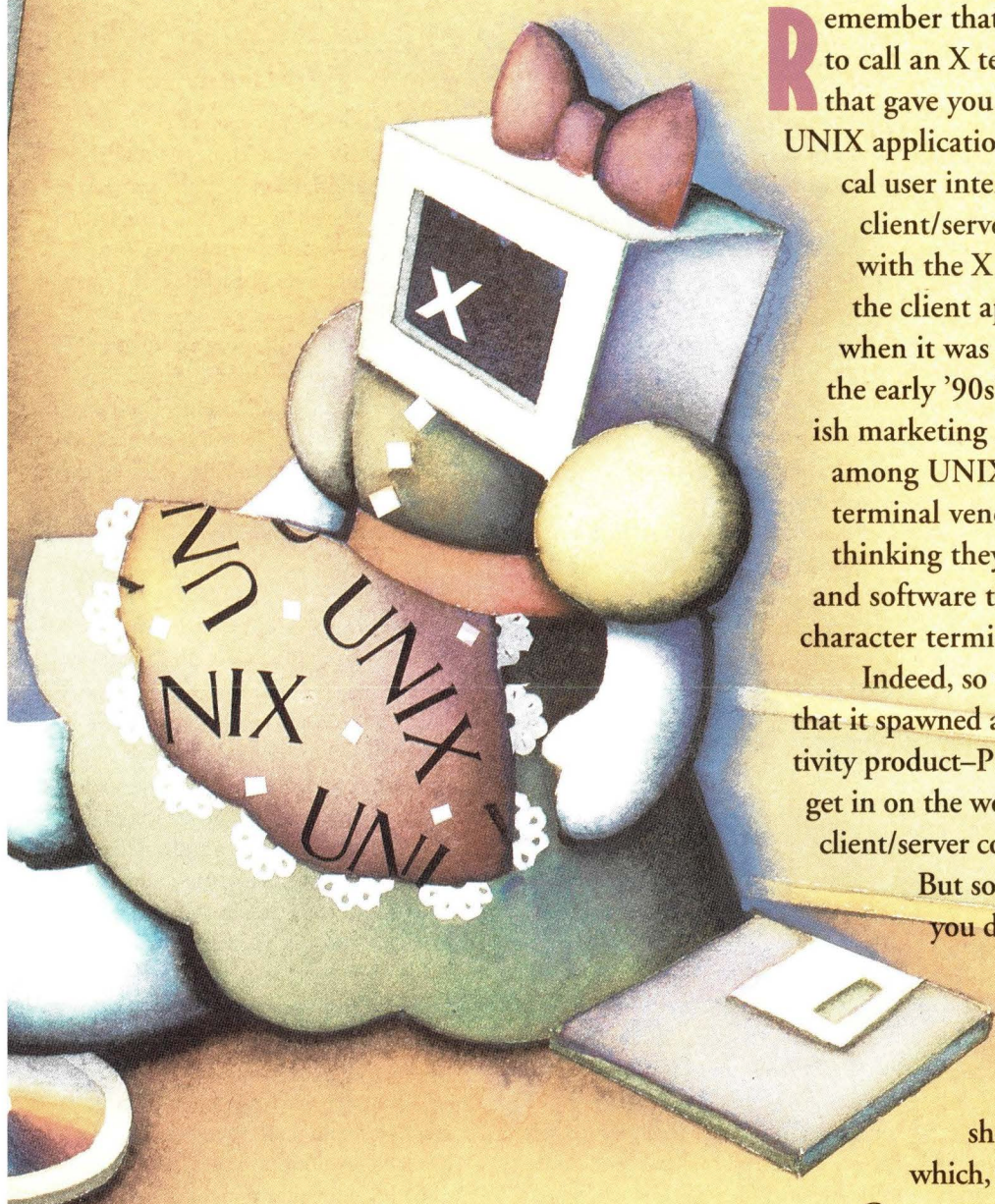
Circle No. 31 on Inquiry Card

# New Garb for



# X Terminals

Can X terminal vendors boost sales by dressing terminals in the latest network computing fashions?



Remember that desktop device they used to call an X terminal? You know, the one that gave you speedy access to your UNIX applications from a nice crisp graphical user interface? The one that fit the client/server model (but backwards, with the X server on the terminal and the client application on the host) when it was just coming into fashion in the early '90s? How about all the feverish marketing maneuvers five years ago among UNIX systems suppliers and terminal vendors, many of the latter thinking they'd found the hardware and software that would save them from character terminal oblivion?

Indeed, so useful was the X protocol that it spawned a new PC-to-UNIX connectivity product—PC X servers—to allow PCs to get in on the wonderful world of shared client/server computing.

But something happened. Today, you don't hear vendors utter the letter X very often (and you almost *never* heard Sun utter it). However, you do hear them fairly shout two letters: N and C, which, of course, stand for Network Computer. This is what the X terminal

by John S. Webster

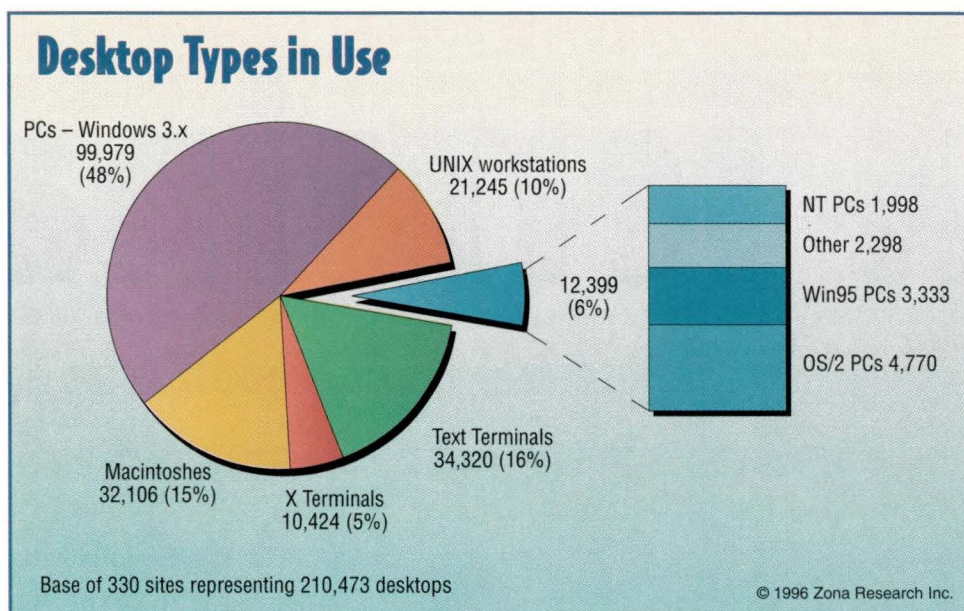
world has come to, and what is being viewed by many terminal vendors as the Second Coming, the savior that will once again allow them to move their products in earnest.

The promise is what the buzzword coiners call "universal access" to not only UNIX applications on the network, but also Microsoft Corp. Windows and Windows NT applications, Internet/intranet services using a Web browser, Apple Computer Inc. Macintosh applications and even Java applets and the Java Toolkit, all from one device.

And while X still pops up in NC discussions with industry analysts, they also point out that the health of the X terminal market has declined rapidly during the ongoing explosion of Windows applications on the corporate desktop, and they note the waning interest in UNIX among many IS managers.

"X terminal sales hit the wall in 1994 because the vendors erred in being so heavily tied to UNIX and by not providing Windows access," says Eileen O'Brien, an analyst at International Data Corp., Framingham, MA.

As usual, the numbers tell the story. According to IDC, 278,000 X terminal units were shipped worldwide in 1994. In 1995, that number dropped by more



It became increasingly difficult to make this known to a business community bombarded by (and buying by the crate-load) Windows and Windows NT.

Earlier this year, however, a combination of technological developments converged: Use of the Internet/intranet exploded in businesses; X terminal and workstation vendors licensed en masse technology from Citrix Systems Inc., Coral Springs, FL, whose products, based on the company's ICA protocol, allow X devices to access Windows applications (see "Citrix' ICA Is Everywhere X Is [Almost]"); and Sun Microsystems Inc.'s Java programming language created a big fuss in the corporate community.

Because vendors expect the NC devices to cost less than \$1,000, they are targeting the home consumer market as well as the commercial desktop. Products complying with the specification guidelines will carry an NC1 brand.

According to the group's literature, those specifications comprise general hardware guidelines, Internet protocols, World Wide Web features, email protocols, common multimedia formats, boot protocols and security features (see "Elements of the Profile").

### Whither the X Terminal?

Significantly, the NC specification builds on the innards of an X terminal and provides X terminal and workstation vendors with a second wind in their efforts to proffer a desktop device that gives users access to a variety of applications and operating systems.

Manuel Roy, for example, IT supervisor for the Southern Region at Blue Cross and Blue Shield, Miami, FL, oversees what is primarily a Windows shop and wants to access both SNA mainframe applications and Windows applications on the server. He's going to try to do that with NCs.

"I call the NC a schizo machine because it can do so many things. We want to revolutionize the desktop, and the NC is the machine that can do that," he says.

Roy explained that the health care giant had looked at X terminals in

## The NC specification builds on the innards of an X terminal and provides X terminal and workstation vendors with a second wind.

than 40,000 to 236,000 units. Putting X on PCs, however, continued to become more popular, with shipment figures climbing from 460,000 to 655,000 from '94 to '95, reflecting the ever-growing presence of PCs and Windows on the client/server network.

So over the past several years, X terminal vendors and systems suppliers saw a shrinking demand for their X devices, despite what is widely acknowledged as an efficient, cost-effective way to provide access to UNIX from the desktop.

As a result of these market influences, an unlikely alliance between Sun, IBM Corp., Apple Computer Inc., Oracle Corp. and Netscape Communications Corp. produced the Network Computer Reference Profile, announced with much fanfare in May. The specification is intended to bring to market a desktop device that offers graphical windows into a variety of legacy, UNIX and desktop applications, as well as access to the Internet and Java, from a single box.



# Serve Up Multi-Platform Development with TeleUSE

## A Recipe for Success

The TeleUSE Enterprise family of products supplies you with all the key ingredients you need to easily design, develop and maintain your graphical user interface across multiple platforms. Whether your palate leans toward OSF/Motif or Windows 32bit environments, TeleUSE delivers.

A superior object-oriented GUI development environment, TeleUSE is based on the CDE and CORBA standards, making it simple to reuse and maintain code while shortening development cycles and increasing productivity. TeleUSE allows you to build GUI components that are readily distributed across ORBs.

## A World Class Offering

The TeleUSE family includes TeleUSE/DB, which dramatically reduces the time required to build

relational database GUIs; and TeleUSE/Win, which allows you to develop, deploy and maintain applications on UNIX or Windows NT. With TeleUSE/Win, you can add native Microsoft controls, such as OLE DDE's and OCX toolbars, to your application. A la carte items in the toolkit include KL Group's XRT widgets.

## TeleUSE Express

TeleUSE supports rapid prototyping of design and application ideas. But TeleUSE leaves you with more than just a taste. Unlike other products, TeleUSE enables you to reuse your prototype code in your final application.

## Icing on the Cake

Call today to receive your **FREE** copy of our white paper *Managing Multi-Platform Development*.

**CALL 1-800-833-0085 x244**

ReUSE with TeleUSE

**THOMSON SOFTWARE PRODUCTS**

10251 Vista Sorrento Parkway / San Diego, CA / 92121

Phone: 619-457-2700 Fax: 619-452-1334 e-mail: info@thomsoft.com

WWW: <http://www.thomsoft.com>



"TeleUSE ... the most full-featured tool we looked at, and it is definitely the most impressive."

- UNIXReview



the past, but because he considers his environment more Windows than UNIX, did not purchase an X terminal. But the added flexibility of the NC-compliant terminals, with access to Windows via WinFrame, coupled with Microsoft's intention to allow SNA access with Microsoft Internet Explorer, made it much more attractive. He now plans to replace the company's PCs and dumb character terminals with NC terminals.

Says Roy: "For a CRT user to get imaging, fax and CD-ROMs, in addition to Windows applications, in a graphical way from one desktop, they usually say, 'Why didn't you give me this sooner?'"

At once a founding member of the NC1 alliance and a company with a big stake in the client/server UNIX market, IBM, which at one point offered a line of X terminals, recently announced an NC, the IBM Network Station, codeveloped with Network Computer Devices Inc., Mountain View, CA, itself an X terminal front-runner and now an NC maker. Not only does IBM want to give its customers continued access to its own legacy applications in the workplace, company officials also say that IBM wants to keep pace with developments in the browser arena and with Java.

"Some of our engineers saw a demonstration of NCD's NC terminals and thought that type of device would fit in well with our customers' need to access installed 3270 and 3250 legacy applications, and to preserve those legacy applications, as well

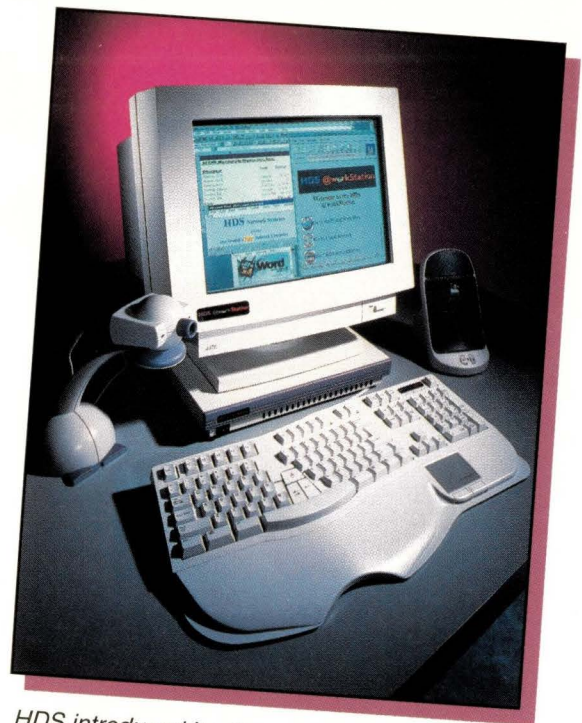
as to accommodate future browsers, Java and Internet/Intranet," says Stephen Dahl, lead engineer for Network Station at IBM's AS/400 division in Rochester, MN.

Dahl explains that the ability to provide through a graphical interface a link to Windows applications on a server, Java inside the box and the intranet was very attractive to IBM.

"On an NC running Citrix' software, users can run transaction processing type applications periodically, and also get into their word processors and spreadsheets. You can accommodate the old applications and have connectivity to new software," Dahl says.

Adds Lou Greer, vice president of marketing at NCD: "Instead of saying, 'How do I change the network to accommodate universal access?' we say use what you already have in place. Accommodate what's in the room, instead of emptying the room and starting over."

In other words, most companies have to live with their legacy systems, and one of the NC's selling points is that it will let these companies access existing 3270 data, for example, as well as newer Windows or Internet-based applications and data.



HDS introduced its @workStation in June, leading the pack in bringing to market a Network Computer.

### Serving up the Net

The real catalyst in bringing about the birth of the NC is the same force that is changing the face of business and personal communications around the globe—the Internet. Now that the corporate network is becoming increasingly intertwined with the Internet to form a company's intranet, the utility of having one device to access those services alongside network application becomes increasingly obvious.

"The most significant event [leading up to the NC spec] was the growth of the intranet over the last year," says Michael Kantrowitz, executive vice president at X terminal/NC manufacturer HDS Network Systems Inc., King of Prussia, PA.

"What people want to do is access databases, for example, and they want to do that now through a browser to the intranet. They want a desktop device that can not only do their word processing and spreadsheets, but also can access all types of computers and applications by combining the network and the Internet," Kantrowitz says.

Internet market analysts agree that the Internet has helped raise the level of awareness among corporations for remote access of server-based appli-

## Worldwide X Terminal Shipments

Vendor	1994 units	Share%	1995 units	Share%	Growth
HP	69,903	25.1	59,784	25.4	-14.5
NCD	69,275	24.9	57,179	24.2	-17.5
Tektronix	34,511	12.4	46,861	19.9	35.8
SunRiver	9,666	3.5	13,562	5.8	40.3
IBM	19,885	7.2	13,441	5.7	-32.4
DEC	25,300	9.1	12,725	5.4	-49.7
HDS	9,994	3.6	11,965	5.1	19.7
Other	38,465	14.2	20,313	8.5	-48.5
<b>Total</b>	<b>276,999</b>	<b>100</b>	<b>235,313</b>	<b>100</b>	<b>-15.2</b>

Source: International Data Corp.



## DATA STORAGE PROBLEMS MAKING YOU NEGLECT SOME OF YOUR FRIENDS?

Spending long hours trying to make your current storage and backup system meet increasing data and end user demands? There's a better way — automated DLT tape libraries from ATL Products, the DLT automation leader.

DLT tape libraries from ATL Products can handle your storage and backup needs today *and* tomorrow. ATL tape libraries provide field expendability from

560 GB to 9.24 TB and throughput rates up to 162 GB per hour, as well as the convenience of unattended operation and unsurpassed reliability.

That's why ATL automated tape libraries should be your first choice for your storage and backup solution.

So, get a life! Call today for more information and the name of the ATL storage expert in your area.



**Two Million MSBF**

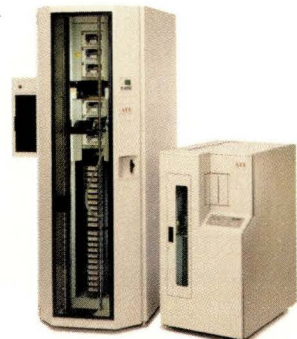
ATL Products, the market leader in automated tape library technology, continually sets the standard for the industry. Many claim to meet ATL's reliability, but only ATL has the documentation to back it up. Find out for yourself, call today for your copy of the ATL Reliability White Paper. And, see what all the others can only hope to achieve.

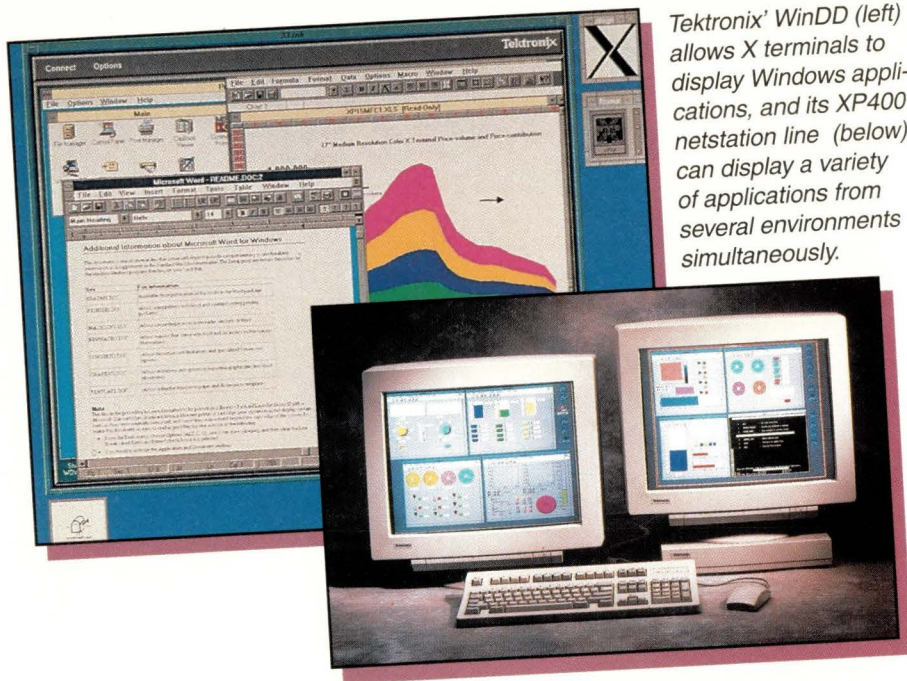
# ATL

Quantum®

1515 S. Manchester Avenue, Anaheim, California 92802 USA  
800-677-6268 714-780 7790 <http://www.atlp.com/>

Circle No. 7 on Inquiry Card





Tektronix' WinDD (left) allows X terminals to display Windows applications, and its XP400 netstation line (below) can display a variety of applications from several environments simultaneously.

cations. "The Internet created an environment for accessing applications that don't reside on the desktop. There's much more awareness of that due to the Internet's presence," says Greg Blatnick, analyst at market research firm Zona Research Inc., Mountain View, CA.

Interestingly, Zona Research was for years the premier X market research firm (as The X Business Group), and it now tracks the Internet, intranet and related technologies.

As X went, so went The X Business Group.

### Did Someone Say 'Where's X?'

It's clear that the Internet was the watershed event that spurred the initial development of the NC1 specification (the number "1" in its moniker should say something about the group's plans to accommodate future technologies) and what's equally evident is X terminal growth was greatly hampered a couple of years ago by the glaring omission of Windows access. While this handicap was resolved by several vendors' products—among them Beaverton, OR-based Tektronix Inc.'s WinDD and Insignia Solutions Inc.'s NTrigue, both of which allowed the X device

to display Windows applications—the truth of the matter is the NC is very much an X terminal with a slew of additional technology thrown on top.

Therefore, even though X terminal vendors had some trouble espousing the virtues of their machines to an increasingly Windows-dominated business community (and thus X remained a behind-the-scenes component in the UNIX marketplace), X is still very much alive in what is shaping up as the NC marketplace.

Much has been written and spoken about NC being the death of the X terminal, but discussions with an array of

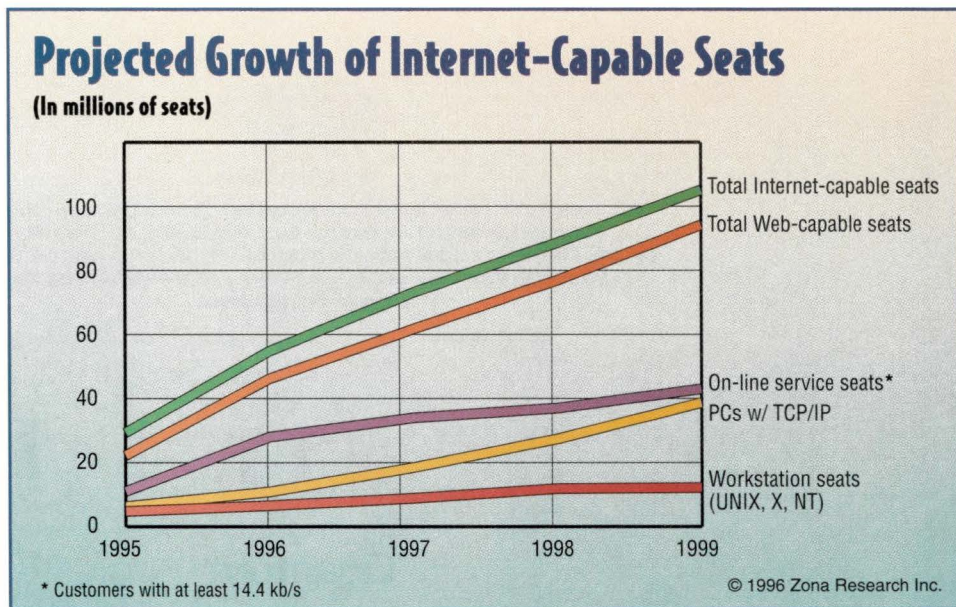
vendors, analysts and users reveal that at least the X Window System and NCs can coexist very peacefully.

Going back more than 10 years to its origins at the Massachusetts Institute of Technology and the first iteration of the X Consortium, the graphical communications protocol called the X Window System was kept under the protective wraps of academia and those few technical arenas that respected where it came from.

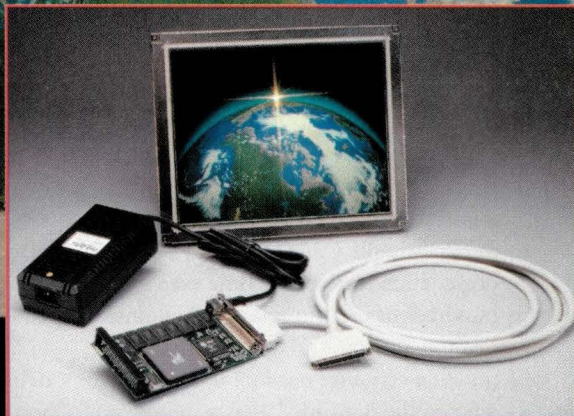
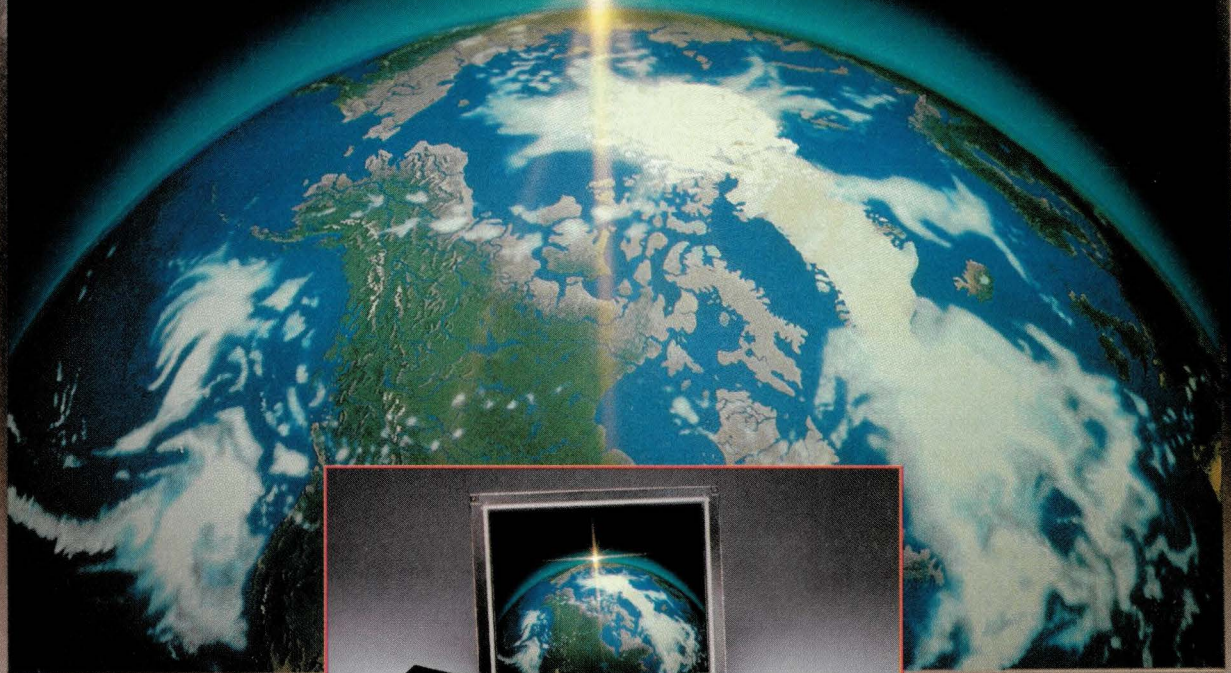
But the functionality of the protocol was too great for its technological light to be kept shrouded, and sure enough it slowly seeped into the commercial marketplace. But IDC's O'Brien says that X is still the "best-kept secret" in the NC specification. In other words, the X protocol is almost always provided in the NC for graphical communication with UNIX applications, even though it is not part of the NC Reference Profile, nor is it trumpeted by vendors.

Furthermore, it is quite apparent that X isn't going away anytime soon. Its new guardian, The Open Group, will continue its development in its Internet version, currently referred to as Broadway. NC vendors, too, point out its continued role in accessing UNIX applications on the server, and working in concert with other communications protocols and software running on the devices.

X terminal stalwart Tektronix, for example, sees the NC as a contiguous



# Make Your Sun Shine Like Never Before.



The **SunScreen™** Flat Panel eclipses the competition in providing the most advanced Digital Technology Displays for the Sun® workstation. The 1280 x 1024 AMLCD screen delivers a brilliant, sharp, jitter-free image, ideal for any application where a 13" or 16" flat screen monitor is required.

This Display Solution is fully S-Bus compatible and works with even the latest Sun UltraSPARC™ processors. The **SunScreen™** display is available as a stand-alone display, custom packaged, or as a kit for integration into your system.

Contact Aydin today to see how bright we can make your future. 1-888-AYD-EAST.

**AYDINDISPLAYS**

414 Commerce Drive • Fort Washington, PA 19034-2699 USA  
Toll Free 1-888-AYD-EAST (or) 1-888-293-3278 • (215) 542-7800 • FAX: (215) 542-8447  
Email: sales@aydin.com • Aydin Home Page: <http://www.aydin.com>

Circle No. 11 on Inquiry Card

extension of the X desktop, with all the added benefits of the software technologies that the NC1 specification denotes.

"The product that was once called an X terminal has been transformed into a device that accesses any data type on a variety of different hosts. Not just UNIX, but IBM 3270 legacy apps, DEC hosts and the Internet, for example," says Lee Rainey, director of product marketing for the storage and networks business at Tektronix.

Adds HDS' Kantrowitz: "The NC Reference Profile specifies a standard for a new generation of network devices used for accessing [network resources, including] HTML pages using a Web browser and Java. A number of companies are also meeting that on the workstation level by implementing X and providing a built-in Web browser, Java, Windows access, terminal emulation—basically making up the universal desktop."

So the X terminal has evolved from the device of choice for many corporations for economical and graphical access to server-based UNIX applications, to, the NC vendors hope, the device (including the X protocol) of choice for accessing not only UNIX applications, but also legacy, Windows and Mac applications, as well as Internet services. Some vendors see this approach as a means to best use the technologies that exist on the typical heterogeneous corporate desktop, rather than ripping out the existing desktop and replacing it with a homogeneous client/server topology. The latter is, of course, simply impractical if not impossible.

Interestingly, that's exactly why IS managers placed X terminals on users' desks. And why many of these managers are now interested in Network Computers. For example, Frank Newman, a consultant at MacDill Airforce Base, Tampa, FL, says users of 400 NCD X terminals at the base are accessing a variety of Windows and UNIX applications on servers connected via a 10BaseT network.

"One of our goals was to run multiple applications on just one terminal, which would interface with UNIX and Windows NT. We didn't know what

## Elements of the Profile

**T**he NC Reference Profile 1 covers general hardware guidelines, Internet protocols, World Wide Web standards, email protocols, common multimedia formats, boot protocols and security features.

- **Hardware guidelines:** minimum screen resolution of 640-by-480 (VGA) or equivalent, a pointing device (mouse or trackball) text input capabilities and audio output.
- **Internet protocols:** Transmission Control Protocol, File Transfer Protocol, optional support of NFS to enable low-cost, medialess devices while allowing for persistent storage in the network and SNMP, a protocol enabling the distributed management of devices.
- **WWW standards:** HTML, HTTP and the Java application environment.
- **Mainstream protocols:** SMTP, IMAP4, POP3.
- **Multimedia formats:** JPEG, GIF, WAV, AU.
- **Security standards:** ISO 7816 SmartCards and the Europay/MasterCard/Visa (EMV) specification.

The entire NC Reference Profile 1 draft can be viewed at <http://www.nc.ihost.com.-jsw>

the future would hold, but we did know that the X terminal would be flexible," Newman says.

From the NCD X terminals, which are running Citrix WinCenter, users at the base can access Microsoft Office, Delrina Forms, Verity Topic and Netscape 2.0, as well as custom UNIX applications.

"The simplicity, security and minimal degradation in response time even with hundreds of users in multiple buildings tied together by FDDI make the X terminals a very nice option for attaching users to the network," Newman says.

### So Is It an X terminal, or Is It an NC?

The question remains: Is it an X terminal if it complies with the NC specification? Well, yes and no. Most X terminal vendors will not be selling anything called an X terminal anymore, in part because they had already realized they need to add more functionality (in some form of Windows access, at least) and couldn't rely merely on the merits of X to sell the product.

But because they are in reality adding features and functionality to what was once an X terminal, even if they add every NC feature specified in the Reference Profile, they're still selling what has become, in simple terms,

a beefed-up X terminal.

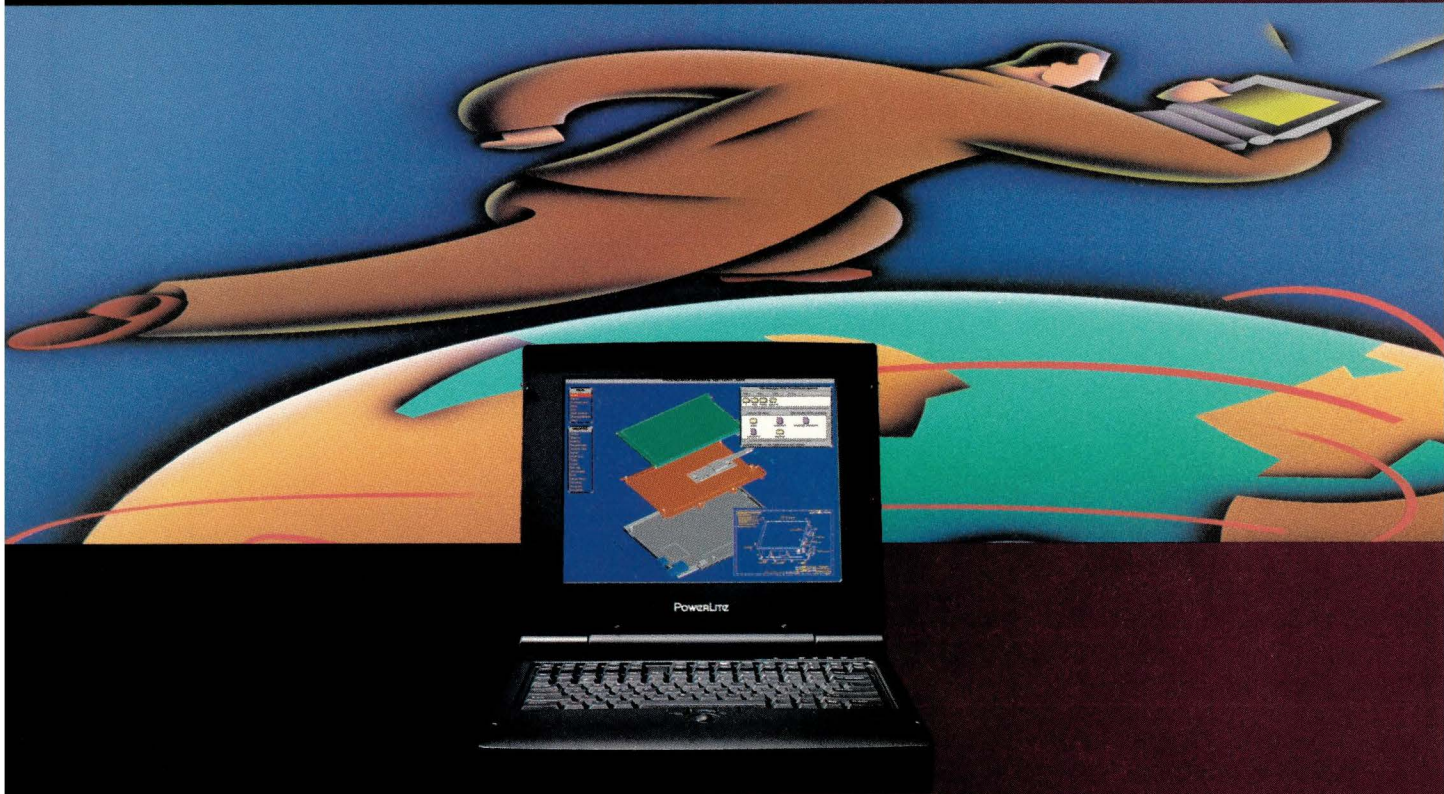
"Nobody is calling NCs X terminals anymore, even though that's what they are," says Zona's Blatnick. "You can see that in the direction they're headed, but you still wonder why X is in the fine print in the spec sheets of the NCs. X comes into play to access UNIX applications. When UNIX is in place, X can be used. X becomes minor, however, if you don't need UNIX access."

The X protocol will continue to deliver, in a graphical manner, UNIX applications to the NC desktop, even though this is not stated explicitly in the NC1 specification, agrees HDS' Kantrowitz.

"X terminals were designed for UNIX," he says, "and that's originally where they were sold, as low-cost workstations. In the X terminal and the NC, the X protocol transports graphics and windowing and the X terminal provides access to the applications. Now, in addition, it has access to Windows, mainframes, Java and UNIX, all from the same device: the X terminal."

Zona's Blatnick says that the two terminals are often interchangeable when they are accessing UNIX applications on the network.

**{ LET'S TALK SPEED. }**



**THE POWERLITE® TURBO 170**

**THE WORLD'S FASTEST SPARC® NOTEBOOK.**

**TURBO-CHARGED TO A BLAZING 170 MHZ.**

**SPARCSTATION 20 PERFORMANCE. 100% SUN COMPATIBLE.**

**12.1" ACTIVE MATRIX LCD. LET'S TALK.**

"X is in most of these products now called NCs. The vendors are making a transition from a UNIX-specific protocol to a broader scope to use their expertise. The concept is identical: a server-based, low-maintenance, high-performance terminal built on network protocols. The X protocol is [often] still the mechanism by which you're getting the information from the server," Blatnick says.

Other terminal vendors report that they plan to continue to implement X in their NCs, due to its adroitness at transporting graphics across a network.

But the protocol will continue to be near the bottom of the checklist on vendors' spec sheets, says Robert Porter, chief technical officer at NC manufacturer Boundless Technologies.

"X is an enabling technology, but not something you put up on a marquee for marketing purposes. People want what it does, not what it's called," Porter says.

So what of the X terminal? If the NC includes all the capabilities of the X terminal, with the added functionality of a built-in Web browser, Java and specified Windows access, all priced comparably (at less than \$1,000) to

low-end X terminals, won't corporate buyers opt for greater functionality for their money? That's what the X terminal and UNIX systems vendors hope, and that's why they will stress the ability to access network applications, instead of the capabilities of X.

Both HDS and Tektronix, for example, have begun to replace their entire lines of X terminals with NCs of varying functionality. HDS, which shipped its first NC model in June of this year, this month ships Version 2.0 of its NC software, which includes support for Windows 95.

## Citrix' ICA Is Everywhere X Is (Almost)

Several years ago, Citrix Systems Inc. developed multiuser server software and a network protocol designed to help IS managers broaden users' access to OS/2 applications on the server. Shortly thereafter, the company released a version on Windows NT. Called WinFrame, the software now appears in some form on a range of network terminals (including Network Computers, or NCs) and PC-to-UNIX connectivity applications.

The software's primary goal is to enable deployment of 32-bit applications beyond PC users on the LAN to users who aren't using Windows machines, according to the company. This includes extending Windows to DOS, UNIX, Macintosh and wireless systems.

Central to WinFrame is the Intelligent Console Architecture (ICA) protocol, which forms the network display portion of the software. The other component, the multiuser layer, sits atop the OS on the server. In the case of WinFrame, the multiuser layer runs on the Windows NT server, and the ICA protocol runs on the desktop device.

On the desktop side, the result is the sought-after thin-client terminal, which can display multiple applications from a variety of operating environments in an efficient manner.

It is primarily the ICA portion that has garnered the attention of NC vendors. Its task is to receive display representation packets from the server—transported using IPX or IP, for example—and interpret and display to users the information contained in those packets, says David Weiss, director of product management at Citrix, Coral Springs, FL.

"On the client is the ICA protocol, a thin piece of software, which consumes only about 200 KB of memory," says Weiss. "From the beginning, it was built as a low-bandwidth protocol and to have a very light load on the network."

NC vendors toss accolades at Citrix for helping to provide the sorely needed Windows access to X terminal and NC users.

Tektronix Inc., Beaverton, OR, broke the Windows access barrier a couple of years ago by introducing its WinDD software, a proprietary communications module shipped with its X terminals for displaying Windows data. WinDD is itself an extension of ICA, and the latter continues to play a part in Tektronix' current and future products, says Lee Rainey, director of product marketing, storage and network business at Tektronix.

"I'd have to give Citrix credit for developing a solution for accessing PC applications from the UNIX environment," says

Rainey. "ICA delivers a light load on the network in a data format that sits on TCP/IP for moving Windows data across the network. It's one of a number of data streams we support."

To ICA, Tektronix added features such as cut-and-paste between different operating environments and administration tools in WinDD. ICA comes into play to provide access to the Windows server from the X terminal.

Now, with a letter of intent signed by Sun to license ICA for its NC iteration, it would appear that Citrix' proclamation that the protocol is becoming the de facto standard for Windows display across heterogeneous networks is not just marketing bluster, but an approaching reality.—jsw







## Switch gears, not workstations.

Introducing TurboSPARC from Fujitsu Microelectronics,  
the affordable, high-performance SPARCstation 5 upgrade.

Ready to switch your SPARCstation® 5 into high gear without breaking your budget? Look no further. Fujitsu's powerful TurboSPARC™ CPU upgrade module more than doubles the performance of your SPARCstation 5, leveraging your hardware and software investment.

The TurboSPARC upgrade module is fully compatible with SunOS and Solaris™, speeding all your CPU intensive applications, from financial to design engineering. With 512 KBytes of level 2 cache, the TurboSPARC module exceeds SPECint\_92



performance of SPARCstation 20 model HS21 with 125 MHz hyperSPARC™. The module also provides pin-to-pin compatibility with your existing CPU (microSPARC™-II) in your SPARCstation 5, and requires no additional modifications to your system. Best of all, TurboSPARC delivers uncompromising performance at an unbeatable price.

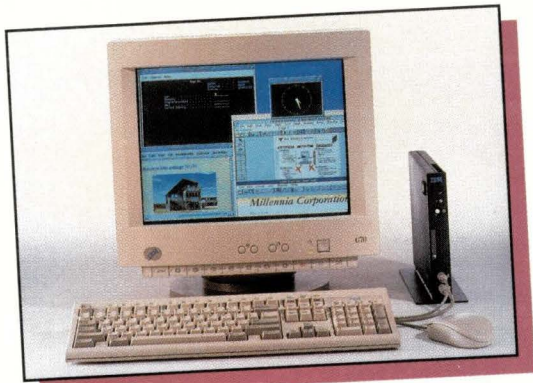
For more information on how you can switch your workstation into high gear, call Fujitsu at **1-800-866-8608** today or visit our web site at [www.fujitsumicro.com/sparcupgrade](http://www.fujitsumicro.com/sparcupgrade).

# FUJITSU

COMPUTERS, COMMUNICATIONS, MICROELECTRONICS

Fujitsu Microelectronics, Inc., 3545 North First Street, San Jose, CA 95134. ©1996 Fujitsu Microelectronics, Inc. All trademarks or registered trademarks are the property of their respective holders. All SPARC trademarks are trademarks or registered trademarks of SPARC International, Inc. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc.

Circle No. 16 on Inquiry Card



The IBM Network Station, codeveloped with NCD, offers customers access to legacy applications and keeps pace with developments in the Internet and Java.

### Multisusage Terminal

For users, whether they've bought X terminals, or whether they're considering buying NCs, it is the flexibility of the device—its ability to access a variety of applications on the server or the Internet—that is attractive.

Some UNIX and X terminal users have found the X devices to be quite

adept at Internet access, but still hold a wait-and-see stance regarding the intended capabilities of NCs.

"We've found X to be a good environment for development of Web-based programs," says Larry Dwork, assistant professor of pharmacology at St. Louis College of Pharmacology. "Our X terminals were purchased before the NC1 spec was announced, and that could be interesting in terms of providing inexpensive access to lots of information. But

we'll see if for \$800 to \$1,000 all that they want to do is doable."

So forget about everything you may have read about NCs heralding the death of the X terminal. That's a fact in name only. NCs are more accurately the next guardians of that secret link between the desktop and UNIX—the X Window System. ➔

## Companies Mentioned in this Article

**Apple Computer Inc.**  
1 Infinite Loop  
Cupertino, CA 95014  
**Circle 150**

**Boundless Technologies**  
Echelon IV, Ste. 200  
9430 Research Blvd.  
Austin, TX 78759  
**Circle 151**

**Citrix Systems Inc.**  
210 University Drive, Ste. 700  
Coral Springs, FL 33071  
**Circle 152**

**HDS Network Systems Inc.**  
400 Fehleley Drive  
King of Prussia, PA 19406  
**Circle 153**

**IBM Corp.**  
Contact local sales office

**Insignia Solutions Inc.**  
1300 Charleston Road  
Mountain View, CA 94043  
**Circle 154**

**Microsoft Corp.**  
One Microsoft Way  
Redmond, WA 98052  
**Circle 155**

**Netscape Communications Corp.**  
501 E. Middlefield Road  
Mountain View, CA 94043  
**Circle 156**

**Network Computer Devices Inc.**  
350 N. Bernardo Ave.  
Mountain View, CA 94043  
**Circle 157**

**Oracle Corp.**  
500 Oracle Pkwy.  
Redwood Shores, CA 94065  
**Circle 158**

**Sun Microsystems Inc.**  
2550 Garcia Ave.  
Mountain View, CA 94043  
**Circle 159**

**Tektronix Inc.**  
26600 Southwest Pkwy.  
P.O. Box 1000  
Wilsonville, OR 97070  
**Circle 160**



## THE FREEDOM TO EXPLORE

**LOOK FOR IT**

Look for the "Try It First" logo displayed in ads and materials for leading software programs utilizing the Solaris™ Operating System.

**FIND IT**

Open your current issue of CDware™, to find information about that software program. If you don't currently receive CDware, check it out on the Web and start your free subscription today.  
<http://www.sun.com/sunsoft/cdware/>

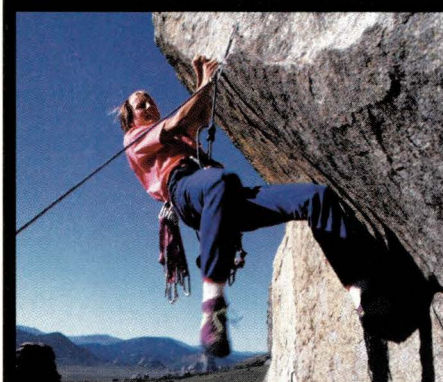


**TRY IT**

You'll find information, a self-run demonstration or perhaps even a trial version of the software program to explore at your leisure. You'll also find the complete Catalyst™ Catalog of more than 12,000 titles for both SPARC™ and Intel® platforms.

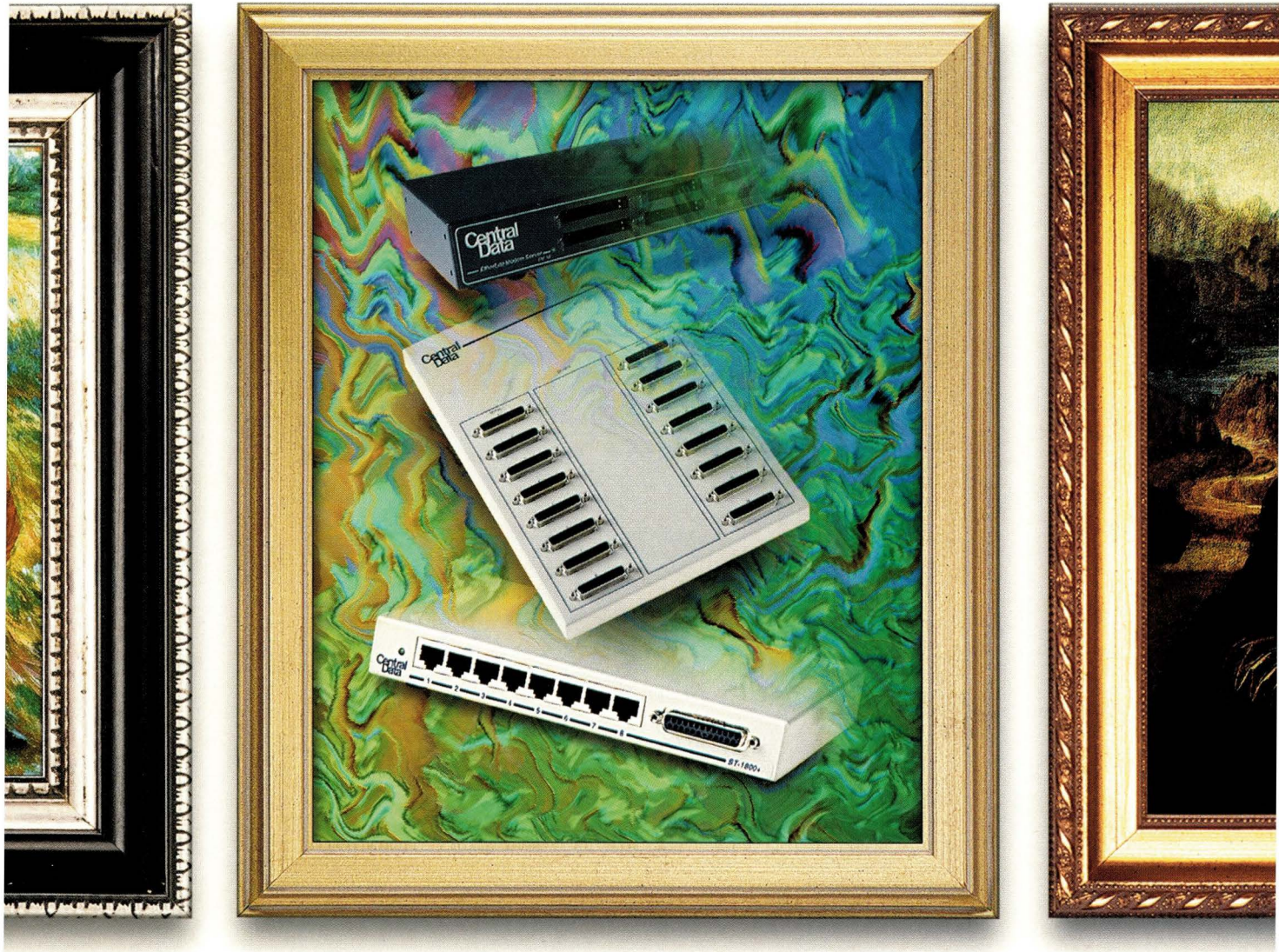


© 1996 Sun Microsystems, Inc. Sun, SunSoft, the SunSoft logo, Solaris, Catalyst CDware, and Java are trademarks or registered trademarks of Sun Microsystems, Inc. SPARC is a trademark of SPARC International, Inc.



Circle No. 41 on Inquiry Card

# SERIAL PORT ORIGINALS



**A**t Central Data, serial communications is not a side business. It's our only business. This dedication has inspired a collection of "originals" for UNIX® and Windows NT™ not found anywhere else. If we don't have exactly what you need, send us your specs. We specialize in OEM and custom solutions.

Our high-speed scsiTerminal Servers™ and EtherLite™ Port Servers allow you to add from two to hundreds of *real* (not pseudo) serial ports. Without network configuration hassles. And without using any card slots.

Adding modems? Reduce the normal cabling mess with our streamlined SCSI and EtherLite Modem Servers. They connect up to 16 PCMCIA modems in a single box.

If you're looking for PCI boards, try our new 4- and 8-port serial cards. They're our lowest-cost solutions ever.

To fully appreciate our Serial Port Originals, evaluate one FREE for up to 30 days. Call **1-800-482-0470**. Or view our website at <http://www.cd.com/>. See how Central Data has turned UNIX and NT connectivity into a work of art.

## Central Data

# X-Ready Network Computers

EY:

VWM – Feeble Virtual Window Manager ♦ TWM – Tom's Window Manager ♦ opt. – Optional ♦ config. – Configuration ♦ fps – Frames per second

	Boundless Technologies XL	Boundless Technologies XLC	Dickens Data Systems NCD Explora	Dickens Data Systems NCD HMX	GraphOn Corp. 19S
Resolution (pixels)	640x480 up to 1280x1024	640x480 up to 1280x1024	1024x768	640x480, 800x600, 1024x768, 1152x900, 1280x1024	1280x1024
Screen size (inches)	9, 14, 15, 17, 20	9, 14, 15, 17, 20	15, 17	17, 20, 21	19
NC spec-compliant Processor	Yes i80960CA	Yes i80960CA/CF	Yes PowerPC	No —	No 68000
Graphics coprocessor	—	—	S3 graphics accelerator	—	Host coprocessor
Local memory min./max. (MB)	4/32	4/64	4/36	8/136	1/1
Hard disk	No	No	No	No	No
Multimedia support	Telephony, digital video, digital audio	Telephony, digital video, digital audio	Audio	No	No
Audio support	Yes	Yes	PCMCIA-16-bit linear PCM resolution, 2-channel stereo input and output	Yes	No
Peripherals supported	—	Expansion slot	3½ -inch floppy drive	—	Any RS-232 devices, modems, local printing
Remote management	SNMP, MIB I, MIB II	SNMP, MIB I, MIB II	SNMP and remote config. support via GUI or telnet	—	—
Refresh rate (Hz)	75	75	76	60, 66, 70, 72, 75	70
X11 security and authority support	Yes	Yes	Yes	No	No
X11 release supported	5	5	6	5	6
X server location	Local, downloaded	Local, downloaded	In FLASH, download from host or another terminal	Downloaded from host	Running on host
X remote support	Planned	Planned	Yes	No	Yes
Built-in window manager	Motif, Open Look, VUE, FVWM	Motif, Open Look, VUE, FVWM	Motif, NCD window manager	NCD window manager	Supports host-based window manager
Built-in clients	Xclock, Xlock CT320, VT220, other	Xclock, Xlock CT320, VT220, other	Xclock, VT320, 3270, 3179G, keymap editor	—	Wyse 60, VT100/220, PCTerm, other
Monochrome, gray scale or color	Gray scale, color	Gray scale, color	Color	Color	Monochrome
Input devices	Keyboard, mouse, touch screen	Keyboard, mouse, touch screen	3-button mouse, 7 keyboard options	Keyboard, mouse	Keyboard, mouse
SLIP/PPP support	Yes	Yes	—	Yes	No
Interfaces and number of each	Ethernet, 2 RS-232, 1 parallel	Ethernet, 2 RS-232, 1 parallel	1 PCMCIA, 2 PS/2, 1 VGA, 1 parallel, 1 serial, 1 Ethernet	Ethernet, AUI, token ring, serial	3 RS-232/423
Type of Ethernet	Twisted pair, thin	Twisted pair, thin	Twisted pair	Twisted pair, thin	—
Server extensions supported	SHAPE, SHM, XTEST, other	SHAPE, SHM, XTEST, other	SIE, DEC-XTRAP, SYNC, other	—	—
Warranty	1 year	1 year	1 year standard, upgrades available	1 year	1 year
List price (\$)	995	1,635	Contact vendor	Contact vendor	695

# First Desktop RAID for SPARC™

## RD10

### RAID Storage Subsystem

#### Features

- High Availability
- True RAID data integrity
- Fast throughput-17mb/sec
- Up to 25.2GB storage
- SPARC/SUN pizza box form factor
- Easy to use GUI

When you need your data safe, reliable, and ready, the Integrix RD10 delivers high performance with low cost per Mbyte.

Thanks to a dedicated 33MHz RISC processor and enhanced RAID technology, combined with dedicated I/O processors for each drive and host, the RD10 reaches throughput speeds in excess of 17Mbytes/sec. For high availability environments, dual fast/wide SCSI ports make your data available to two hosts simultaneously.

Five different hardware RAID levels, hot spare disks, and hot-swappable drives keep your data safe and secure. Data automatically and transparently rebuilds on the spare drive eliminating downtime and data loss. Data integrity is assured for all mission-critical applications.

The RD10 Graphical User Interface eliminates the need to type obscure commands found buried in the back of a service manual. Historical performance software analyzes and fine tunes your RAID. Configuration and firmware upgrades can be handled automatically. RD10 status and context-sensitive online help are made instantly available. All with the click of a mouse button.

#### RD10 RAID Storage Subsystem

Compatible with Solaris and Windows NT

#### RD10 RAID Throughput Performance

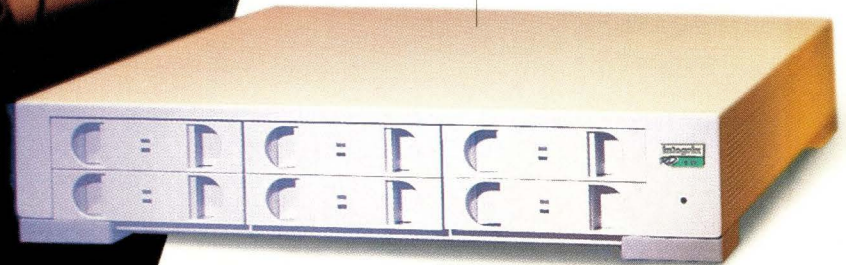
(5400rpm F/W SCSI-2 HDD)	Mbytes/sec	IOs/sec
Sequential Read (max)	16.8	1307
Sequential Write (max)	17.2	1247
Random Read (max)	9.9	620
Random Write (max)	13.0	357

#### RD10 RAID Subsystem Specifications

RAID Levels Supported	0, 1, 3, 5, 6, (0+1)
Processor	33MHz 32bit RISC
Cache Memory	8Mbytes to 128Mbytes
Channels	2 host channels 6 disk channels
Disks Supported	3.5", 1" high SCA-2 or 68-pin connector Fast/wide Single Ended SCSI-2 interface

[www.integrix.com](http://www.integrix.com)

Circle No. 22 on Inquiry Card



#### Corporate Headquarters

2001 Corporate Center Drive  
Newbury Park, California 91320  
Tel: 800-300-8288 / 805-376-1000  
Fax: 805-376-1001  
Email: [sales@integrix.com](mailto:sales@integrix.com)  
<http://www.integrix.com>

#### Asia

Beijing, P.R.China  
Tel: 8610-253-5305  
Fax: 8610-253-5306  
Seoul, Korea  
Tel: 822-515-5303  
Fax: 822-515-5302

## X-Ready Network Computers

	GraphOn Corp. 14S	HDS @workStation @workBasic	HDS @workStation @workPrima	HDS @workStation @workSupra	HDS @workStation @workDuo
Resolution (pixels)	Up to 1280x1280	640x480 to 1600x1200	640x480 to 1600x1200	640x480 to 1600x1200	640x480 to 1600x1200
Screen size (inches)	14 (flat)	14, 15, 17, 19, 20, 21	14, 15, 17, 19, 20, 21	14, 15, 17, 19, 20, 21	14, 15, 17, 19, 20, 21
NC spec-compliant Processor	No 68000	Yes 16-66-MHz I960	Yes 16-66-MHz I960	Yes 16-66-MHz I960	Yes 16-66-MHz I960
Graphics coprocessor	Host coprocessor	No	No	—	—
Local memory min./max. (MB)	.5/.5	4/128	8/128	8/128	8/128
Hard disk	No	42 MB, 105 MB, 1 GB	42 MB, 105 MB, 1 GB	42 MB, 105 MB, 1 GB	42 MB, 105 MB, 1 GB
Multimedia support	—	Teleconferencing, TV tuner, analog/digital video	Teleconferencing, TV tuner, analog/digital video	Teleconferencing, TV tuner, analog/digital video	Teleconferencing, TV tuner, analog/digital video
Audio support	—	Yes	Yes	Yes	Yes
Peripherals supported	Any RS-232 devices, modems, local printing	Modem, floppy, printers, bar-code readers, pointing devices	Modem, floppy, printers, bar-code readers, pointing devices	Modem, floppy, printers, bar-code readers, pointing devices	Modem, floppy, printers, bar-code readers, pointing devices
Remote management	No	BOOTP, ARP, RARP, XDM, SNMP	BOOTP, ARP, RARP, XDM, SNMP	BOOTP, ARP, RARP, XDM, SNMP	BOOTP, ARP, RARP, XDM, SNMP
Refresh rate (Hz)	78	70	70	70	70
X11 security and authority support	No	Yes	Yes	Yes	Yes
X11 release supported	6	5	5	5	5
X server location	Running on host	In ROM, downloaded from host	In ROM, downloaded from host	In ROM, downloaded from host	In ROM, downloaded from host
X remote support	Yes	Yes	Yes	Yes	Yes
Built-in window manager	Supports host- based window manager	Windows 95, Open Look, Motif, FVWM, TWM	Windows 95, Open Look, Motif, FVWM, TWM	Windows 95, Open Look, Motif, FVWM, TWM	Windows 95, Open Look, Motif, FVWM, TWM
Built-in clients	Standard X clients	Xclock, Xcalc, Java engine, telnet, other	Xclock, Xcalc, Java engine, telnet, other	Xclock, Xcalc, Java engine, telnet, other	Xclock, Xcalc, Java engine, telnet, other
Monochrome, gray scale or color	Monochrome	Monochrome, gray scale, color	Monochrome, gray scale, color	Monochrome, gray scale, color	Monochrome, gray scale, color
Input devices	Keyboard, mouse	Keyboard, mouse, other (opt.)	Keyboard, mouse, other (opt.)	Keyboard, mouse, other (opt.)	Keyboard, mouse, other (opt.)
SLIP/PPP support	No	Yes	Yes	Yes	Yes
Interfaces and number of each	3 RS-232	3 Ethernet, 1 RJ-11 serial, 1 RJ-11 parallel, 1 DB25 serial, 1 DB25 parallel, VGA	3 Ethernet, 1 RJ-11 serial, 1 RJ-11 parallel, 1 DB25 serial, 1 DB25 parallel, VGA	3 Ethernet, 1 RJ-11 serial, 1 RJ-11 parallel, 1 DB25 serial, 1 DB25 parallel, VGA	3 Ethernet, 1 RJ-11 serial, 1 RJ-11 parallel, 1 DB25 serial, 1 DB25 parallel, VGA
Type of Ethernet	Thin, twisted pair (opt.)	Thin, thick, twisted pair	Thin, thick, twisted pair	Thin, thick, twisted pair	Thin, thick, twisted pair
Server extensions supported	—	PEX	PEX	PEX	PEX
Warranty	1 year	1 year return to factory, extended available	1 year return to factory, extended available	1 year return to factory, extended available	1 year return to factory, extended available
List price (\$)	1,595	699-2,699	899-3,299	1,299-3,699	2,299-6,699

# EFFECTIVE PROTECTION FROM TOO MUCH SUN.

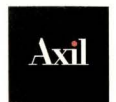


There are a lot of factors to consider when you're buying quality SPARC-based servers and workstations. You want power, you want speed, and you want all this performance for the best price. What you don't want is technology that's outdated as soon as it's up and running. And buying a big name is no guarantee of protection.

Luckily, there's a brighter choice. Axil. The Axil Ultima 1 and Ultima 2 systems feature a full range of UltraSPARC processors and up to 2GB of RAM. Not only that, there's our unique modular chassis design that makes upgrading simple. As technology evolves you can either upgrade your processor, add another for dual processing, or change the motherboard for even faster performance. So you get investment protection built in.

If you want us to shed some light on our servers and workstations, just call 1-800-284-AXIL or visit us at <http://www.axil.com>. And let us tell you all the reasons we outshine the competition.

©1996 Axil Computer Inc. All product names and trademarks and registered trademarks are the property of their respective owners.



Computer, Inc.  
A Hyundai Company

Circle No. 10 on Inquiry Card

## X-Ready Network Computers

	HP Entria Plus Family 15C/17C/17Ch/19Ch	HP Envixez Family 19 Cp/17CpS/ 19 Cp/20CpS	IBM Network Computer	IGEL LLC Etherminal 5X	NCD Explora
Resolution (pixels)	1024x768, 1280x1024	1280x1024	Up to 1600x1280	1280x1024	1024x768
Screen size (inches)	15, 17, 19	17, 19, 20	—	User supplied	15, 17
NC spec-compliant Processor Graphics coprocessor	Yes Intel i960 RISC ASIC	Yes Intel i960 RISC ASIC	Yes Power PC 403GC S3 64V	No 133-MHz AMD X5 Cirrus Logic 5436	Yes PowerPC S3 graphics accelerator
Local memory min./max. (MB) Hard disk	4/68 No	6/102 No	8/64 No	8, 12, 2-/36 No	4/36 No
Multimedia support	MPEG-1 video (opt.), audio kit (opt.)	MPEG-1 video, audio, telephony	Native 8-bit sound addition capability via PCMCIA	16-bit slot for sound card or ISDN card	Audio
Audio support	Yes	Yes	Yes	Add on	PCMCIA-16-bit linear PCM resolution, 2-channel stereo input, 2-channel stereo output 3½-inch floppy drive
Peripherals supported	Printer, modem	3½-inch floppy drive, SCSI scanner, printer, modem	—	Modem, printer	3½-inch floppy drive
Remote management	DHCP, BOOTP, SNMP, X terminal manager soft- ware available	DHCP, BOOTP, SNMP, X terminal manager soft- ware available	Server load config.	Via network	SNMP and remote config. support through GUI or telnet
Refresh rate (Hz)	72, 75	72, 75	Per selected mode	—	76
X11 security and authority support X11 release supported X server location	Yes 6 Downloaded from host, resident in Flash ROM	Yes 6 Downloaded from host, resident in Flash ROM	Yes 5 Downloaded	— 6 Flash memory	Yes 6 In FLASH, download from host or another terminal
X remote support Built-in window manager	No VUE, VUE/RX, CDE, CDE Lite, Motif, Open Look, TWM	No VUE, VUE/RX, CDE, CDE Lite, Motif, Open Look, TWM	Yes Yes	Yes Motif and Windows 95 lookalikes	Yes Motif, NCD window manager
Built-in clients	Xlock, Xclock, Xflash, other	Xlock, Xclock, Xflash, other	No	Xclock	Xclock, VT320, 3270, 3179G, keymap editor Color
Monochrome, gray scale or color	Color	Gray scale	—	Color	Color
Input devices	Keyboard, mouse	Keyboard, mouse	Keyboard, mouse, serial, parallel, PCMCIA, VGA Planned	Keyboard, mouse	3-button mouse, 7 keyboard options
SLIP/PPP support	Yes	Yes	—	Yes	—
Interfaces and number of each	Ethernet	Ethernet, token ring (opt.), 100VG AnyLAN (opt.)	10BaseT, 4/16 token ring	2 serial, 1 parallel, Ethernet	1 PCMCIA, 2 PS/2, 1 VGA, 1 parallel, 1 serial, 1 Ethernet
Type of Ethernet	ThinLAN (BNC coax), 10BaseT (twisted pair built-in)	Thick, thin, twisted pair built-in	Twisted pair	Twisted pair	Twisted pair
Server extensions supported	XIE, DPS/NX, other	XIE, DPS/NX, other	—	No	SIE, DEC-XTRAP, SYNC, other
Warranty	1 year on-site standard, extended available	1 year on-site standard, extended available	1 year	1 year	1 year standard, upgrades available
List price (\$)	1,998-3,495	2,390-5,390	700	1,245-1,445	1,195+



## X-Ready Network Computers

	NCD Explora Pro	NCD HMX	NCD HMX Pro	NCD HMX Pro24	PhaseNet Systems PXCH and PXCS Families
Resolution (pixels)	1024x768, 1280x1024	1280x1024, 1600x1200	1280x1024, 1600x1200	1280x1024, 1600x1200	800x600, 1024x768, 1280x1024
Screen size (inches)	15, 17, 20	17, 20, 21	17, 20, 21	17, 20, 21	15, 17, 19, 20, 21
NC spec-compliant Processor	Yes	Yes	Yes	Yes	Yes
Graphics coprocessor	PowerPC S3 graphics accelerator	80-MHz R4000 Custom ASIC	125-MHz R4000 Custom ASIC	125-MHz R4000 Custom ASIC	i8960, R3000A —
Local memory min./max. (MB)	8/36	8/136	8/136	8/136	4/64
Hard disk	No	No	No	No	No
Multimedia support	Audio	Audio, digital video	Audio, digital video	Audio, digital video	Audio, audio/ video opt.
Audio support	PCMCIA-16-bit linear PCM resolution, 2-channel stereo input, 2-channel stereo output	PCMCIA-16-bit linear PCM resolution, 2-channel stereo input, 2-channel stereo output	16-bit linear PCM resolution, 1-channel mono input, 2-channel stereo output	16-bit linear PCM resolution, 1-channel mono input, 2-channel stereo output	Yes
Peripherals supported	3½ -inch floppy drive	3½ -inch floppy drive	3½ -inch floppy drive	3½ -inch floppy drive	—
Remote management	SNMP and remote config. support through GUI or telnet	SNMP and remote config. support through GUI or telnet	SNMP and remote config. support through GUI or telnet	SNMP and remote config. support through GUI or telnet	—
Refresh rate (Hz)	76	76	76	76	—
X11 security and authority support X11 release supported	Yes 6	Yes 6	Yes 6	Yes 6	Yes 5, 6
X server location	In FLASH, download from host or another terminal	In FLASH, download from host or another terminal	In FLASH, down- load from host or another terminal	In FLASH, down- load from host or another terminal	Downloaded from host
X remote support	Yes	Yes	Yes	Yes	Yes
Built-in window manager	Motif, NCD window manager	Motif, NCD window manager	Motif, NCD window manager	Motif, NCD window manager	Yes (opt.)
Built-in clients	Xclock, VT320, 3270, 3179G, key- map editor, other	Xclock, VT320, 3270, 3179G, key- map editor, other	Xclock, VT320, 3270, 3179G, key- map editor, other	Xclock, VT320, 3270, 3179G, key- map editor, other	Yes
Monochrome, gray scale or color	Color	Color	Color	Color	Monochrome, gray scale, color
Input devices	3-button mouse, 7 keyboard options	3-button mouse, 7 keyboard options	3-button mouse, 7 keyboard options	3-button mouse, 7 keyboard options	Keyboard, mouse, PCMCIA slot
SLIP/PPP support	—	Yes	Yes	Yes	Yes
Interfaces and number of each	1 PCMCIA, 2 PS/2, 1 VGA, 1 parallel, 1 serial, 2 Ethernet	2 RS-232-C, 1 parallel, 1 PS/2, 1 VGA, 1 audio in/out, Ethernet (opt.)	2 RS-232-C, 1 parallel, 1 PS/2, 1 VGA, 1 audio in/out, Ethernet (opt.)	2 RS-232-C, 1 parallel, 1 PS/2, 1 VGA, 1 audio in/out, Ethernet (opt.)	1 AUI, 1 parallel, 2 RS-232-CI
Type of Ethernet	Twisted pair, thin	Twisted pair, thin	Twisted pair, thin	Twisted pair, thin	Twisted pair, thick/thin
Server extensions supported	SIE, DEC-XTRAP, SYNC, XIDLE, other	XIE, PEX, OGL, DPS, XIDLE, other	XIE, PEX, OGL, DPS, XTEST, XIDLE, other	XIE, PEX, OGL, DPS, XTEST, XIDLE, other	—
Warranty	1 year standard, upgrades available	1 year standard, upgrades available	1 year standard, upgrades available	1 year standard, upgrades available	1, 2 or 3 years opt.
List price (\$)	2,315-4,315	2,895-4,845	3,395+5,345	5,395-7,145	995-2,495

## X-Ready Network Computers

	Sanar Systems APPT-50	Tech-Source GX-station 4 models*	Tektronix XP200 and XP200H Series	Tektronix XP400 Series	Tektronix XP400D Series
<b>Resolution (pixels)</b>	1024x768	1152x900	1024x864, 1280x1024, 1152x900	1280x1024, 1600x1188	1600x1188
<b>Screen size (inches)</b>	14, 17, 20	15, 17, 19, 21	15, 17, 19, 21	17, 21	21
<b>NC spec-compliant Processor</b>	No	No	Yes	Yes	Yes
<b>Graphics coprocessor</b>	186 Trident	— Weitek P9100	25-MHz LSI33020 —	40-MHz LSI33120 C-Cube CL480 (opt.)	40-MHz LSI33120 —
<b>Local memory min./max. (MB)</b>	16/32	1/4	4/36	8/136	8/136
<b>Hard disk</b>	Yes	No	No	No	No
<b>Multimedia support</b>	Videoconferencing	If supported by host	30 fps, full screen, synchronized audio	30 fps, full screen, synchronized audio	30 fps, full screen, synchronized audio
<b>Audio support</b>	Yes	No	16-bit mono/ stereo	16-bit mono/ stereo	16-bit mono/ stereo
<b>Peripherals supported</b>	Modem, floppy drive	—	Printers, modems, floppy drives, scanners, other	Printers, modems, floppy drives, scanners, other	Printers, modems, floppy drives, scanners, other
<b>Remote management</b>	Remote central administration	No	Centralized con- fig. files for boot up config., remote setup, remote console	Centralized con- fig. files for boot up config., remote setup, remote console	Centralized con- fig. files for boot up config., remote setup, remote console
<b>Refresh rate (Hz)</b>	75	60-76	70-85	70-85	70-80
<b>X11 security and authority support</b>	Yes	Yes	Yes	Yes	Yes
<b>X11 release supported</b>	—	4, 5, 6	5	5	5
<b>X server location</b>	On local hard drive	Running on the host and GXTRA card	Downloaded from host, flash-based (opt.)	Downloaded from host, flash-based (opt.)	Downloaded from host, flash-based (opt.)
<b>X remote support</b>	Yes	Yes	Yes (opt.)	Yes (opt.)	Yes (opt.)
<b>Built-in window manager</b>	Motif, Open Look	Open Look or any window manager	Tektronix window manager, Motif (opt.), Open Look (opt.)	Tektronix window manager, Motif (opt.), Open Look (opt.)	Tektronix window manager, Motif (opt.), Open Look (opt.)
<b>Built-in clients</b>	Yes	—	XIE, Xlock, other	XIE, Xlock, other	XIE, Xlock, other
<b>Monochrome, gray scale or color</b>	Monochrome, gray scale, color	Monochrome, gray scale, color	Monochrome, gray scale, color	Color	Color
<b>Input devices</b>	Keyboard, mouse	Keyboard, mouse	Keyboard, mouse, other	Keyboard, mouse, other	Keyboard, mouse, other
<b>SLIP/PPP support</b>	Yes	No	No	No	No
<b>Interfaces and number of each</b>	Up to 2 Ethernet, 2 RS-232, 1 parallel	—	2 RS-232, 10BaseT, 10Base2, parallel (opt.)	2 RS-232, 10BaseT, 10Base2/5 (opt.), parallel (opt.)	2 RS-232, 10BaseT, 10Base2/5 (opt.), parallel (opt.)
<b>Type of Ethernet</b>	Twisted pair, thick	—	Twisted pair	Twisted pair	Twisted pair
<b>Server extensions supported</b>	—	PEX, DPS, XTEST	XTEST, DPS, Xvideo, other	XTEST, DPS, Xvideo, other	XTEST, DPS, Xvideo, other
<b>Warranty</b>	1 year	2 years	1 year	1 year	1 year
<b>List price (\$)</b>	1,000+	1,975+	1,245-3,545	2,645-4,145	3,345-7,145

## Companies Included in this Survey

**Boundless Technologies**

9430 Research Blvd.  
Ste. 200, Bldg. IV  
Austin, TX 78759  
Circle 200

**Dickens Data Systems Inc.**

1175 Northmeadow Pkwy., Ste. 150  
Roswell, GA 30076  
Circle 201

**GraphOn Corp.**

150 Harrison Ave.  
Campbell, CA 95008  
Circle 202

**HDS Network Systems Inc.**

400 Feheley Drive  
King of Prussia, PA 19406  
Circle 203

**Hewlett-Packard Canada Ltd.**

Panacom Automation Division  
455 Phillip St.  
Waterloo, Ontario  
Canada N2J 3X2  
Circle 204

**IBM**

Contact local sales office

**IGEL LLC**

31 Stonecroft Drive, Ste. 105  
Easton, PA 18045  
Circle 205

**Network Computing Devices**

350 N. Bernardo Ave.  
Mountain View, CA 94043  
Circle 206

**PhaseNet Systems Inc.**

19545 N.W. Von Neumann Drive, Ste. 230  
Beaverton, OR 97006  
Circle 207

**Sanar Systems Inc.**

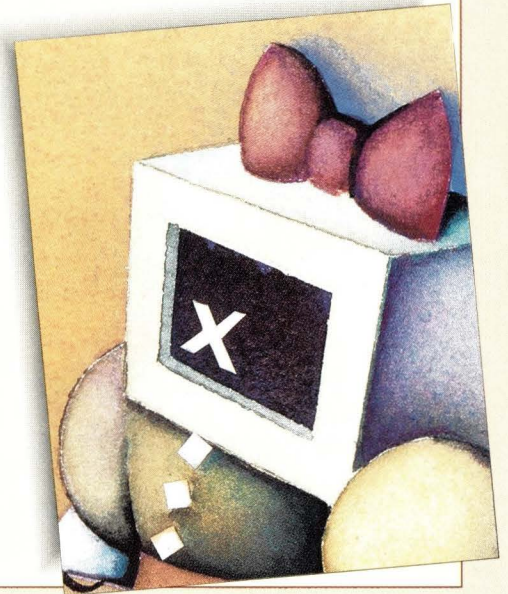
3350 Scott Blvd., Bldg. 6501  
Santa Clara, CA 95054  
Circle 208

**Tech-Source Inc.**

442 S. North Lake Blvd.  
Altamonte Springs, FL 32701  
Circle 209

**Tektronix Inc.**

Video and Networking Division  
P.O. Box 500  
Beaverton, OR 97077  
Circle 210



# In The Works

## DECEMBER

### WORKGROUP PRINTING

- Trends in Color
- Printer Administration Issues

**Survey: Color Network  
Printers**

## JANUARY 1997

### SOFTWARE DEVELOPMENT IN AN OBJECT WORLD

- Rapid App Development Tools
- Developing for the Client, for the Server
- ActiveX, Java, CORBA, Open Doc

## February

### STORAGE TECHNOLOGIES

- Trends in Hard Disk Design
- The Price Wars
- Disk and Array Interfaces

**Survey: 4-MB or Higher  
3 1/2-inch Disk Drives**

Visit Our Web Site

<http://www.cpg.com>

*FIELD REPORT*

# SUNNET MANAGER AS SYSADMIN HELPER

**This is the story of how one group of systems administrators monitor, maintain and troubleshoot a mixed bag of computers and network devices.**



by **JIM BOYLE**

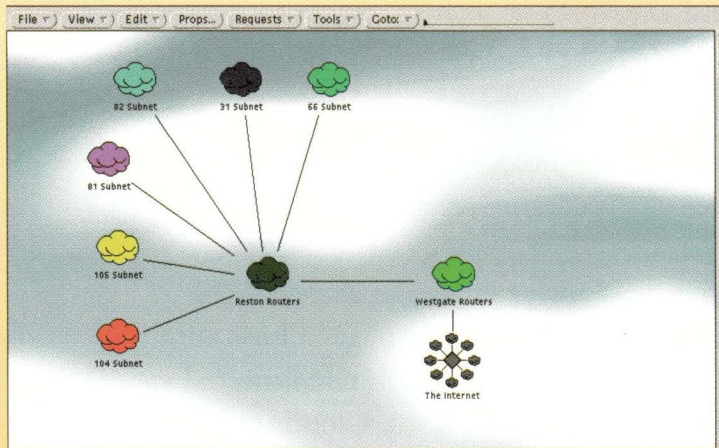
**S**unSoft Inc.'s SunNet Manager is more often than not used to manage large-scale wide-area networks. You'll find SunNet Manager in network operations centers monitoring the availability of data network links and tracking utilization. However, busy systems administrators can use it to understand the status and utilization of all the network elements within their domains. In our operational environment of six LANs with more than 200 managed nodes (UNIX workstations, Macintoshes, PCs, hubs, printers, etc.), SunNet Manager keeps an administration staff apprised of

machine status changes and provides the necessary data to prepare reports for analyzing resource utilization.

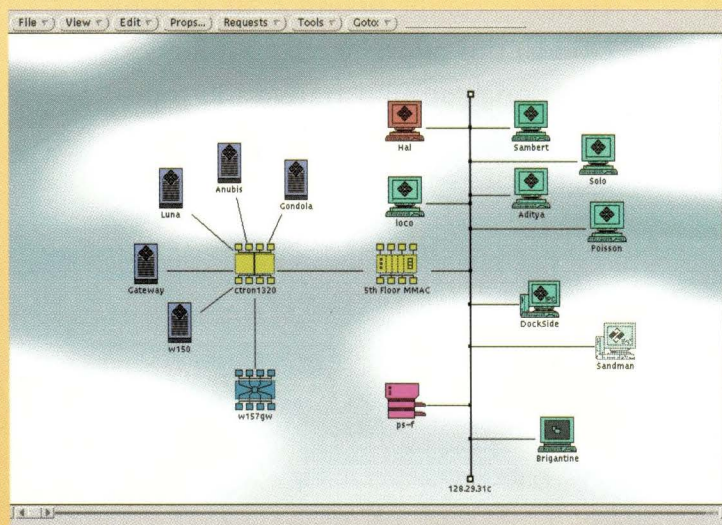
#### **SunNet Manager Capabilities**

SunNet Manager allows administrators to create interconnected views of their network. Clouds can be created to contain networks or network elements such as computers, routers and printers (see Figure 1). Network elements can be members of multiple clouds; this allows maps to follow functional, administrative and topological boundaries. I chose to create a cloud for each of our LANs, and a

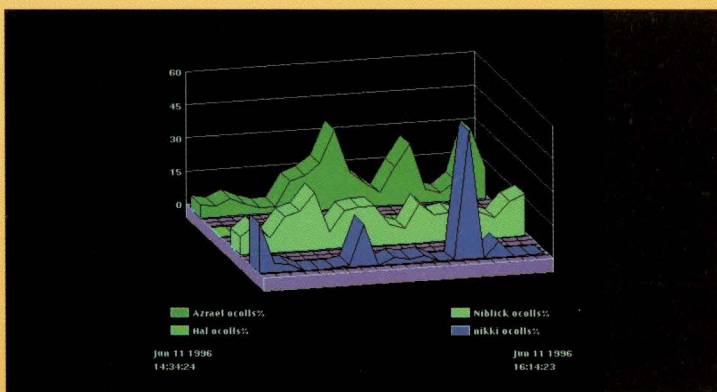


**Figure 1. The Home View of All the Networks**

Network 31 is blinking, indicating that there is an element at a lower level that has triggered an event.

**Figure 2. Network 31, Viewed from SunNet Manager**

Sandman is currently not available, and so its icon has started to blink.

**Figure 3. Data Request Display**

Parameters in data requests can be displayed in graphs and logged to files. This graph shows the Ethernet collision rate encountered by a host from four networks.

cloud that just contains the routers that interconnect the LANs (see Figure 2).

To create any object, be it a LAN cloud or a network element, you select an Open Look menu on the view where you want the object to reside. The pop-up window allows you to select an object to create, and then another window pops up to ask for information particular to that object.

To add a SPARCstation 20 named anubis, you add a Sun Workstation Component and enter the information for this element. For example, enter the name anubis and the queries it will respond to, such as ping and hostperf. The queries are sent to software agents, which can be on a local or remote workstation. The agents then issue the query to the managed object and return the information to the management console. There are agents to handle requests, including ping, hostperf data and SNMP.

SunNet Manager's design allows it to categorize information based on the nature of the information and how the administrator uses it. Information can be short-lived and administrator-initiated. For example, an administrator might want to ping a workstation. The administrator selects the object, brings up an Open Look menu and then goes to Quick Dump to initiate a ping.

Other types of information can be persistent, meaning they can be described by the system manager as a predefined request and applied to one or many objects. Predefined requests build upon the information available under Quick Dump. The system manager further categorizes predefined requests as either data requests, which can be used to log system parameters, or event requests (see Figure 3).

Events are retrieved system parameters that indicate a situation in the network. The administrator determines and defines the event criteria. A ping off a server that fails might be defined as a server not reachable event and could be used to initiate an email notification to a group of administrators. It is important to be very careful in the definition of events.

A failed ping is a good indication that a server is not available, and that

polling interval of 30 seconds or so. But email with each failed ping could flood your mailbox. With this in mind, an administrator should probably describe the event as a change in ping reachability. Such an event definition would result in two messages: one when the system becomes unavailable and one when it comes back on-line.

Data requests can be logged to files, and a manager needs only to define the polling interval and tell the system what information to log. To prevent the flooding of the network with predefined requests, you could use network analyzers or programs such as `etherfind` and `snoop` to determine the typical length of each request. This information can be used to ensure that the management workstation's impact on the network is minimal. In a routed LAN environment, you should be able to get all the information you need without it having a significant impact on your LANs.

It is easy to create objects on your maps, which in turn adds objects into

your object database. The manager has control over naming objects, where to place the objects, defining which information to request from objects, what to do with the information and how often to retrieve the information.

Unfortunately, there is no facility for repetitive tasks, such as adding several similar hosts or changing parameters of predefined requests. Thus, initial map configuration requires the administrator to create each entity individually. SunNet Manager can write out and read in the configuration for a map and the predefined requests. Therefore, to change parameters on several predefined requests, you can write out your configuration, quit SunNet Manager, edit the text-based configuration files, wipe out the runtime database, `/var/adm/snm/db.<userid>/*`, restart SunNet Manager and read the text configurations back in. I found that the discovery tool component was not sufficiently powerful to create maps useful for my purposes and keep them up to date.

Editing the text-based management database files by hand proved useful in creating and removing objects because our administrators have to keep the maps up to date. This workaround also highlights the importance of being selective when adding objects and requests to your database.

SunNet Manager is a single-user application. If two administrators start up two consoles on the same database, each console will request information from the running agent. The agent will send each request in duplicate instead of consolidating it into a single request. To avoid this problem, I have only one console open and the console notifies administrators of events via email.

### Planning your Configuration

LAN administrators must ask themselves three questions when planning a SunNet Manager configuration:

- What information do I need?
- How important is the information?
- What do I want to do with the information?

# Thinking about DLT?

**Think again!** We know that many of you are thinking about DLT tape libraries. But recent advances in 8mm technology and a library made by StraightLine—might make you want to think again. Led by Exabyte and Sony, 8mm technology has taken a giant step forward in performance and capacity—3MB per second data transfer rate and up to 25GB per tape in native mode. With built-in compression, it's even better. And that's not all.

**Reliability** — DLT, once the leader in reliability, has been surpassed here, too. StraightLine took the best in 8mm drive technology and engineered a library with mainframe-class robotics—aerospace structural frame and optical sensing of mechanical movement. It's a powerful combination of reliability and performance at a really competitive price.

**Easy to maintain** — It can be expensive to replace DLT library drives. They have special tape ejection motors and a modified handle, and you can only get them from the library manufacturer. If you ever need to replace a drive in a StraightLine library, just remove four wing nuts, unplug the drive, and pop in an off-the-shelf replacement.

**Built with the operator in mind** — With seven years of experience manufacturing tape libraries, StraightLine knows how to make one that's operator friendly. Unique tape drawers slide tapes out of the machine to the user. There's no reaching in and around the robotics. It takes only seconds to exchange one tape or all the tapes, which are loaded in convenient tape boxes.

**Industry standards** — StraightLine libraries are compatible with all standard systems and software—Sun, HP-UX, IBM RS/6000, Sequent, NT, DEC; Novell, LAN Manager; Arcada, Legato, ArcServe and many others.

	StraightLine	StraightLine	ATL	ADIC
Model	SL-850	SL-8150	ACL 4/52	Scalar
Drive format	8mm*	8mm*	DLT 4000	DLT 4000
Number of tapes in library	50	150	52	52
Tape drawer(s)	Yes	Yes	No	No
Removable tape boxes	Yes	Yes	No	No
Sustained transfer rate (native)	3MB/sec	3MB/sec	1.5MB/sec	1.5MB/sec
Total capacity (native)	1.25TB	3.75TB	1.04TB	1.04TB
Bar code reader	Yes	Yes	Yes/6-digit	Yes
Number of drives	4 or 5	4 or 5	4	4
Head life (hours)	>20,000**	>20,000**	10,000	10,000
Media uses (passes)	20,000	20,000	15,000	15,000
Drive MTBF (hours)	200,000	200,000	80,000	80,000
Library list price	\$43,995	\$61,995	\$65,000	\$65,000

\* Exabyte's recommended 8mm tape—Exatape 170M Advanced Metal Evaporated tape  
 Sony's recommended 8mm tape—SDX-T3N 170M Advanced Metal Evaporated tape  
 \*\* Exabyte Mammoth head life—20,000 hours  
 Sony AIT SDX-300 head life—30,000 hours

If you're thinking about a tape library, think about 8mm. Then call StraightLine—the leader in 8mm tape libraries. Now that's good thinking!

**Call: 206.865.8314**



straightline

677 120th Ave. NE, Suite 146 • Bellevue, Washington 98005 • www.igmc.com • e-mail: igmc@igmc.com

Circle No. 40 on Inquiry Card

SUNEXPERT Magazine November 1996

4mm format also available.

© 1996 StraightLine. All rights reserved. StraightLine is a division of IGM Communications. All brand and product names are property of their respective holders.

Carefully answer these questions, and you should arrive at a good configuration that maximizes usefulness and minimizes maintenance.

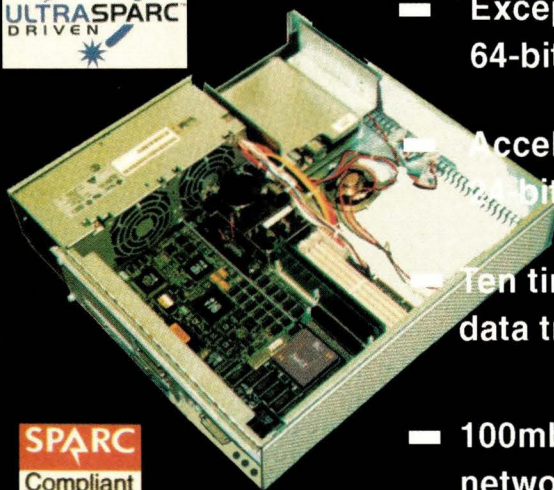
My main objective for using SunNet Manager is to minimize the time and effort that I have to put into systems administration. If I do that, I have more time available for other projects. A low-maintenance database is important to me.

At a high level, I am interested in having SunNet Manager tell me what resources are being utilized, which are free and, in some cases, how these resources are being utilized. For instance, server CPU % and load can be monitored to show which servers are the busiest. A summary of this information is more useful than manually checking all of the servers with `vmstat` and `ps aux`. High-end work-

stations can be monitored to show which are being overutilized and which are not. A much more pressing—and interesting—issue is how busy each of the network segments are and where all of the traffic is coming from and going to.

To answer the above questions, I decided to classify network objects into several categories and define what information I could retrieve from these objects. I then decided how important this information was, based on what I was told about network events and resource utilization.

# Get UltraSPARC<sup>TM</sup> Performance Without Paying The Price



- Exceptional speed with 64-bit architecture
- Accelerated 2D/3D 100Mbit graphics
- Ten time increase in data transfers
- 100mb/sec fast ethernet networking bandwidth

The Sanar SA/ULS1 and ULS2 UltraSPARC-based system surpasses price/performance barriers and put your business in front of the competition.

800-80-SANAR  
www.sanar.com  
sales@sanar.com



All trademarks are registered trademarks of their respective owners.

## OBJECTS

Servers, high-end workstations, low-end workstations, PCs, Macs, printers, hubs, switches and routers

## AGENTS OF INTEREST

**hostperf:** CPU %, context switches, interrupts, load averages, uptime, boot time, current time, paging, swapping, network I/O and errors, outbound network collision %

**ping:** Reachability

**SNMP-II:** Interface statistics

**CISCO-MIB:** Interface statistics and rates

The most useful information for hosts is the `hostperf` data returned from `rpc.rstatd`. This gives you almost everything you need, and many vendors supply an `rpc.rstatd` with their workstations. Other agents can be installed on remote systems using the `getagents` script supplied with SunNet Manager. These agents can retrieve information such as disk space usage, interface and protocol statistics, or network traffic information from remote LANs.

In addition, an SNMP agent for Sun machines comes with SunNet Manager. It provides some interesting data, such as process tables. Other Management Information Bases, or MIBs, can be added for the SunNet Manager SNMP software to monitor the SNMP-capable equipment on your LANs. At a minimum, all TCP/IP objects should respond to the `ping` agent.



After getting the basics, we can prune out possibilities that are not of high importance. In our environment, we are not particularly worried about the reachability of every workstation and PC. The database would be hard to keep current, and these events would just add to the noise level. Therefore, only high-end workstations and servers are included in the map.

For high-end workstations, I want to know resource utilization and when they are rebooted. A predefined data request is created that logs hostperf data every five minutes. This request is given the name get-hostperf.

A predefined event request monitors boot time from the hostperf agent every hour. If the boot time increases by more than 10 seconds, an email message is sent to administrators. The 10 seconds is necessary to avoid false events caused by clock drift among the computers. Additionally, a predefined ping event can be sent every 10 minutes in case the machine crashes and does not come back up.

Servers are ping'd every 30 seconds. If their reachability changes, the administrators receive email. SunNet Manager will recognize the next failed ping as a nonchange in reachability, and will reset the views of the maps to unset the blinking of the down server. For this, another predefined event is created that just pings every 60 seconds. A failed ping keeps the server symbol in a down state—which in this case causes the symbol on the map to blink. The get-hostperf data event is also sent to the servers. This data will help us allocate resources to our servers.

Routers are sent the same ping request that servers are sent. This is useful during network outages. By examining how far away from the management workstation your console can get, you can make a quick assumption as to where the problem is. Typically, I will receive an email message noting that the corporate router and some servers on the other side are down, because SunNet Manager does not correlate the events. Based on those few

messages, I can quickly check that the router is in fact down.

In other words, I have looked into a problem before users have a chance to reach for their phone or walk to my office. This illustrates another important reason to limit the amount of data you collect and amount of notices you generate. If you get a message from every workstation and PC on a LAN that become unavailable due to a router, it can obscure the more critical information: The router is down.

If your LANs are Ethernet media, the collision rate from the get-hostperf data request above will indicate whether your LANs are overloaded. However, to properly analyze what changes would be best for your LAN, you need to know the traffic patterns of your network. For this, you can study the sniffer data or use the traffic agent provided with SunNet Manager. Either way, determining the nature of your LAN traffic—multiple symmetric conversations, client/server and so on—requires some effort.

## Diagnosing crashes can be as easy as flipping a switch!



### The central management solution that tells you what went wrong.

Network and server crashes are your job - you need to bring your system back up quickly - no matter where you are - at home, off-site, or in the office. You need to know WHY your server went down. That's why SystemConsoleSwitch contains an audit trail, containing 40 full screens of data for each port, enabling you to see what happened in the final moments before your device went down.

Not in the office when the crash happened? No problem - SystemConsoleSwitch gives you remote access to your devices via modem.

The SystemConsoleSwitch is an intelligent switch that allows a single text (RS-232) terminal to control and monitor an entire data center, up to 120 ports, from one central location.

SystemConsoleSwitch is compatible with a variety of computers, UNIX servers, LAN/WAN components and management systems.

**1-800-871-9838**

 **Lightwave Communications, Inc.**  
203 878-9838 • [www.lightwavecom.com](http://www.lightwavecom.com)

Circle No. 25 on Inquiry Card

SUNEXPERT Magazine November 1996

The traffic agent must be installed on workstations on the remote LANs using the `getagents` in SunNet Manager. It samples the network traffic and can report a variety of information back to the requester. I chose the `betweenIP` option, which creates a list of source and destination IP pairs and the number of packets sent between them. The traffic agent cannot see traffic that its host generates, so it is important to run it on a host that is not a major contributor to the network traffic. If you have bridges on your network, you must consider them and place your traffic agents accordingly.

In my case, a router is attached to a highly utilized server segment that is bridged to a less active segment. If I place the traffic agent on the client segment, it would inevitably miss significant portions of the traffic. If you have a number of bridged segments on your network and want to put an agent on each, you will need to add extra correlation code to the program that will summarize your traffic data.

## Generating Reports

The log file format is not quite readable by humans, but it is easily parsed and well documented in the man page `snm.logfile(5)`. Once you have determined which fields you are interested in, you can create a script using `awk` to pull out the data you need for your reports. After that, you can use various utilities to create the reports. UNIX shell scripts and programs written in C and Perl will be useful for condensing the data.

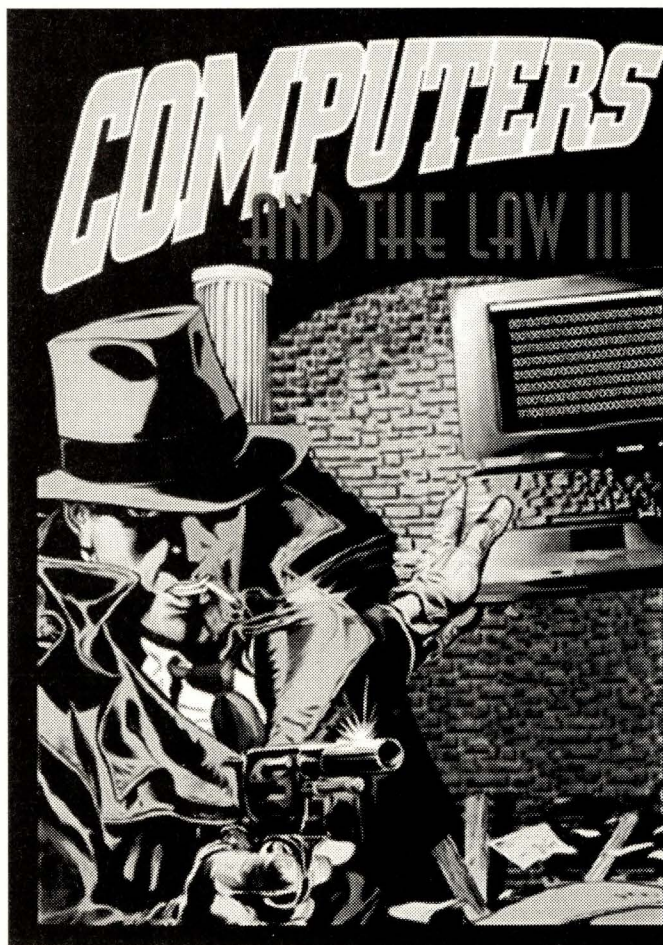
In addition, I suggest using any mathematical commercial software you have available, such as Matlab, Mathematica or S-Plus—even if it means you have to learn something new. These programs have the statistics utilities needed to compute the average, range check and create histograms of your data.

Processing the `hostperf` data is straightforward. First, you go through the log file and find out the names of all your nodes. You separate the data, possibly filtering out data from non-

business hours. Then, for each node, you go through and find out information such as average CPU utilization and average load. Because I would like to distinguish between a workstation that is constantly having a 5% collision rate and one that normally runs around 1% but often shoots up over 15%, I create a histogram of the collision rate for each host.

The `hostperf` scripts to summarize the data took about a day to write and consist of around 150 lines of `csH` and S-Plus scripting. Every Monday morning, the scripts save from the old data log file and generate a report that summarizes resource utilization. This report can be used for troubleshooting and resource allocation. Resource allocation is quite simple. The reports clearly show which servers are busy and which workstations are most active (and most idle). For troubleshooting, report inconsistencies often point to runaway programs that need to be killed.

Although the grapher and data



...I knew I was in over my head - yeah, way over my head. I needed help and I needed it fast. A while back I heard about this annual gathering of lawyers, police, and computer types. They knew it all: copyright law; fair use policy; trademarks on the Internet; security issues; how to deal with the local, state, and federal government. In a nutshell, the past, present and future of computer crime.

Not just talk, but an exhibit hall where a fella like me could get my hands on the latest technology for encryption, firewalls, Internet security, and more.

I knew it was in San Jose, California from December 1-4, 1996 - but that was all I knew. No problem... I knew who to ask for more information.

The Sun User Group  
 (617) 232-0514  
[office@sug.org](mailto:office@sug.org)  
<http://www.sug.org/conference.html>

browser with SunNet Manager are not recommended for condensing and analyzing general trends in your data, they can be used effectively to analyze specific subsets of your data. A recent application crash on our network provides an excellent example of how troubleshooters can use this information.

A mathematical simulation was started on one of the SPARC 10s in the afternoon. It did not run to completion, and we were not sure if more memory and more swap space were needed to keep the program running. Reviewing CPU utilization and paging rates from the get-hostperf data showed that the CPU utilization remained over 80% for the life of the program. The program had inefficiently been acquiring memory that it did not necessarily access frequently. When swap was exhausted, the program crashed even though it was not having much of a paging problem. Based on this, we avoided adding more physical memory, instead a large chunk of additional swap space solved the problem. The disk space was cheaper than the memory and the user did not have to rerun the program with our monitoring of it to re-create the problem.

Because the data had already been collected, analysis and problem resolution took an administrator about a half hour. This saved the user six hours of trying to re-create the problem alone. It also saved an administrator the time it would have taken to write scripts and analyze their output to resolve the problem. In this case, SunNet Manager proved itself to be a real time-saver.

Creating report files from the traffic data logs is far more difficult. Unlike the hostperf data, this data does not lend itself easily to straightforward shell scripts. One data collection point, and thus one line in the log file, can have several hundred fields. That's a big line. Too big for standard awk. A week's worth of data can contain several hundred thousand source-destination data pairs.

It took me a whole week to develop a C program to process the data and produce statistics such as total network traffic, top network hosts and

who they are talking with. If you are comfortable with C programming, this might be an option for you.

You must decide whether or not it's cost-effective compared with other solutions such as network sniffer analysis (very time consuming) or commercial network analysis products (which can be expensive).

In our case, I knew we had overloaded networks, confirmed by sniffer

data and host data, and that I had to come up with a solution. This solution was a cost-effective means of acquiring the data I need to evaluate various network upgrade options. →

**Jim Boyle** works for a systems engineering firm in Washington, D.C., and can be reached by email at [jboyle@cpg.com](mailto:jboyle@cpg.com).

## Lose your mouse and increase your productivity.

*From Wall Street to Silicon Valley, your top competitors have replaced hundreds of free mice that came with their workstations with \$199 MOUSE-TRAK™ trackballs. The reason: productivity and reliability.*

**Productivity:** Laboratory testing has shown that only 4 hours of continuous mouse usage can result in as much as 60% loss of hand strength. A trader, engineer, or data entry user in that condition is simply not going to be as productive in the second half of the day as in the first. The same tests show no signs of physical fatigue when using a MOUSE-TRAK.

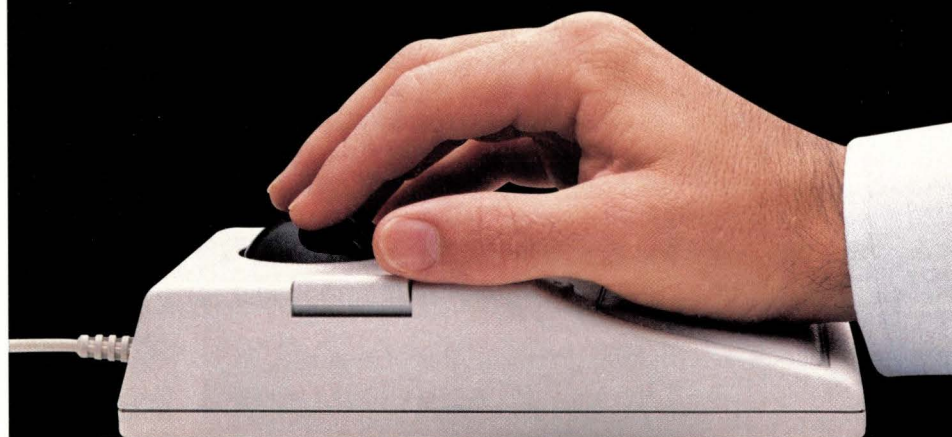
**Reliability:** MOUSE-TRAK's rugged construction results in *much* higher reliability than mice or consumer trackballs. MOUSE-TRAK doesn't take traders out of play or make support people pull their hair out!

*Call, Fax, or email today to order or receive more information about MOUSE-TRAK.*

**1-800-533-4822**  
sales @ moustrak.com

**mouse-trak**®

The Professional's Trackball



**ITAC Systems, Inc. 214 494-3073 Fax 214 494-4159**  
[www.moustrak.com](http://www.moustrak.com)

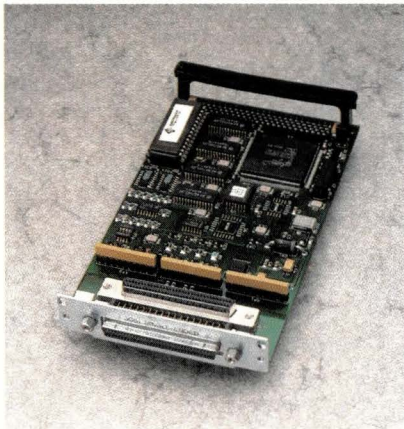
# NEW PRODUCTS

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

## **SBus Ultra SCSI Adapter**

Performance Technologies has announced an Ultra SCSI adapter for Sun's SBus architecture.

The PT-SBS450 SBus Adapter offers 40-MB/s SCSI performance in Ultra/Wide/Fast mode, and supports



both the Solaris 2.x and SunOS 4.1.x operating systems, the company says.

The PT-SBS450 Adapter is based on two processors: an embedded RISC processor for supervising operations and minimizing system overhead; and an Ultra SCSI controller processor to run the SCSI bus operations. This design, the company says, is used to reduce interrupt latency.

The PT-SBS450 includes the company's proprietary Adaptive Synchronous Negotiation (ASN) feature, which reportedly uses statistical techniques to maintain the highest possible transfer rates. Also, the PT-SBS450 is fully backward-compatible with 16-bit Fast/Wide SCSI devices.

The PT-SBS450 comes with either a single-ended or differential SCSI bus architecture. The single-ended version costs \$1,095, and the differential version costs \$1,145.

**Performance Technologies Inc.**  
315 Science Pkwy.  
Rochester, NY 14620  
Circle 101

## **UNIX Version of Desktop DBA**

Desktop DBA, the client/server database administration tool from Platinum Technology, now runs

under Motif. Platinum hopes to lure relational database managers from UNIX environments, to add to the 50,000 database managers running the program under Windows.

Desktop DBA is designed to automate database comparisons; alter database objects; drag and drop database objects; and perform routine administration tasks, such as configuring local and remote servers, modifying user permissions and performing catalog reporting.

Desktop DBA has a Motif GUI and runs on HP-UX, Sun Solaris and IBM AIX. Support for additional UNIX platforms is forthcoming, the company says. It currently supports Oracle Corp., Sybase Inc. and Microsoft SQL Server databases. Pricing starts at \$2,490.

**Platinum Technology Inc.**  
1815 S. Meyers Road  
Oakbrook Terrace, IL 60181  
Circle 102

## **Connect Multiple Fat Pipes**

Hitachi Computer Products has introduced its HiSpeed 150 (HS 150) Ethernet switching unit, which supports a total of 32 Ethernet connections, 16 Fast Ethernet connections, and the ability to switch between

## **Turnkey CD-R Production**

**R**image has put out a comprehensive system for writable CD (CD-R) production, called The Perfect Image Producer line. The system is intended to let users automate both recording and surface printing of multiple CD-Rs in an unattended environment, the company says.

The Perfect Image Producer line is composed of a single drive unit, with an Automation Station and a specially-configured control center. The Automation Station houses the 4X CD recorder, transport robotics and the thermal-transfer surface printer. The PC-based control center runs proprietary Rimage software that is said to manage premastering, recording and surface printing.

In addition, Rimage offers the optional Automation Protocol software (for \$1,500), that allows users to manage multiple unique printing jobs from any node on a network. Support for the ISO 9660 premastering standard is also included. Pricing for The Perfect Image Producer line starts at \$25,995.



**Rimage Corp.**  
7725 Washington Ave. S.  
Minneapolis, MN 55439  
Circle 100

*Congratulations!*

# With Rave, your business is the winner.



Your business will maximize operating efficiency with Rave's economical, SPARC™-based hardware and software solutions. Here's why IT managers and systems administrators rely on Rave Computer as their single source supplier:

**Flexibility** Rave offers the flexibility of custom built, scalable or RAID-ready workstations and servers. From processor upgrades, to trade-ins or custom modifications, Rave has the products you need, when you need them.

**Availability** Exclusively dedicated to SPARC technology equipment, Rave offers a full line of brand name SPARC-based hardware, software and peripherals. All are in stock for immediate delivery.

**Service & Support** Satisfied users in all industries rely on Rave's toll-free technical

support hotline and Sun certified engineers. Experienced account managers provide configuration consulting to fit any budget.

**Value** With Rave, you not only save money, you receive a complete one year warranty on all SPARC systems.

*Sun Marketplace Solutions Provider*

## **Rave Computer Association, Inc.**



36960 Metro Court  
Sterling Heights, MI 48312

**1-800-966-7283**

(810) 939-8230

Fax: (810) 939-7431

E-Mail: [info@rave.com](mailto:info@rave.com)

<http://www.rave.net>



*Sun Microsystems  
Workstations & Servers*



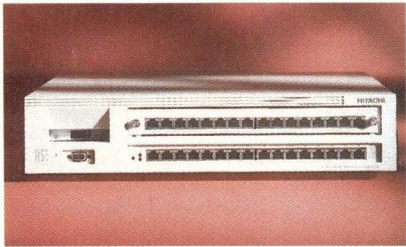
*Axil Computer  
Workstations & Servers*



*Rave Systems  
Workstations & Servers*

All SPARC trademarks are trademarks or registered trademarks of SPARC International, Inc. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc. All other products or service names mentioned herein are trademarks of their respective owners.

Circle No. 32 on Inquiry Card



FDDI, ATM and WAN uplinks, all within the same unit.

Additional features of the HS 150 are said to include IP/IPX routing, ATM LAN emulation, a Frame Relay interface, integrated ISDN and a built-in PCI bus for WAN or high-speed LAN uplink. These features are typically found on units priced 30% to 50% higher than the HS 150, Hitachi says.

By integrating the HS 150 with a PCI bus architecture, it is easy for users to upgrade to faster networking technologies (ATM, Gigabit Ethernet) as they emerge, the company says. All one needs to do is replace the PCI module.

The HS 150 can reportedly be maintained via UNIX or Windows management software, remotely via telnet, through a local console inter-

face or with a third-party SNMP-based management package.

The product is available in various configurations. For example, the HS Model 150-100-16 provides 16 100BaseT ports and costs \$12,785. Additional modules (protocols, management software) are optional and are priced individually.

**Hitachi Computer Products Inc.**  
3101 Tasman Drive  
Santa Clara, CA 95054  
Circle 103

### Guaranteed Messaging Middleware

New Era of Networks (NEON) has released NEONet 2.2. NEONet is used by MIS departments to balance message and message-queuing loads; guarantee message delivery, sequence and accurate data replication between databases; and increase speed across diverse platforms, the company says.

NEONet 2.2 reportedly differentiates itself from other messaging middleware with guaranteed messaging, which means each message is delivered only once in the order in which it was sent.

NEONet is responsible for initiating, tracking and guaranteeing the uniqueness of each message, NEON says.

Guaranteed message delivery is said to ensure a synchronized network. Synchronization is important because in the event of downtime, a synchronized network is easier to recover, the company says.

The NEONet Formatter allows users to format data from disparate operating systems and applications on the fly, with only minor programming. The Rules Engine lets users send multiple, independently formatted messages from a single source, with a Publish-Subscribe messaging structure. NEONet reportedly maintains the transparency between the two.

NEONet is available for SunOS, Solaris and Windows NT. It supports Sybase, Oracle and SQL Server databases. Pricing is based on platform, network and database configurations, ranging from \$18,000 to \$85,000.

**New Era of Networks Inc.**  
7400 E. Orchard Road, Ste. 230  
Englewood, CO 80111  
Circle 104

# DLT HEAVEN

**1.2GB/minute native throughput**

**3.36TB capacity**

**4 drives and 58 tape cartridges for automated storage**

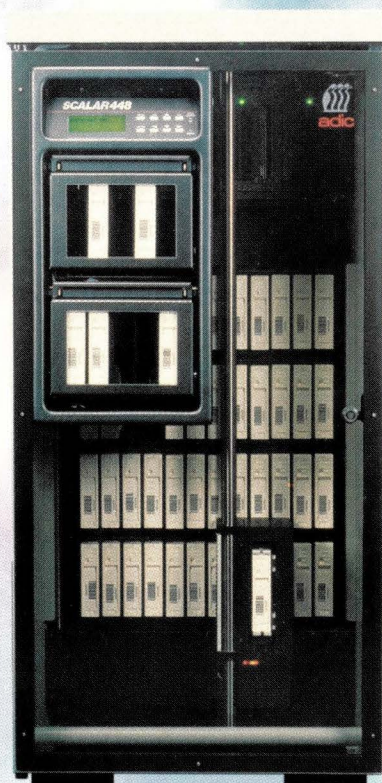
**Scalar Series  
DLT Libraries**

2, 3, or 4 drives  
Up to 48 tapes  
10-cartridge mailbox  
Floor model or rack mount

**Scalar 448/2000XT**  
Capacity: 720GB; 1.44TB\*  
Transfer rate: 150MB/ to 600MB/min\*

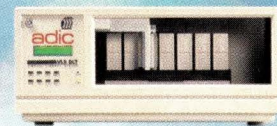
**Scalar 448/4000**  
Capacity: 960GB; 1.92TB\*  
Transfer rate: 180MB/ to 720MB/min\*

**Scalar 448/7000**  
Capacity: 1.68TB; 3.36TB\*  
Transfer rate: 300MB/ to 1.2GB/min\*



Looking at DLT™ technology to upgrade your data storage? ADIC manufactures the industry's most complete line of DLT products. It includes stand-alone drive systems, the VLS DLT desktop library, and the Scalar libraries for enterprise networks and data centers. Full support for NetWare, Windows NT, and UNIX systems.

Compatible with all leading applications software, more than 12,000 ADIC tape libraries are in the field, performing backups, providing HSM support, and generally taking the hassle out of tape management.



**DLT Desktop**  
VLS DLT Series Libraries provide up to 280GB capacity with 180MB/minute throughput in a one-drive, 7-tape library.

Call today for more information about ADIC's DLT solutions—and about our complete line of 4mm and 8mm products.

1-800-336-1233

**ad ic**

E-mail: [info@ad ic.com](mailto:info@ad ic.com)  
<http://www.ad ic.com>

\* Note: All capacities and transfer rates are listed at native and with 2:1 compression. Transfer rates show possible throughput with 4 drives operating concurrently. DLT is a trademark of Quantum Corporation.

Circle No. 1 on Inquiry Card

## Get Paged from a Web Page

EtherWeb from Personal Productivity Tools allows users to send alphanumeric pages across the Internet from a Web page. EtherWeb is the Web-enabled version of the company's EtherPage product.

By using a Web browser as the GUI, EtherWeb will quickly find applications in the customer support, help desk or finance/banking fields, the company says.

The EtherWeb client runs as an HTML 2.0-compliant Web page on an intranet server. To use the program, users simply access the EtherWeb page as if it were a link. Users can choose who they want to page by scrolling through a dynamic list. In addition, users can view the status of the page they have sent, the company says.

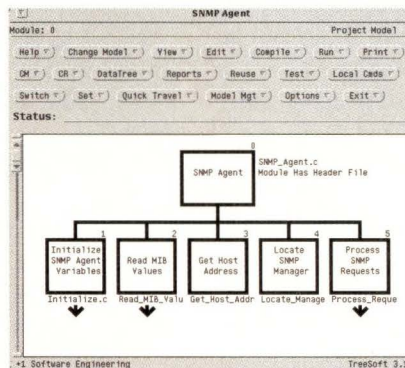
The EtherWeb server product runs on various Web server platforms, including SunOS, Solaris, HP-UX, IBM AIX and SCO UNIX. Pricing for EtherWeb is on a per-Web server basis, from \$595 for a maximum of

three pagers and \$1,095 for eight pagers to \$2,195 for an unlimited number of pagers.

**Personal Productivity Tools Inc.**  
14141 Miranda Road  
Los Altos Hills, CA 94022  
Circle 105

## Manage Code from Many Languages

+1 Software Engineering has released two new components of its TreeBase software line: TreeSoft/Base and TreeSoft/CM. Both modules are development support tools for software projects written in Ada, C, C++, FORTRAN, Pascal, as well as other



languages, the company says.

TreeSoft/Base is a process tool that supports multiple software projects. Once a project has been supported, TreeSoft/Base is said to graphically display the calling structure of the program, letting users edit its structure, view source code or documentation. TreeSoft/Base manages and runs the project's Makefile and can display runtime statistics of C and FORTRAN code, the company says.

TreeSoft/CM is a configuration management module that expands upon the UNIX Source Code Control System (SCCS) utility. It is said to support identification, variations, baselines, accounting, auditing and access control.

TreeSoft/Base and TreeSoft/CM run on SunOS and Solaris platforms, and support OpenWindows, Motif and CDE. TreeSoft/Base and TreeSoft/CM cost \$1,250 each per floating license.

**+1 Software Engineering**  
2510-G Las Posas Road, Ste. 438  
P.O. Box 6041  
Camarillo, CA 93011  
Circle 106



RETHINK YOUR  
SERVICE ASSUMPTIONS

## Sun and HP Service Make a Lasting Difference.

Contemplating a change? Maybe it's time to rethink your service assumptions. Polaris has new, flexible, reliable alternatives for Sun and HP 9000 users that will make a lasting difference.

We will show you how to take better advantage of your resources, capitalize on new trends in computer service, and get a better return on your service investment.

Find out about your options. Call 800-541-5831 in the U.S., or +31-26-3116068 in Europe. You can also e-mail us at sales@polaris1.com in the U.S. and sales@polaris.nl in Europe.

### Custom Service Plans

On-Site Maintenance  
Self-Maintenance  
Software Support

### Education Services

Maintenance Training  
SunSoft Authorized  
Training

### Expert Support

Help Desk  
Parts and Systems

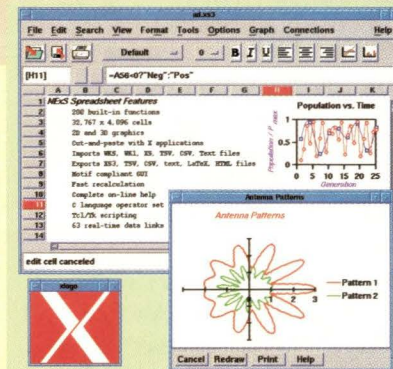
See our homepage: <http://www.polaris1.com>

**POLARIS**

The Leader in Independent UNIX Systems Service.

## Upgrades, Enhancements, Additions...

❑ X Engineering Software Systems has released Version 1.2 of its low-cost NExS spreadsheet. The spreadsheet features 200 built-in math and business functions and 2D and 3D graphing. Data can be imported or exported from a variety of formats, the company says. An API that can support up to 63 real-time connections is also available. NExS runs on Solaris, SunOS, Linux, HP-UX, IBM AIX and Digital UNIX. A single user-license, without the API, costs \$49. **X Engineering Software Corp. Systems**, 2608 Sweetgum Drive, Apex, NC 27502. **Circle 107**



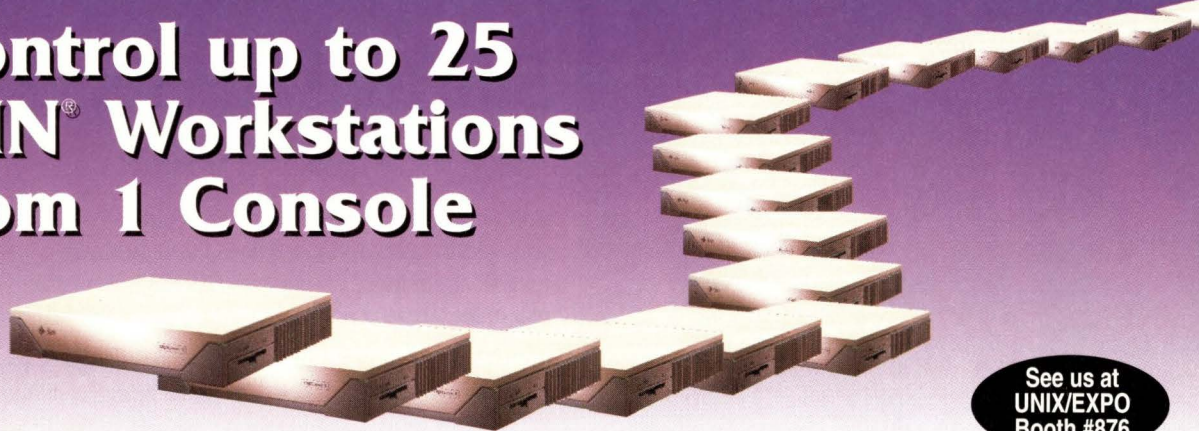
❑ Oracle 7.x databases can now be backed up using PDC's BudTool backup management product, the company says. Called BudTool Support for Oracle, the add-in module allows users to automate their backup process. Users can reportedly perform either hot or cold backups of tablespaces, archive logs and configuration files. Backup tapes are restored using standard UNIX or Oracle commands. BudTool Support for Oracle is a free add-in module for BudTool 4.4 users. Pricing starts at \$2,495, plus maintenance. **PDC**, 1002 West 9th Ave., King of Prussia, PA 19406. **Circle 108**

Network Node Manager 4.1. NerveCenter Pro reportedly collects data from UNIX, Windows NT and Novell Inc. NetWare systems, and uses behavior models to correlate network conditions, identify problems and filter out superfluous events. A release for SunOS and Solaris is imminent, with an enterprise license priced at \$15,000. **Seagate Enterprise Management Software Inc.**, 19925 Stevens Creek Blvd., Cupertino, CA 95014. **Circle 109**

❑ Version 2.6 of Seagate NerveCenter Pro now supports Hewlett-Packard Co.'s distributed OpenView

❑ Users of RDI's PowerLite portable SPARC-based workstation can now use the PowerLite Maximum Peripheral Expansion Unit (MAX) to expand their systems with up to 8.6 GB of hard disk space, a

# Control up to 25 SUN® Workstations from 1 Console



See us at  
UNIX/EXPO  
Booth #876

With the **ServerSwitch**, you control/monitor up to 25 SUN® workstations from a single keyboard, monitor and mouse. Effortlessly switch between CPUs without affecting active software processes.

- Eliminate extra monitors and keyboards.
- Cascadable 5 port design.
- SPARC™ Verified.
- Remote control unit available.
- No rebooting.
- Pushbutton selection.
- Ideal for networks.

**1-800-871-9838**

**Lightwave Communications, Inc.**

261 Pepe's Farm Road, Milford, CT 06460 ■ 203-878-9838 ■ Fax: 203-874-0157  
■ Email: lightwve@MCIEmail.com ■ World Wide Web: www.lightwavecom.com



Circle No. 26 on Inquiry Card



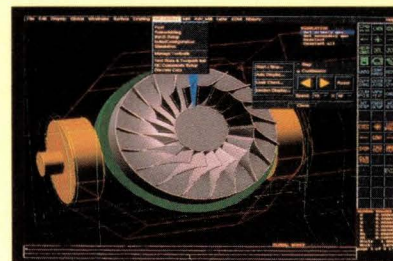
CD-ROM and SBus expansion slots. MAX weighs 7.4 lb.s and supports all the PowerLite models. It can reportedly be configured in a variety of ways. Pricing starts at \$3,995. **RDI Computer Corp.**, 2300 Faraday Ave., Carlsbad, CA 92008. **Circle 110**

Users of Transarc's Distributed File System can now incorporate Windows files into a DFS environment. The product, DFS-Light, is the Windows thin-client version of DFS, the file system associated with The Open Group's Distributed Computing Environment. DFS reportedly allows any computer on a network to transparently access information found on any other computer on the network. DFS-Light costs \$150 per seat, with volume discounts available. **Transarc Corp.**, The Gulf Tower, 707 Grant St., Pittsburgh, PA 15219. **Circle 111**

Progressive Systems has released a new version of its Morning Star PPP product. The software runs the point-to-point (PPP) protocol on UNIX workstations, providing low-cost access to the Internet, the company says. The latest version, 1.4.1.7, adds support for Solaris 2.5. Morning Star PPP costs \$795 per license. **Progressive Systems Inc.**, 3518 Riverside Drive, Ste. 201, Columbus, OH 43221. **Circle 112**

Exodus Technologies has released Version 1.1 of NEnterprise, which enables users to display Windows applications running on an NT server to any X terminal on a network. It supports UNIX and Macintosh computers running X server software. NEnterprise comes in Pentium and PowerPC versions, and costs \$795 per single-user license. **Exodus Technologies Inc.**, 11130 NE 33rd Place, Ste. 260, Bellevue, WA 98004. **Circle 113**

Version 11.0 of Camand software, from CAMAX, a subsidiary of Structural Dynamics Research Corp., has been released. The new version features enhancements in Multiple Surface Fillet construction and Bay/Island Cleanout; a Motif GUI; and an on-line documentation viewer. Pricing for Version 11.0 of Camand software starts at \$10,000. **Structural Dynamics Research Corp.**, 2000 Eastman Drive, Milford, OH 45150. **Circle 114**



## Running Out Of Time?



### Lease or Rent the SPARC™ System of Your Choice.

- Sun Workstations & Servers • Axil Workstations & Servers
- Tadpole SPARCbooks • Rave Systems-POWER Tower & Rack

- Lowest rental prices
- From 1 to 60 months
- Immediate approval
- Easy application
- Sun OS pre-loaded
- Flexible lease structuring
- Overnight delivery available
- Complete SPARC inventory

### Rave Financial Services, Inc.



36960 Metro Court • Sterling Heights, MI 48312  
 Fax: (810) 939-7431 • E-Mail: rent@rave.com  
<http://www.rave.net>

**1-800-500-7283**

MEMBER  
**ELA**

SPARC® is a registered trademark of SPARC International, Inc. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc.

## EXB 220. Fast. Roomy. Affordable.

No other drive puts away so much data so fast for so little. In fact it's the most cost effective backup solution for network and application servers.

- Supports up to two Exabyte Mammoth 8mm half-high drives and 20-plus-one EXATAPE™ 8mm data cartridges
- 173 GB backup in a 4-hour window
- Automates storage for up to 800 GB of data at a 12 MB/sec. aggregate transfer rate
- SCSI Fast/Wide option for maximum performance
- 2-year warranty



For further information, call  
 1-800-724-2692.

### APPLIED DIGITAL SYSTEMS INC.

BOSTON • HERNDON • CHICAGO • ORLANDO • HOUSTON

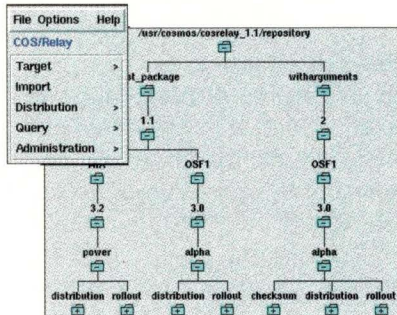
30 Liftbridge Lane East  
 Fairport, NY 14450-1526

email: info@adsys.com  
 GSA#GS00K93AGS5629-PS02  
<http://www.adsys.com>

**EXABYTE®**

## Automate Software Distribution

For managers of distributed networks, Open Systems Management has announced COS/Relay, an automated software installation and distribution package.



COS/Relay can be used to distribute software to any number of systems from a single console, which the company calls "the master console." The product respects system security by allowing access to permissioned systems only, and by allowing managers to configure different levels of security for different users, Open Systems Management says.

When installing software with COS/Relay, users can automate certain steps such as rebooting or restarting daemons. The product is said to automatically collect audit information, recording each step of the installation. In this way, the entire operation can be rolled back, if necessary, the company says.

COS/Relay is part of the COS-MOS suite of applications. It runs on various UNIX platforms, and is priced at \$2,925 per floating license.

**Open Systems Management Inc.**  
1111 Third Ave., Ste. 2500  
Seattle, WA 98101  
Circle 115

## UPS Bundled With Admin Tools

Two new uninterruptible power supply (UPS) systems that come with free administration and management features are available from MGE UPS Systems.

The Merlin Gerin Pulsar ESV8 is rated to 750 VA and will support a tower server for 25 minutes. The ESV11 is rated to 1,150 VA and will support a similar server with periph-

erals for 25 minutes, MGE says.

Both products come with the company's proprietary CD-ROM SolutionPac, which reportedly contains the necessary software for local or remote SNMP administration, installation of the Pulsar ESVs on LANs or WANs, and managing the UPS in a heterogeneous environment.

Features supported in the Pulsar ESV line include switchable receptacles; voltage threshold customization; fader mode to protect from voltage variations; regular, automatic battery testing; and an auto-sleep feature.

The ESV8 and ESV11 are priced at \$499 and \$659, respectively.

**MGE UPS Systems**  
1660 Scenic Ave.  
Costa Mesa, CA 92626  
Circle 116

## Three-Tier Transactional Middleware

Prolifics, a JYACC company and maker of JAM, has announced a development tool called Prolifics.

Prolifics is said to combine transaction processing and a Visual Server

## ALPHANUMERIC PAGING FOR UNIX

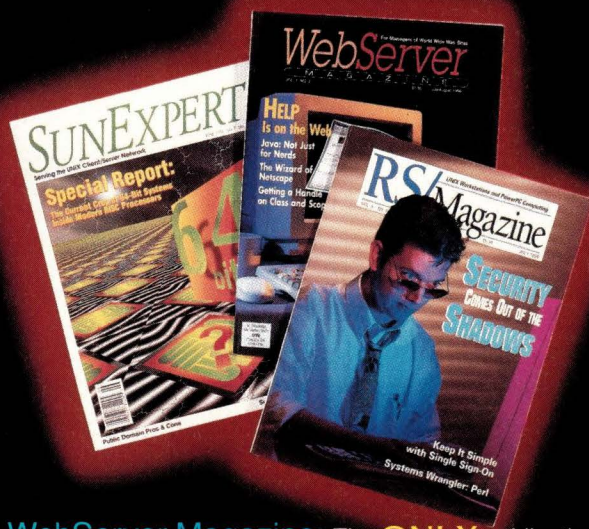
RELIABLE, EASY DELIVERY OF MESSAGES ANYTIME ANYWHERE

- Email forwarded to pager automatically
- Pages can be generated from scripts, and network monitoring programs
- GUI and command line interface
- Works with any paging service
- Automatic email confirmation, history logs and error reporting
- Client-server technology
- Works with digital and alphanumeric pagers

### Personal Productivity Tools for the Unix Desktop

14141 Miranda Rd  
Los Altos Hills, CA 94022  
Email: sales@ppt.com  
Tel: (415) 917-7000  
Fax: (415) 917-7010  
<http://www.ppt.com>

## Advertise to the ONLY Technical Leaders

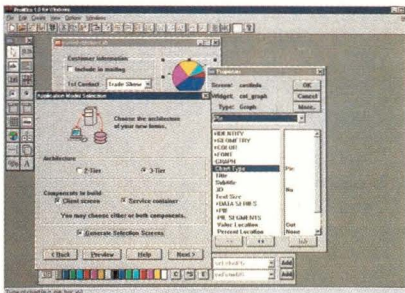


**WebServer Magazine:** The **ONLY** publication targeted to corporate WWW site technical management.

**SunExpert:** The **ONLY** publication targeted to technical managers of workstation/server networks.

**RS/Magazine:** The **ONLY** publication targeted to technical managers of RS/6000 System and PowerPC computing networks

Visit our WWW site at: <http://www.cpg.com>



Development environment. The company says it expands on JAM in that it supports three-tier environments, including Web clients.

JetNet, the OLTP middleware in Prolifics, is based on BEA TUXEDO. Prolifics' own Visual Server Development speeds up object-oriented server development by using standard visual development features such as drag-and-drop, and the reuse of developed systems, the company says.

Both the Prolifics Visual Server Development environment and the transaction processor are shipping. A five-user license costs \$35,000.

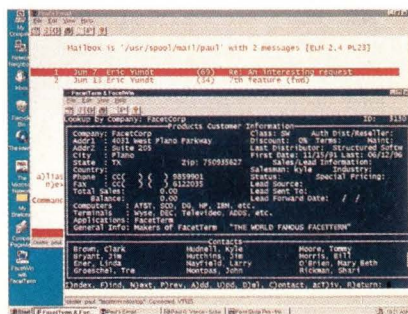
**Prolifics Inc.**  
116 John St.  
New York, NY 10038  
Circle 117

### Connect PCs to UNIX without NFS

For those environments running Windows NT and 95 clients with UNIX-based servers, FacetCorp has announced FacetWin, which is said to enable users to access UNIX resources (files, disks, printers, applications, etc.).

The benefits of using FacetWin include transparent access to network printing services and modems, terminal emulation and the ability to back up networked PCs to a UNIX tape drive, the company says.

FacetCorp says that, unlike other



PC-to-UNIX connectivity packages, FacetWin does not rely upon NFS to transfer data, but rather on Microsoft's Server Message Block (SMB) technology. Instead of turning a PC into an NFS client, FacetWin installs an SMB server on the UNIX server. The only software that runs on the PC is the terminal emulator. This methodology, FacetCorp says, provides higher throughput for file and printer services and is easier to install

and administer.

FacetWin works on major UNIX platforms, including SunOS, Solaris, IBM AIX and HP-UX, and will be ported to additional platforms as the need arises. FacetWin is priced at \$195 per single-user license. A free 30-day evaluation is also available.

**FacetCorp**  
4031 W. Plano Pkwy.  
Plano, TX 75093  
Circle 118



## MINICOMPUTER EXCHANGE

**SELL • BUY • RENT • REPAIR**

**SUN MICROSYSTEMS  
&  
SILICON GRAPHICS**  
**SYSTEMS  
PERIPHERALS  
PARTS**

**THE MCE ADVANTAGE:**  
OVER 140 YEARS CUMULATIVE SUN & SGI EXPERIENCE  
TRADITIONAL dependability  
EXPANDED sales staff  
NEW TECHNICAL support  
ADVANCE EXCHANGES & UPGRADES  
COMPLETE line of SUN and SGI  
120-day WARRANTY  
INTERNATIONAL shipping  
WE BUY USED EQUIPMENT  
WEEKLY price revisions. CALL for a QUOTE today!

**COMPUTER RESELLERS SINCE 1973**  
**COMMITTED TO QUALITY & VALUE**  
**TELE: 408-733-4400**

**FAX: 408-733-8009**      **EMAIL: info@mce.com**  
**WEB: HTTP://WWW.MCE.COM**

Circle No. 27 on Inquiry Card

## Visual Development for C/C++, Java

For object-oriented development environments coding both in C/C++ and Java, or for environments planning to migrate to Java in the next couple of years, Integrated Computer Solutions has released a visual development tool that allows users to generate either C/C++ or Java code.

Called Builder Xcessory PRO (BX PRO), it is the first visual reuse tool environment to support both languages, the company says. BX PRO consists of Builder Xcessory, a GUI builder for Java and OSF/Motif; ViewKit ObjectPak, a C++ reuse framework; and EnhancementPak, a library of 27 reusable components.

BX PRO runs on Sun Solaris, HP-UX, IBM AIX, Digital UNIX and SGI IRIX. However, code developed with it can be deployed on non-UNIX platforms. This is because Java is by nature multiplatform. For C/ C++ code, ICS provides an optional kit that generates Windows NT or 95 executables. A single floating license costs \$6,495.

Integrated Computer Solutions Inc.  
201 Broadway  
Cambridge, MA 02139  
Circle 119

## Distribution Panel has 24 Ports

Peradata Technology has announced a new line of 24-port distribution panels. Model 963 is designed for 10BaseT networks, Model 972 is for token-ring LANs, and Model 980 is for RS-232 terminal servers. All models come with internal surge protection for each port.

The Model 900 line is more economical than installing an individual surge protector at each port, the company says. Each model features standard "110" connectors for rear cable termination, and RJ45 jacks for connecting to a workstation. A solid-state suppression circuit, rated to 1,500 watts, protects each wire of the port. Pricing for the Model 900 line is \$890 each.

Peradata Technology Corp.  
17 Birch St.  
Lake Grove, NY 11755  
Circle 120

### U.S. POSTAL SERVICE STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685)

- Title of Publication: SunExpert Magazine
- Publication No: 1053-9239
- Date of Filing: September 25, 1996
- Frequency of Issue: Monthly
- No. of Issues Published Annually: 12
- Annual Subscription Price: \$60.00 domestic \$95.00 outside U.S.
- Complete Mailing Address of Known Office of Publication: Computer Publishing Group, 320 Washington Street, Brookline, Norfolk County, MA 02146.
- Complete Mailing Address of the Headquarters or General Business Offices of the Publisher: Same as Item 7.
- Full Names and Complete Mailing Address of Publisher, Editor and Managing Editor: Publisher - S. Henry Sacks, Computer Publishing Group, 320 Washington Street, Brookline, MA 02146; Editor - Douglas Pryor, Computer Publishing Group, 320 Washington Street, Brookline, MA 02146; Managing Editor - Lisa Guisbond, Computer Publishing Group, 320 Washington Street, Brookline, MA 02146.
- Owner: S. Henry Sacks, Douglas Pryor, 320 Washington Street, Brookline, MA 02146.
- Known Bondholders: None.
- Not Applicable.
- Publication Name: RS/Magazine.
- Issue Date for Circulation Data Below: September 1996.
- Extent and Nature of Circulation:

	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies (Net Press Run)	76,870	76,471
B. Paid and/or Requested Circulation		
1. Sales through dealers and carriers, street vendors and counter sales	197	207
2. Mail Subscription	71,276	70,086
C. Total Paid and/or Requested Circulation	71,473	70,293
D. Free Distribution by Mail, (Samples, Complimentary and Other Free Copies)	2,502	2,561
E. Free Distribution Outside the Mail (Carriers or Other Means)	816	1,198
F. Total Free Distribution	3,318	3,759
G. Total Distribution	74,791	74,052
H. Copies Not Distributed		
1. Office use, left over, unaccounted, spoiled	1,596	1,911
2. Returns from News Agents	483	508
I. TOTAL	76,870	76,471
Percent Paid and/or Requested Circulation	95.6	94.9

17. I certify that the statements made by me above are correct and complete.

*S. Henry Sacks*

S. Henry Sacks  
Publisher

## COME ON AND TAKE A FREE RIDE.

**HERE'S WHAT IT IS**

Catalyst CDware™ is the interactive CD-ROM featuring software and hardware products for the Solaris™ environment. Inside each issue, you'll discover a wide range of product and industry information, a complete catalog of all available software for the Solaris operating environment, product demos . . . even free software in most issues.



**HERE'S HOW**

Here are some easy ways to subscribe:

- Check it out first: CDware on the Web <http://www.sun.com/sunsoft/cdware/>
- Email: [cdware-form@sun.com](mailto:cdware-form@sun.com)
- Fax back Number: (510) 372-8582 for subscription form
- Toll-Free Number: 1 (800) 2CDware

**HERE'S WHY**

CDware integrates the power of CD-ROM technology and seamless interaction with the World Wide Web utilizing Java™, making this one of the most comprehensive information tools available anywhere. Contact SunSoft™ today to receive your FREE subscription to this exciting CD-ROM in either SPARC™ or Intel® format. Take us for a free spin.

**HERE'S WHO IT IS**



<http://www.sun.com/sunsoft/cdware/>





**Catalyst Catalog**  
On-line  
Third Party Solutions for Sun™  
<http://www.sun.com/catalyst/>



© 1996 Sun Microsystems, Inc. Sun, SunSoft, the SunSoft logo, Solaris, Catalyst CDware, and Java are trademarks or registered trademarks of Sun Microsystems, Inc. SPARC is a trademark of SPARC International, Inc.

# THE *SUNEXPERT* MARKET

To advertise your product/service in the next issue or for more information, please call Carol Flanagan at

**(508) 839-4016** Email: [carolf@cpg.com](mailto:carolf@cpg.com)

## ATTENTION READERS/BUYERS

For more information on the products/services advertised in this section, please circle the appropriate reader service number(s) on the reader inquiry card located elsewhere in this issue.

OR

You can E-mail your requests for more information using the reader inquiry card numbers.

Here's how:

E-mail address: [BERKCOMP@AOL.COM](mailto:BERKCOMP@AOL.COM)

Include

1. Magazine name and issue date
2. Your name and address
3. Reader inquiry numbers, separated by commas, for which you need more information.

## PRODUCT SHOWCASE

### SCSI SOLUTIONS



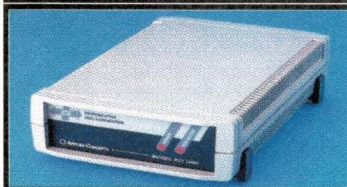
#### SCSI SWITCHES

- 4x4 & 4x2 SCSI Port Switching
- Single-ended / Differential SCSI
- Narrow / Wide SCSI
- RS-232 / Network Interface
- Rack Mount / Desk top Versions
- GUI Software Included



#### SCSI FIBER OPTIC EXTENDERS

- Extends SCSI Bus to 6000 feet
- "FAST SCSI" Compatible
- Single-ended / Differential
- Low Cost Internal Board Versions
- UL, CSA, TUV Approved



#### SCSI DIFFERENTIAL CONVERTERS

- Extends SCSI Bus to 120 feet
- Single-ended to Differential
- "FAST SCSI" Compatible
- Internal Board Versions



#### SCSI BOOSTERS

- Extends SCSI Bus to 40 feet
- Narrow / Wide Versions
- Improves Computer Performance
- Internal Board Versions

APCON, INC.  
17938 SW Boones Ferry Road, Portland, OR 97224  
Tel: 503-639-6700 Fax: 503-639-6740 E-mail: [sales@apcon.com](mailto:sales@apcon.com)

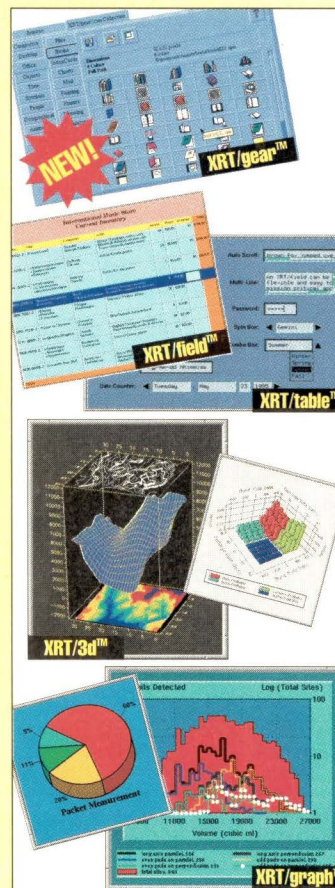


**800-624-6808**

x 107

[www.apcon.com](http://www.apcon.com)  
WEB SITE

Circle No. 303 on Inquiry Card



### XRT Widgets

With the XRT family of widgets you can build professional applications faster, easier and more cost-effectively than ever before. For example, the new XRT/gear gives you a Tab Manager, Widget Tips pop-up spot help, a Toolbar, an Aligner, enhanced Motif widgets, a collection of icons and much more. And like all XRT products, XRT/gear can be integrated with any popular GUI-builder tool or C++ environment.

Discover why over 20,000 developers worldwide choose award-winning XRT widgets for their Motif applications. Call your local reseller or KL Group today to start your free 30-day evaluation. Don't forget to ask about special pricing for XRT/gear.

**FREE 30-DAY EVALUATION**  
**(800) 663-4723** [www.klg.com](http://www.klg.com)

**KL GROUP**  
(416) 594-1026 Fax (416) 594-1919  
[info@klg.com](mailto:info@klg.com) [www.klg.com](http://www.klg.com)

**XRT**  
GUI COMPONENTS

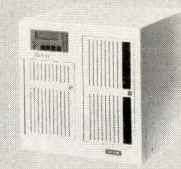
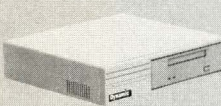
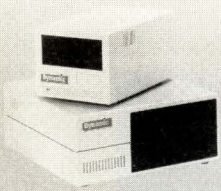
XRT is a registered trademark of KL Group Inc.

Circle No. 302 on Inquiry Card

# PRODUCT SHOWCASE

The Preferred Choice For

# Disks & Tapes



## Disk Subsystems

1.0 Gb Seagate Hawk .....	\$ 485
2.1 Gb Seagate Hawk .....	\$ 658
2.1 Gb Seagate Barracuda .....	\$ 888
4.3 Gb Seagate Hawk .....	\$ 1,088
4.3 Gb Seagate Barracuda .....	\$ 1,185
9.0 Gb Seagate Elite .....	\$ 2,049

## Tape Subsystems

40 Gb DLT .....	\$ 4,804
8.0 Gb HP 4 MM DDS-2 .....	\$ 1,096
48 Gb HP 4 MM DDS-2 w/Autoloader .....	\$ 2,520
7.0 Gb Exabyte 8 MM .....	\$ 1,416
14. Gb Exabyte 8 MM .....	\$ 2,120
280 Gb DLT 4700 Autoloader .....	\$ 9,966

## Memory

Dataram & Kingston  
Memory Upgrades

Call for current  
low prices

A complete family of mass storage products for  
RS/6000, SUN, HP, SGI, DEC & NOVELL

"Sales Representatives Needed"



Dynamic Computer Products...  
not just price,  
but over 25 years of technical  
expertise, service and support.

233 Greenwood Avenue, Bethel, Connecticut 06801  
Tel: 203 / 791-9511 • 1-800-714-SCSI • Fax: 203 / 778-4535

Circle No. 355 on Inquiry Card

## SUN SGI HP INTERGRAPH

BUY SELL TRADE UPGRADE  
SYSTEMS, MEMORY, DISKS, GRAPHICS,  
MONITORS, CPU, PARTS

### SPECIAL!

SUN 16" PREMIUM TRINITRON...240.00  
SUN 16" TRINITRON....140.00

Upgrade Sparc 1, 2, to Sparc 5  
Upgrade Sparc 5 to Ultra

## INMARTECH

TEL: (408) 733-1480

FAX: (408) 733-1481

EMAIL info@inmartech.com

Circle No. 356 on Inquiry Card

## SYSTEMS & CPU's

S20TX1N-50-32-P46 .....	\$ 7,000.00
S20TX1N-71-32-P46 .....	\$ 8,000.00
S20TX1N-151-32-P46 .....	\$11,150.00
S51TX1N-85-32-P44 .....	\$ 3,950.00
S10GXN-41-32-P43 .....	\$ 3,200.00
S10GXN-81-32-P46 .....	\$ 5,200.00
4/40FC-16-P43 .....	\$ 750.00

## GRAPHICS & MONITORS

TX1 .....	\$ 675.00
ZX .....	\$ 3,600.00
TX4 .....	\$ 1,375.00
GX .....	\$ 350.00
365-1324 20" cir Sony .....	\$ 1,400.00
365-1330 20" cir Sony .....	\$ 1,475.00
365-1335 20" cir Sony .....	\$ 1,650.00
365-1167 20" cir Sony .....	\$ 1,200.00
365-1112/1160 19" cir Sony .....	\$ 675.00
365-1159/1113 16" cir Sony .....	\$ 375.00
365-1140/1168 20" greyscale .....	\$ 700.00

## MEMORY & DISKS

X164P .....	64mb SS20/Ultra .....	\$ 900.00
X132P .....	32mb SS20 .....	\$ 450.00
X116F .....	16mb SS10 .....	\$ 175.00
1GB SS20/SS5 .....		\$ 375.00
1GB SS10/SS2 .....		\$ 350.00
EXB8700 .....	14GB 8mm external .....	\$ 1,475.00

**X868A 140GB dual drive 8mm auto tape library  
\$ 4,500.00**

Large inventory of unused, refurbished, and previously owned Sun and Dec, workstations, servers, peripherals, memory, and spare parts.

12 month warranty with same day shipping on all in stock items.

Check our web page for weekly specials

Email: sales@gshiis.com

techinfo@gshiis

www.gshiis.com



\* Call for full product line and availability

\* We buy excess Sun and Dec inventory

## GSH

Intelligent Integrated Systems, Inc.

95 Fairmount Street Fitchburg, MA 01420

Tel: (603) 529-7880 Fax: (603) 529-7884

Circle No. 359 on Inquiry Card

## M.C.I.I.

The Memory People

TM

WORKSTATION MEMORIES at AFFORDABLE PRICES  
LIFETIME WARRANTY

### SILICON GRAPHICS

IRIS INDIGO  
IRIS INDY  
CHALLENGE SERIES  
IRIS CRIMSON  
INDIGO 2 EXTREME  
IRIS POWER 4D SERIES  
PERSONAL WORKSTATION  
PROFESSIONAL WORKSTATION  
ONYX

### HP/APOLLO

9000 SERIES  
700/800 SERIES  
NETSERVER SERIES  
ENMIZEX  
ENTRIA  
Also  
Printer & NoteBook  
Memory for Most Systems

### SUN WORKSTATION

STATIONS/SERVERS  
1/2/5/10/20  
&  
630/670/690  
330/370/390  
CLASSIC/CLASSIC X  
ELC/IPC/IPX/LX  
VOYAGER

Call **1-800-247-MCII (6244)**

MEMORY CARD INTERNATIONAL, Inc.

2101 W. CRESCENT #F

ANAHEIM, CA 92801

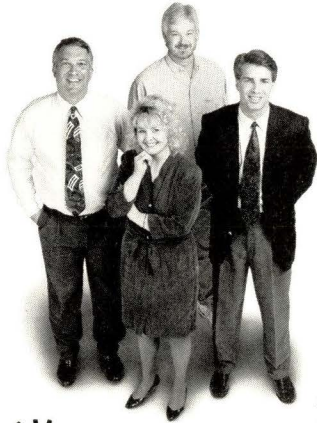
714-502-9085

714-502-9361 fax

Circle No. 358 on Inquiry Card

## Discover Solar Systems with hundreds of Suns.

Refurbished **Sun Microsystems** equipment at great prices. Fully-tested inventory on hand, same-day shipping, satisfaction guaranteed.



- Workstations & Servers
- Upgrades & Parts
- Storage Options
- Rental & Leasing Available
- Cycle 5 Master Reseller
- SunSoft Authorized Reseller

To buy or sell,

# 1-800-253-5764

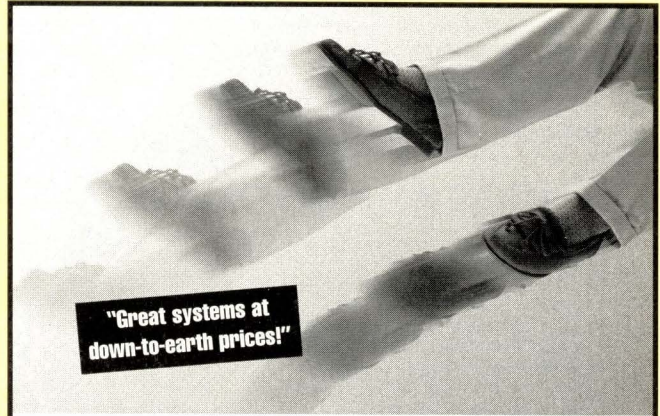
Ext. 220



Outside the U.S. call (206) 222-7588 Fax (206) 222-7388  
<http://www.solarsys.com>



Circle No. 333 on Inquiry Card



"Great systems at down-to-earth prices!"

## Customer Blown Away By Low Prices

Work Stations • Servers • Peripherals • Parts  
 Sales • Rentals • Leases • Exchanges • Repairs  
 Maintenance • 120 Day Warranty

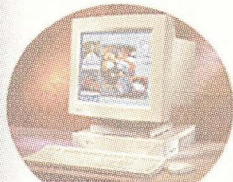
Call today to buy, sell or trade SUN and Silicon Graphics equipment with Security!



622 Rossmor Building • 500 North Robert Street • St. Paul, MN 55101  
 612/227-5683 • FAX: 612/223-5524 • [seccomp@seccomp.com](mailto:seccomp@seccomp.com)

Circle No. 336 on Inquiry Card

## Sun® / Sparc® Users Internet / Intranet Medical Imaging



- Communications
- Imaging
- Integration
- Internet
- Intranet
- Networking
- System Administration
- Technical Support



### SELL • RENT • LEASE

## COMPUTER MARKETPLACE

A PUBLICLY TRADED COMPANY • NASDAQ: MKPL

<http://www.mkpl.com>

# (800) 858-1144

(909) 735-2102 • Fax: (909) 735-5717

All SPARC trademarks, including SCD compliant logo, are trademarks or registered trademarks of SPARC International Products having SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc. Sun, the Sun Logo, Sun Microsystems are trademarks or registered trademarks of Sun Microsystems, Inc.

Circle No. 324 on Inquiry Card

## OPTICAL DISK BLOWOUT!



### BEST PRICING ON OPTICAL DISKS!

- Worm & Rewritable
- 3.5", 5.25", 12" and 14"
- All Brands Available
- All Media Available (i.e. Tape & CD-ROM)
- All Data Storage Drives & Jukeboxes Available
- ISO Standard, Long Shelf/Archival Life
- Best Prices... *Call Us Now!*



ENTERPRISE  
 STORAGE  
 SOLUTIONS

1 Park Plaza, Suite 600 / Irvine, CA 92714  
 TEL: (714) 833-7100 / FAX: (714) 833-7101

Circle No. 325 on Inquiry Card



## INNOVATIVE COMPUTER SOLUTIONS

"YOUR ONE STOP SOURCE FOR ALL YOUR UNIX SOLUTIONS"

- Original SUN and SUN compatible SPARC 2 through Ultra *\*In Stock*
- Specializing in 100% fault tolerant RAID Storage Solutions
- Ross Technologies Master VAR *\*Lowest Prices Guaranteed*
- Huge SUN spare part inventory *\*CPU's, Graphics Boards, RAM, Disk Drives, etc.*
- Cycle Computer Corporation Master Reseller *\*Upgrade SPARC 5, 10, and 20 to UltraSPARC (board swap only save thousands in upgrades)*
- Oracle Premier Business Partner
- Cisco Pro Certified Business Partner
- Master Reseller ASG/TFS Firewall Distributor *\*Complete Network Security Solutions*
- Pac Bell Value Solution Partner *\*INTRANET Provider*

"MONTHLY SPECIAL"  
SPARC 20 and UltraSPARC Memory,  
64 MB Simm only \$1175.00 ea.  
*\*Lifetime Warranty*

**800-838-2850**

FAX: 408-685-8800

E-MAIL: [tod@earthlink.net](mailto:tod@earthlink.net)

Circle No. 334 on Inquiry Card

## LARGE SAVINGS ON REFURBISHED SUN/SGI

Sell • Buy • Rent • Exchange

- Sun Workstation/Servers
- System Configuration
- Monitors Repair (Functional & Cosmetic)
- Sun Parts & Peripherals (Depot Repair)
- Weitek & Ross Tech Authorized Dealer

QUALITY • SERVICE • RESPONSE

101 First Street  
Utica, New York 13501  
Phone: (315) 724-2209  
Fax: (315) 724-0794  
Email: [fstv@aol.com](mailto:fstv@aol.com)  
[ccny@netacc.net](mailto:ccny@netacc.net)



**800-566-4SUN** (4786)

COMPUTER CONNECTION  
OF CNY, INC.

<http://www.ccnny.com/>



180 DAY SYSTEM WARRANTY • LARGE INVENTORY • FAST DELIVERY • INTERNATIONAL SHIPMENTS



Circle No. 331 on Inquiry Card

## Intranet Fax

Fax software from the  
people who developed  
SunFax for Sun.



**FREE by FTP!**

- Email/Fax gateway  
(send & receive faxes by email)
- Web/Fax gateway  
(send & receive faxes using a Web browser)
- easy integration with apps
- MS Windows clients (3.x, 95, NT)
- prices from \$495

**Faximum**

(604) 925-3600

<http://www.faximum.com>

fax: (604) 926-8182 - Email: [info@faximum.com](mailto:info@faximum.com)

Product names may be trademarks. 30-day evaluation free by FTP.

Circle No. 362 on Inquiry Card

## RENT to OWN

**SUN  
SPARC 20 or 5**

S20 TX1-11-32-P46

**\$535/mo\***

SPARC5 TX1-110-32-P46

**\$389/mo\***

20" Trinitron Monitor 1.05 Gb Disk

1.44Mb Floppy 32Mb Memory

Country Kit Solaris

\* 24 mo. \$1 buyout

**DATALEASE**

**(714) 632-6986**

FAX (714) 632-9248

Circle No. 330 on Inquiry Card

SUNEXPERT Magazine November 1996

## Sun Microsystems & Silicon Graphics

# BUY SALE TRADE

SPARCstations

SPARCservers

**Boards**

**Monitors**

**Disks**

**Tapes**

## DEPOT REPAIR CENTER

- ♦ 30% To 50% Cost Savings
- ♦ 2 - 5 Day Turnaround
- ♦ Overnight "Swap" Service
- ♦ 1 Year Warranty
- ♦ Monthly Maintenance Contracts



**ADVANTEC  
COMPUTER COMPANY**

43272 Christy Street  
Fremont, CA 94538

Phone: (510) 440-9700

Fax: (510) 440-9709

E-mail: [sale@advanteco.com](mailto:sale@advanteco.com)

<http://www.advanteco.com>

Circle No. 335 on Inquiry Card



# Multiple Monitors With Multiple Benefits



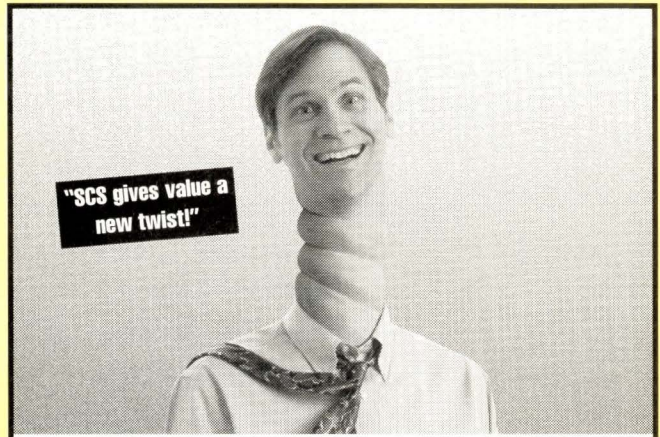
- Connects multiple monitors to a single Sun®, SGI or any 13W3-based workstation
- 2 or 4 outputs
- Supports distances up to 150 ft.
- 300 MHz bandwidth supporting resolutions up to 1600 x 1280
- 3-year warranty/30-day guarantee
- Extension cables available
- Designed and manufactured in the USA
- Compact size
- Quality construction
- Starting at \$595

**Fax NOW™**  
Call 1.888.4.FAX.NOW  
or 1.516.273.1710  
To Retrieve Information

☑ Communications  
☑ Specialties, Inc.

...For high-performance computer video interfaces.  
For More Information, Call: 516.273.0404  
or Fax To: 516.273.1638  
Email: info@commspecial.com  
Internet: http://www.commspecial.com

Circle No. 350 on Inquiry Card



"SCS gives value a new twist!"

## Customer's Head Spins Over Great Deals

Call today to buy, sell or trade SUN and Silicon Graphics equipment with Security! Unbeatable value, unparalleled service -- no wonder so many heads are spinning!



622 Rossmor Building • 500 North Robert Street • St. Paul, MN 55101  
612/227-5683 • FAX: 612/223-5524 • seccomp@seccomp.com

Circle No. 342 on Inquiry Card

# REPRINTS SunExpert

Keep up with the latest in Sun technology with the best minds in the industry. Use reprints to *promote, inform, and sell.*

**Reprint Management Services™** provides you the opportunity to obtain reprints of reviews, articles, and features in *SunExpert Magazine*.

*High-quality editorial reprints will help your company in many ways:*

- Increased EXPOSURE for your product or service
- Credible, believable information that consumers TRUST
- Excellent SALES tool for trade shows, mailings and media kits
- Powerful EDUCATIONAL RESOURCE for consumers and employees

Reprints are completely customized to your needs. Call today for additional information!

**JODY LISTER**  
Reprint Operations Specialist

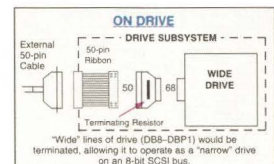
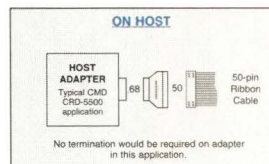
**REPRINT  
MANAGEMENT  
SERVICES™**

147 West Airport Road  
P.O. Box 5363  
Lancaster, PA 17606  
Phone: (717) 560-2001 Fax: (717) 560-2063



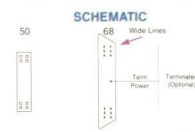
### Internal Adapter for Adapting 68 → 50 (Wide-to-Narrow) SCSI

- Ideal for CMD's CRD-5500 RAID Controller
- Superior fit to the Meritec adapter when used on CMD's CRD-5500
- Universal for either "Single-Ended" or "Differential" SCSI.



Call your sales representative today for pricing!

**CS ELECTRONICS**  
1342 Bell Avenue • Tustin, CA 92680  
Tel: (714) 259-9100  
Fax: (714) 259-0911  
E-mail: CablesCS@aol.com  
Web: http://www.SCSI-cables.com/scsi



Circle No. 348 on Inquiry Card

**CLEARPOINT MEMORY**

**SUN – HEWLETT PACKARD – DEC**

Let us earn your business  
Manufactured in Massachusetts

We offer:

- Lifetime Warranty
- Superb Engineering
- Competitive Pricing
- Free Technical Support

for more info call

(800) 253-2778 or Email [clearpt@world.std.com](mailto:clearpt@world.std.com)

<http://www.ultranet.com/~memory>

Circle No. 306 on Inquiry Card

**WANTED TO BUY**

**SUN**

**Cash Paid Now For  
ULTRA 1 & 2 • SPARC 20s • SPARC 5s**

Also wanted SUN 1000; 2000; Series Servers  
SPARC 10, 1+; 2; CLASSICS; IPX & LX;  
SUN Monitors; Memory; Disks; Tapes; Options.

SAVE on OFF LEASE  
and REFURBISHED SYSTEMS

**CALL NOW FOR QUOTE**



**(714) 632-6986**

**FAX (714) 632-9248**

Circle No. 304 on Inquiry Card

**S**martSockets is an industrial strength message-oriented middleware product that enables programs to communicate quickly, reliably and securely across LANs, WANs and the Internet. SmartSockets is used by the world's largest companies to build and deploy the most demanding distributed applications.

<http://www.talarian.com>

**download it today!**

[info@talarian.com](mailto:info@talarian.com) (800) 883-8050

**SMARTSOCKETS®**  
INTERPROCESS MESSAGING



Guaranteed Message Delivery

Publish/Subscribe

Extremely Scalable

LAN/WAN/Internet

Graphical Development

Real-Time IPC

Platform/Protocol Independent

Authentication/Encryption

UNIX,  
WINDOWS NT,  
VMS,  
OS/2



Circle No. 305 on Inquiry Card

**BASE 2 TECHNOLOGIES**

*Solutions for the Future*

Service, sales and support for  
**Sun Microsystems**

- Buy/Sell Hardware
- Depot Repair
- Emergency Swaps/Exchanges
- Complete Technical Support
- Training

Call us at 1-800-756-4766 for your solutions!

**BASE 2 TECHNOLOGIES**



236 S.W. 43rd Street  
Renton, WA 98055  
In WA: 206.251.9724  
FAX: 206.251.9725

Circle No. 307 on Inquiry Card

**Reach Over  
72,000**

**Buyers In the  
Sun/UNIX Client/Server  
Market.**

Visit Our Web Site  
<http://www.cpg.com>

Advertise your product/service in the **SunExpert  
Marketplace** Section.

Call Carol Flanagan  
**(508) 839-4016**

# PRODUCT SHOWCASE



**UNIDATA**  
ENTERPRISE SOLUTIONS WORLDWIDE

**DIGITAL  
SUN  
HP**





**ciscopros**

**UNLIMITED  
CASH  
FOR YOUR  
SURPLUS  
EQUIPMENT**

**EXABYTE REPAIR** Includes Upgrade and Cleaning at NO Extra Cost!

- BUY
- SELL
- RENT
- REPAIR

**Fully Integrated Systems • New and Used Equipment  
SCSI Tapes/Disks • Workstation • Servers**

Call UNIDATA Today!  
**1-800-427-0400**  
**Fax: (916)797-1414**  
 e-mail: [sales@uc.unidata1.com](mailto:sales@uc.unidata1.com)




The All Encompassing Distribution & Accounting Software



8331 Sierra College Blvd. • Suite 212  
Roseville • California • 95661


Circle No. 317 on Inquiry Card



**"When it comes to service,  
SCS doesn't monkey around!"**


## Customer Goes Ape Over Great Service

Call today to buy, sell or trade SUN and Silicon Graphics equipment with Security. Unparalleled service, unbeatable value – No wonder so many people are going ape.



622 Rossmor Building • 500 North Robert Street • St. Paul, MN 55101  
612/227-5683 • FAX: 612/223-5524 • [seccomp@seccomp.com](http://seccomp@seccomp.com)

Circle No. 318 on Inquiry Card



## SCA ADAPTER BOARDS: LOWER PROFILE, LOWER PRICE!

✓ 80 TO 68 WIDE    ✓ 80 TO 50 NARROW


✓ ISO 9002 / UL / CSA CERTIFIED

YOUR SOURCE FOR **FAST 20 / ULTRA-SCSI** CABLES

TCC OFFERS GREAT PRICES ON HIGH QUALITY  
CABLES, ADAPTERS & TERMINATORS  
ALL IN STOCK FOR FAST DELIVERY

CALL TCC -- WHERE PRICE & QUALITY CONNECT!  
**TEL: 714-835-1081    FAX: 714-835-1595**

1790 E. McFADDEN, UNITS 103-105  
SANTA ANA, CA 92705



**TECHNICAL  
CABLE  
CONCEPTS**

CHECK-OUT OUR  
NEW WEB SITE:  
[www.techcable.com](http://www.techcable.com)

CUSTOM ENGINEERED INTERNAL & EXTERNAL CABLE ASSEMBLIES

Circle No. 319 on Inquiry Card

## SAVE BIG \$\$\$\$\$ X-TERMINAL SALE



### SALE PRICE \$ 1,295.

**NCD17CR X-Terminals**

Includes: 10MB memory, Unix kybd, mouse  
**Sony Trinitron 17"**

1280x1024 high resolution color display  
**NORMAL LIST PRICE \$ 5,445.**

We have **300 Refurbished (like new)**

Call Open Concepts Inc.  
**(800) 394-5114**  
E-mail at [oci@seacoast.com](mailto:oci@seacoast.com)

DEC Open Systems  
&  
Storage Solutions



Open Concepts Inc. is an authorized DEC & NCD Reseller

Circle No. 312 on Inquiry Card

# PRODUCT SHOWCASE



**NEED MORE MEMORY?  
CHECK OUR PRICES!**

### MEMORY KITS FOR SUN

SPARC 4 & 5		SPARC 20	
8 MB MODULE.....\$ 118		16 MB MODULE .....	\$ 200
32 MB MODULE.....\$ 341		32 MB MODULE .....	\$ 382
		64 MB MODULE .....	\$ 688

SPARC 10		ULTRA 1 & 2	
16 MB MODULE.....\$ 200		32 MB KIT .....	\$ 400
64 MB MODULE.....\$ 688		64 MB KIT .....	\$ 671
		128 MB KIT .....	\$ 1,312

Memory prices quoted are as of 10/01/96. Prices are subject to change without notice.

### HARD DRIVES

	IBM FAST SCSI-2	IBM FAST/WIDE SCSI-2	SEAGATE FAST SCSI-2	SEAGATE FAST/WIDE SCSI-2
2.0 - 2.2 GB	\$ 955	\$ 995	\$ 650	\$ 720
4.3 - 4.5 GB	\$1,155	\$1,195	\$1,095	\$1,165
9.0 GB	\$2,850	\$2,900	\$2,185	\$2,255

Note: Nordisk stocks other manufacturer's disk drives from 1 GB. Please call for details.

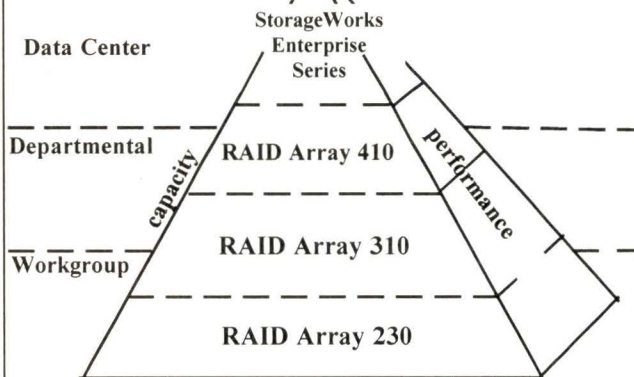
**SALES 1-800-676-2777 or 503-244-2777**

FAX: 503-244-0125 • E-MAIL: rs6000@nordisk.com  
9600 SW CAPITAL HWY, 2ND FLOOR • PORTLAND, OR 97219



Circle No. 338 on Inquiry Card

## STORAGEWORKS ENTERPRISE SERIES 155 GB TO 10 TB



**Your're Covered Top To Bottom  
Call for a free Catalog**

**Call Open Concepts Inc.**

DEC StorageWorks Solution Provider

**(800) 394-5114**

E-mail at [oci@seacoast.com](mailto:oci@seacoast.com)



Open Concepts Inc. is an authorized **digital** Reseller

Circle No. 309 on Inquiry Card

<http://www.hds.com>

# Easy

**Tired of hassling with PCs?**

Try a Network Computer - the @workStation from HDS. It's much easier than a PC.

**Runs everything**

Windows™, UNIX, main-frame, Java™, Web browsing - whatever.

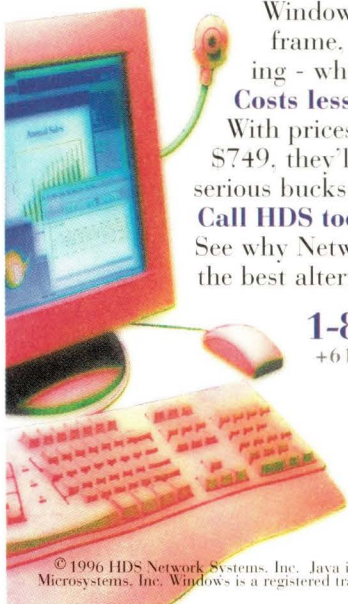
**Costs less**

With prices starting at only \$749, they'll save you some serious bucks.

**Call HDS today**

See why Network Computers are the best alternative to PCs.

**1-800-HDS-1551**  
+610-277-8300



© 1996 HDS Network Systems, Inc. Java is a registered trademark of Sun Microsystems, Inc. Windows is a registered trademark of Microsoft Corporation.

82

Circle No. 344 on Inquiry Card **SUNEXPERT Magazine** November 1996

**America's Largest  
Independent Reseller  
of New and Refurbished  
SPARCstations, Servers, Clones,  
Parts, Disk & Tape Subsystems**

**1-800-333-2SUN**

**Tel: 617-491-0400**

**Fax: 617-491-7710**

SunSoft  
Authorized  
Support  
Provider



SunSoft OEM  
Valid  
Right-to-Use  
Licenses



Sun Trained Technicians

Visit Our Website At  
<http://www.concorde.com>

**The Concorde Group, Ltd.**

**Trade-in Programs Available**

Circle No. 343 on Inquiry Card

# PRODUCT SHOWCASE

## CONTROL MULTIPLE SPARCS WITH ONE KEYBOARD, MONITOR & MOUSE

### Keyboard, Monitor & Mouse Switches:

- Control up to 64 SPARCS with one switch.
- Operate using keyboard or buttons on front.
- Keyboard type 4 & 5 compatible.
- Simulates keyboard & mouse 100% of the time.
- "Caps, Num, Scroll-Lock, and Compose" lights updated for each SPARC.
- Available in rackmount.



### Monitor, Keyboard & Mouse Splitters

- 1600 x 1200 resolution with no degradation.
- Drive 8 monitors at once.
- Up to 3 keyboards on one SPARC.

See our full line of Sun products call toll free 800-742-8324 for a free catalog



**NETWORK TECHNOLOGIES INC**  
1275 Danner Dr • Aurora, OH 44202  
216-562-7070 • FAX: 216-562-1999  
E-Mail: netftch@ibm.net

Circle No. 310 on Inquiry Card

# Tape

Your single source for all tape backup needs:

Introducing new **MAMMOTH** unit 40 GB capacity at 6 MB/sec.

Sales  
Service  
Upgrades



- Full range of technologies, including 8mm, DLT, 4mm and all 3480 tape units
- Expert service and repair for all Exabyte and DLT drives
- Largest inventory and lowest pricing in marketplace
- Aggressive trade-in programs

**800-952-3215**  
**www.morsol.com**  
**More Solutions Inc.**

Circle No. 337 on Inquiry Card

## WORKSTATIONS MEMORY & DISK

**Kingston** TECHNOLOGY CORPORATION

**Sun** Value Added Reseller

**RS/6000**

**hp HEWLETT PACKARD**

**MOTOROLA**

**Features**  
**Parts**  
**Systems**  
**Upgrades**

**(800) 858-1144**

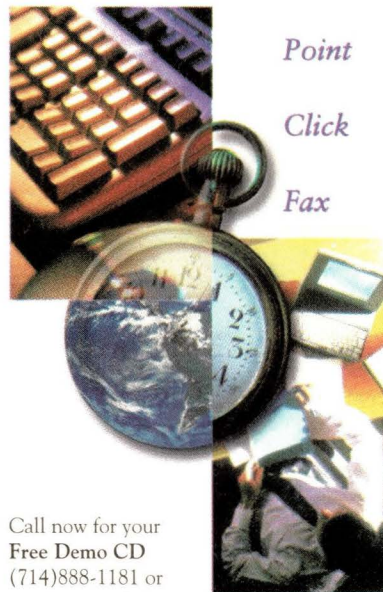
**COMPUTER MARKETPLACE**

A PUBLICLY TRADED COMPANY • NASDAQ: MKPL  
<http://www.mkpl.com>  
(909) 735-2102 • Fax: (909) 735-5717

All SPARC trademarks, including the SCD compliant logo, are trademarks or registered trademarks of SPARC International. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc. Sun, the Sun Logo, Sun Microsystems are trademarks or registered trademarks of Sun Microsystems.

Circle No. 313 on Inquiry Card

## TIRED OF WALKING TO YOUR FAX MACHINE?



Point

Click

Fax

Discover fax automation! Send and receive faxes directly from your desktop with XpressFax.

- Easy to use Motif interface
- Fax directly from other applications
- Broadcast Faxing

Call now for your Free Demo CD (714)888-1181 or access our website at: [www.sftek.com/xpressfax](http://www.sftek.com/xpressfax)



Circle No. 311 on Inquiry Card

# PRODUCT SHOWCASE

**BUY - SELL**

# SUN

**& DATA GENERAL**

PARTS - DISKS  
MEMORY - SERVERS  
WORKSTATIONS

**AMES SCIENCES, INC**  
501 SOUTH STREET, EASTON, MD 21601-3846

**410-820-8100**  
**FAX 410-820-8179**

Circle No. 329 on Inquiry Card

**BUY • SELL  
TRADE • and  
SPARES**

**SUN MICROSYSTEMS**  
Servers and Workstations

- Used
- Refurbished
- Parts and Subsystems
- Same Day Shipping
- Highest Dollar For Your Used Sun
- Consistently Competitive Prices
- Systems Custom Configures

We also handle other UNIX workstations

**ASR Systems & Peripherals, Inc.**  
8910 Chetwood Drive  
Colorado Springs, CO 80920  
ph. 800-378-3522 ph. 719-282-3522  
fax 719-282-3523

Circle No. 361 on Inquiry Card

## ATLANTIC

### PERIPHERAL SYSTEMS

"SUPER" SPARC VALUES!

**MEMORY**

16MB SPARC 20/10	\$785
32MB SPARC 20	\$1,395
64MB SPARC 20/10	\$2,475
32MB SPARC 5	\$1,180

**STORAGE**

1.0GB SGT Internal	\$575
2.1GB SGT Internal	\$965
6.0GB Ext. Subsystem	\$2,195
18GB Ext. Subsystem	\$5,995
4GB Ext. 4mm DAT	\$1,025
8GB Ext. 4mm DAT	\$1,135

**SPARC UPGRADES**

Weitek 80mhz CPU upgrade  
for SPARC 2 & IPX \$775  
GX+ Graphics/2MB \$695

**SPARC WORKSTATIONS**

SPARC 5, 20 CALL

CALL NOW FOR QUOTE!  
703-471-0047 FAX 703-471-6621

Circle No. 327 on Inquiry Card


## Disks & Tapes

**1-800-333-2786**

Bare Hard Drives		External Subsystems	
		1 Bay	2 Bay <small>double capacity</small>
ST51080N (1.08GB)	\$279	\$436	\$849
ST32151N (2.10GB)	\$593	\$750	\$1372
ST32550N (2.10GB)	\$802	\$959	\$1895
ST32550W (2.10GB)	\$884	\$1099	
ST15230N (4.0GB)	\$1023	\$1180	\$2337
ST15150N (4.2GB)	\$1163	\$1320	\$2616
ST410800N (9GB)	\$2007	\$2297	

**Tape Drives**

ST4324RP (2.4GB, 4mm)	\$774
ST4326RP (4.8GB, 4mm)	\$930
EX8505XL (7/14GB, 8mm)	\$1730



The Concorde Group, Ltd.  
*The Leading Integrator of customized mission-critical business solutions*

Circle No. 352 on Inquiry Card


# Reach Over 72,000

**Buyers In the  
Sun/UNIX  
Client/Server Market.**

Advertise your product/service in the  
**SunExpert Marketplace Section.**

Call Carol Flanagan  
**(508) 839-4016**

Call the above listed telephone number



**InterContinental  
Computers, Inc.**  
10907 Valley View Road  
Eden Prairie, Minnesota 55344

**WORKSTATIONS  
SERVERS  
MEMORY  
DISK  
OPTIONS**

**1-800-444-7003**  
VOICE (612) 835-4555 FAX (612) 835-3936  
EMAIL: lyonts@intercont.com

**BUY • SELL • LEASE**

Circle No. 328 on Inquiry Card

# EXCELTEK

*a touch of excellence*

**BUY • SELL • TRADE**

SUN Microsystems  
Hard Disk Drive Memory  
Silicon Graphics Tape Drives CD ROM

Best prices. On-site Service. Maintenance Contracts.  
Factory trained technical staff.  
All equipment's warranted.  
Free technical support. Satisfaction guaranteed!

CALL NOW  
Tel. (408) 945-9440 Fax. (408) 945-0112  
1825 Houret Court, Milpitas, California 95035

Circle No. 349 on Inquiry Card



## ONE SOURCE COMPUTER SERVICES

Providing the highest quality  
UNIX system maintenance on Apollo,  
DEC, Hewlett-Packard, and Sun Workstations.

Expert Repair Capabilities  
Shared Maintenance Programs  
On-Site System Analysis  
Telephone Support  
Training  
Spare Parts

**Take advantage of the lowest cost around!**

**CALL THE ONE SOURCE  
FOR BUYING, SELLING, TRADING AND  
UPGRADING YOUR COMPUTER HARDWARE.**

**(508) 370 - 3960**

Circle No. 326 on Inquiry Card

# PRODUCT SHOWCASE

## WORLDWIDE TECHNOLOGY EXCHANGE

■ Sun Microsystems

■ HP ■ Silicon Graphics

- Workstations/Servers/Peripherals
- Lowest Prices/Extended Warranties
- Will purchase all excess hardware

3198 Cains Hill Place  
Suite 230  
Atlanta, Georgia 30305

Tel. 404-365-7746 Fax: 404-365-7748  
wte@ix.netcom.com

Circle No. 351 on Inquiry Card

## WANTED

### To Buy

Off Lease/Excess Sun\* and HP  
Equipment

- 15 years industry experience
- We offer competitive prices
- Fast response



Workstation  
Technologies, Inc.

**CALL TOLL FREE:**  
**800-645-8327 ext. 154**

Circle No. 308 on Inquiry Card

## Sun Valley Technical Repair, Inc.

Sparc Stations Spare Servers  
Indigo Indy Onyx

**Silicon Graphics  
&  
Sun Workstations**

**1-800-250-5858**

Sales Rentals Repairs  
Upgrades Exchanges

Buy

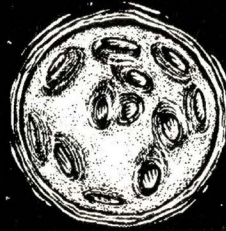


Sell

(408) 779-4115 (408) 779-1535  
Phone Fax

Email: svtr@ix.netcom.com  
15005 Concord Circle • Morgan Hill, CA 95037

Circle No. 345 on Inquiry Card



# TO USERS OF SUN, WE OFFER THE MOON.

Of course Virtual Technology offers, remanufactured Sun Microsystems products. But look how much more we offer:

- Sun Workstations and Servers
- Performance and Capacity Upgrades
- Parts and Subsystems
- Leasing and Rentals
- Same Day Shipping
- ROSS hyperSPARC™ Processors
- Purchase of Used Equipment
- Telephone Technical Support
- Disk and Tape Products
- Exporting

**THE  
VIRTUAL  
GROUP**

<http://www.virtualgrp.com>

*Computer Products and Services*

VIRTUAL TECHNOLOGY, INC. • VIRTUAL SERVICES, INC. • VIRTUAL LEASING, INC. • VIRTUAL SOFT, INC.

2950 WATERVIEW DRIVE, ROCHESTER HILLS, MI 48309 • (810) 853-6000

Circle No. 314 on Inquiry Card

**SunExpert** Serving the UNIX Client/Server Network  
**RS/Magazine** UNIX Workstations and PowerPC Computing  
**WebServer Magazine** For Managers of World Wide Web Sites

Check Out Our World Web Site

**<http://www.cpg.com>**

# PRODUCT SHOWCASE



## E.L.I. SYSTEMS, inc.

139 Hampshire Street  
Cambridge MA 02139

800-447-1156

617-547-1113

Fax: 617-354-1417

E-Mail: eli@world.std.com



### IN STOCK

REFURBISHED AND NEW SUN EQUIPMENT AND PERIPHERALS  
SPARC 10S, SPARC CLASSICS, IPXs, LXs, SPARC 1, 1+, 2S, EXTERNAL  
DISK DRIVES, FRAME BUFFERS, 16", 19" SONY COLOR MONITORS, 1, 4, 16,  
AND 64MB SIMMS LARGE INVENTORY OF SPARC AND REPLACEMENT PARTS

#### ELI SYSTEMS PROVIDES:

- CONSISTENTLY COMPETITIVE PRICES
- SYSTEMS CUSTOM CONFIGURED
- KNOWLEDGEABLE TECHNICAL AND SALES STAFF

### CALL TODAY FOR GSA PRICING

This is only a partial list of our extensive inventory  
90 DAY UNCONDITIONAL WARRANTY

#### EXPORT SPECIALIST

WE ARE ALSO STOCKING DEALERS IN DEC EQUIPMENT

AUTHORIZED **LANTRONIX** DEALER.  
WE BUY SURPLUS HARDWARE.

Circle No. 354 on Inquiry Card

# Reach Over 72,000

## Buyers In the Sun/UNIX Client/Server Market.

Advertise your product/service in the  
*SunExpert Marketplace* Section.

Call Carol Flanagan  
**(508) 839-4016**

**Integrate Your Macs with Your Sun...**  
using Xinet networking software

**K-Share** – enables Macintoshes to use a UNIX host as an AppleShare file server.

**K-FS** – allows UNIX users to access AppleShare volumes on a Mac.

**K-Spool** – allows Mac and UNIX users to share PostScript printers anywhere on the network.

**FullPress** – a fully integrated OPI server with file sharing, print spooling and queue management.

**Server to the Macs...™** **Ideal for client/server web authoring!**  
Contact us for details today.

2560 Ninth Street, #312  
Berkeley, CA 94710  
tel: 510.845.0555  
fax: 510.644.2680  
email: expert@xinet.com  
http://www.xinet.com

Circle No. 357 on Inquiry Card

## UNIX Diagramming & Flowcharting

visual thought®

#### Use Visual Thought for:

- Network diagrams with network component clip art
- Clickable Web diagrams with GIF/JPEG and server/client-side imagemap export
- Framemaker documentation graphics with MIF, EPSI export
- Software design diagrams (Booch, Rumbaugh, Objectory, Fusion, custom notations)
- Flowcharts for ISO 9000, TQM, BPR
- Dataflow diagrams, org charts
- Presentation & business graphics

**FREE** CD-ROM, FTP & 30-day trial

#### Additional benefits

- Intelligent, rubberbanding lines
- Macintosh-like ease-of-use... on UNIX!
- Editable, WYSIWYG drag-and-drop palettes
- Hyperlinked, hierarchical documents
- Arbitrary object rotation
- Complete text handling: subscripts, arbitrary fonts, sizes, colors, styles and justification
- Dozens of export formats: GIF89, JPEG, MIF, TIFF, EPSI, XWD, SunRaster, others
- Available on SunOS, Solaris, HP-UX, and soon, Windows 95/NT

**VISIT** (use code AE13)  
<http://www.confluent.com/>  
800-780-2838 ext.153  
info@confluent.com



Confluent, Inc.  
132 Enclave Court  
San Francisco, California 94127  
415-586-8700 Voice  
415-586-8838 Fax

©1996 Confluent, Inc. All rights reserved. Visual Thought, the Visual Thought logo, Confluent, and the Confluent logo are trademarks or registered trademarks of Confluent, Inc. All other names are the property of their respective holders.

See why Visual Thought has thousands of users worldwide! Clients include:

ABB • AT&T • Alcatel • BNR • Bellcore • Boeing • CS First Boston • Credit Suisse  
E-Systems • Eds • Ericsson • Ford • HP • IONA • Lucent • McDonnell Douglas  
Motorola • Nokia • Nomura • Nortel • Persistence • Prediction  
Pure Software • SAIC • Smith Barney • Spirit • Toshiba  
U.S. Air Force • U.S. Navy • U.S. West • UPS  
Wells Fargo • Nikko

Circle No. 332 on Inquiry Card



# PRODUCT SHOWCASE

VSI-FAX
NETWORK FAX FOR SUN



- Save Time
- Save Money
- Integrate Directly into UNIX Applications!
- Fax Directly From Any Windows Application
- Easy Installation
- Automatic Inbound Routing
- Available on Over 15 UNIX Platforms

WINDOWS 3.1, 95, AND NT CLIENTS AVAILABLE

**CALL: 800-556-4874**  
**714-489-8778**

**FAX: 714-489-2486**

**EMAIL: info@vsi.com**



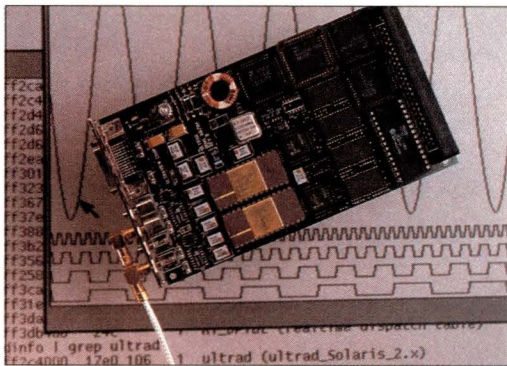
*Special Reseller Programs Available*

**FREE VIDEO!**  
 Call to Save Time and Money with Network Fax.

http://www.VSIFAX.com

Circle No. 316 on Inquiry Card

## ULTRAFast SBUS A/D



### 10 MHz DATA ACQUISITION

The ultimate 12-bit data acquisition board can acquire 8 Million A/D samples while *simultaneously* outputting 8 Million D/A samples and TTL vectors, all without CPU intervention.

Four analog inputs, **twin 5 MHz 12-Bit A/D and D/A converters**, 5 MHz TTL input/output vectors, and **huge 16 MB RAM** allow use in the most demanding scientific and industrial applications.

**ULTRAVIEW CORPORATION** email: ultrav@netcom.com  
 34 Canyon View, Orinda, CA 94563  
 Telephone: (510) 253-2960 Fax (510) 253-4894

Circle No. 315 on Inquiry Card

## Don't get EXA-"Bitten"!!

Save Money, Extend your EXABYTE Warranty

EXB-820x, 24 hr Repair (6 mo war):	\$ 250*
"Hot Swap" Repair (6 mo Warr.):	\$ 325*
One Year Maintenance Agreement:	\$ 275*
"Hot Swap" Maintenance Agreement:	\$ 325*

\* Add \$100. for EXABYTE EXB-850x

**SUN Microsystems**

**Servers & W/S**

**Repairs, Buys, Sells, Spares**

**West Coast Computer Exchange, Inc.**

11167-A Trade Center Drive

Rancho Cordova, CA 95670

Call: 916-635-9340,

FAX: 916-635-9485



Circle No. 320 on Inquiry Card

## IN THE WORKS 1997

### JANUARY

## Software Development in an Object World

- Rapid App Development Tools
- Multiprocessing and Multithreading – The Implication
- Developng for the Client, for the Server
- ActiveX, Java, CORBA, OpenDoc

### FEBRUARY

## Storage Technologies

- Trends in Hard Disk Design
- The Price Wars
- Disk and Array Interfaces

**Survey: 4-MB or Higher 3 1/2-inch Disk Drives**

### BONUS DISTRIBUTION

**Software Development**

San Francisco, CA

**Internet Expo, WebWorld, Electronic Mail**

San Jose, CA

**Sun User Group West**

San Francisco, CA

Call your SunExpert regional sales representative to advertise

# Advertiser's Index

THE AD INDEX IS PUBLISHED AS A SERVICE TO OUR READERS. THE PUBLISHER DOES NOT ASSUME ANY LIABILITY FOR ERRORS OR OMISSIONS.

READER INQUIRY NUMBER	PAGE	READER INQUIRY NUMBER	PAGE		
1	ADIC	68	24	Kingston Technology	C2
335	AdvanTec	78	302	KL Group	75
2	Amdahl	13	25	Lightwave Communications	63
329	Ames Sciences	84	26	Lightwave Communications	70
3	Andataco	7	358	Memory Card International	76
303	ApCon	75	27	Minicomputer Exchange	73
4	Applied Digital Systems	71	337	Moore Solutions	83
5	Apunix	11	310	Network Technologies	83
6	Artecon	27	338	Nordisk Systems	82
361	ASR systems & Peripherals	84	326	One Source	84
7	ATL Products	41	312	Open Concepts	81
8	AT&T Capital	18	309	Open Concepts	82
327	Atlantic Peripheral Systems	84	28	Performance Technologies	5
9	Aurora	17	29	Personal Productivity Tools	72
10	Axil	53	30	Polaris	69
11	Aydin	43	31	Radiant Resources	35
307	Base 2 Technologies	80	32	Rave	67
12	Box Hill Systems	C4	33	Rave	71
13	Centon	9	34	RDI	45
14	Central Data	49	35	Ross	14, 15
306	Clearpoint Enterprises	80	36	Sanar	62
350	Communications Specialties	79	37	Santa Cruz Operation	29
331	Computer Connection of CNY	78	38	Santa Cruz Operation	31
324	Computer Marketplace	77	336	Security Computer Sales	77
313	Computer Marketplace	83	342	Security Computer Sales	79
343	Concorde Group	82	318	Security Computer Sales	81
352	Concorde Group	84	311	SoftTek	83
332	Confluent	86	39	Software Moguls	1
348	CS Electronics	79	333	Solar Systems	77
330	Data Lease	78	40	Straightline	61
304	Data Lease	80	41	SunSoft	48
355	Dynamic Computer	76	42	SunSoft	74
354	ELI Systems	86		Sun User Group	64
15	EMASS	2	345	Sun Valley Technical Repair	85
325	Enterprise Storage Solutions	77	305	Talarian	80
349	ExcelTek Corp.	84	43	Tatung Science & Technology	19
362	Faximum Software	78	319	Technical Cable Concepts	81
16	Fujitsu	47	44	Thomson Software	39
359	GSH Intelligent Integrated Systems	76	315	Ultraview	87
17	Haystack Labs	24	317	UniData	81
18	Human Designed Systems	C3	45	Unisolution	33
344	Human Designed Systems	82	46	Viking Components	25
19	Hummingbird Communications	23	314	Virtual Technology	85
328	ICCI	84	316	V-Systems	87
356	Inmartech	76	320	West Coast Computer Exchange	87
20	Innosoft	21	308	Workstation Technologies	85
334	Innovative Computer Solutions	78	351	Worldwide Technology Exchange	85
21	Integrated Computer Solutions	32	47	Xess	28
22	Integrix	51	357	Xinet	86
23	Itac	60			

## SALES OFFICES

National Sales Manager: **LINDA LIEBICH**

### New England/Upstate New York/ Eastern Canada

**CAROL A. FLANAGAN**  
21 Greany Drive  
North Grafton, MA 01536  
Phone (508) 839-4016  
Fax (508) 839-4226  
email: carolf@cpg.com

### New York/Mid-Atlantic/Southeast

**ROBERT WENTZ**  
110 Pig Pen Point Court  
Queenstown, MD 21658  
Phone: (410) 827-5695  
Fax: (410) 827-5789

### Mid-West/Southwest/Central Canada

**LINDA LIEBICH**  
9600 Great Hills Trail, Suite 150 W  
Austin, TX 78759  
Phone: (512) 502-3035  
Fax: (512) 502-9988

### Southern California/Arizona/Nevada/Hawaii

**TARA DUDAS**  
3803 Vista Azul  
San Clemente, CA 92672  
Phone: (714) 361-4908  
Fax: (714) 361-1564  
email: taradudas@aol.com

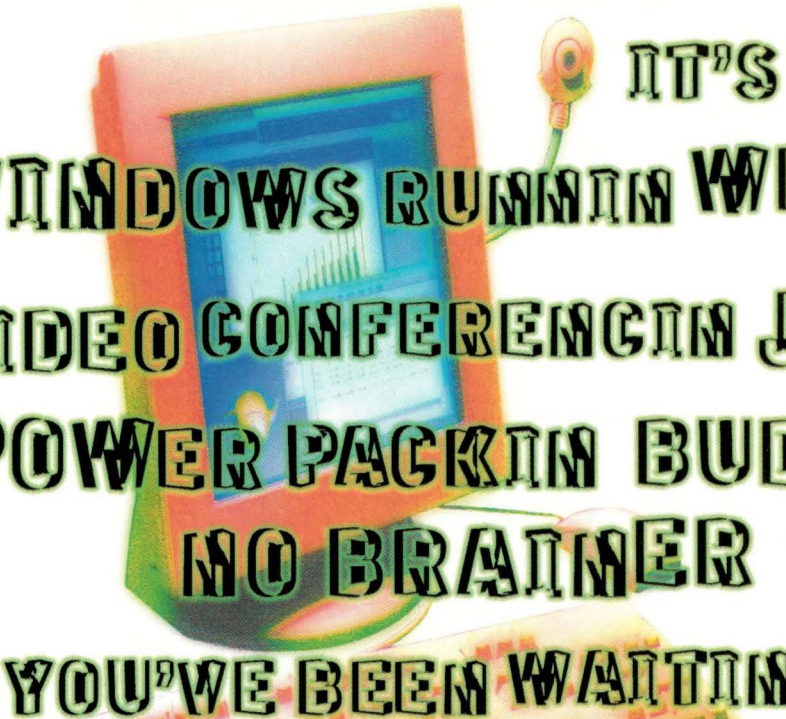
### Northern California/Oregon/Washington/Western Canada

**JUDY COURTNEY**  
640 Forest Lake Drive  
Pacifica, CA 94044  
Phone: (415) 738-2132  
Fax: (415) 738-2432

### Product Showcase/Classifieds/ Postcards

**CAROL FLANAGAN** Mgr, Telemarketing Sales  
21 Greany Drive  
North Grafton, MA 01536  
Phone: (508) 839-4016  
Fax: (508) 839-4226  
email: carolf@cpg.com

# THE HDS @WORKSTATION NETWORK COMPUTER



IT'S THAT  
WINDOWS RUNNING WEB SURFIN  
VIDEO CONFERENCIN JAVA JAVIN  
POWER PACKIN BUDGET SAVIN  
NO BRAINER THING  
YOU'VE BEEN WAITIN FOR.

We're not talkin' PC.

We're talkin' **simple**. We're talkin' **built-in networking**. Windows, Mainframe access, UNIX, DEC – whatever.

We're talkin' **real plug-n-play**. It's all there – software, hardware, and **Internet ready**.

We're talkin' history, PC headaches and outdated technology – gone. And starting at **\$750**,

you're savin' some serious bucks. We're talkin' **future**. We're talkin' **now**.

We're talkin' **visionary**.

The hard workin' HDS @workStation.  
So Simple. What are you waitin' for?

1.800.HDS.1551



WWW.HDS.COM

©1996 HDS Network Systems, Inc. All rights reserved. HDS, @workStation are trademarks of HDS Network Systems, Inc. Other trademarks are the property of their respective owners.  
HDS Network Systems, Inc., 400 Fehleley Drive, King of Prussia, PA 19406: 610.277.8300 phone: 610.275.5739 fax: email: info@hds.com

Circle No. 18 on Inquiry Card

# TAKE

*No more waiting for the nightly backup to run before being able to make that crucial off-site copy!*

# IT

*The Echo Box™ uses real-time Tape Mirroring Software (TMS™) to make two copies at a time.*

# OFF!

*Your backup results are doubled,*

# (SITE)

*and the second copy is ready for off-site storage before your morning coffee.*

## **THE ECHO BOX™ SIMULTANEOUS SELF - DUPLICATING DLT™**

- 2 DLT™ Drives
- 6 MB second transfer rate
- 10 cartridge magazine
- 150-400 GB per base module
- Stack additional modules for up to 3.2 TB of storage and transfer rates of 172 GB/hour.



To find out how to take yours off (site), call Box Hill at 1-800-727-3863 or visit our Web site at <http://www.boxhill.com>.

**BoxHill**  
SYSTEMS CORPORATION

161 Avenue of the Americas, New York, NY 10013 Tel: 212•989-4455/1•800•727-3863 Fax: 212•989-6817 Email: [sales@boxhill.com](mailto:sales@boxhill.com)

\*DLT™ is claimed as a trademark of Quantum Corporation. All products mentioned herein are trademarks of their respective owners. © 1996

Circle No. 12 on Inquiry Card