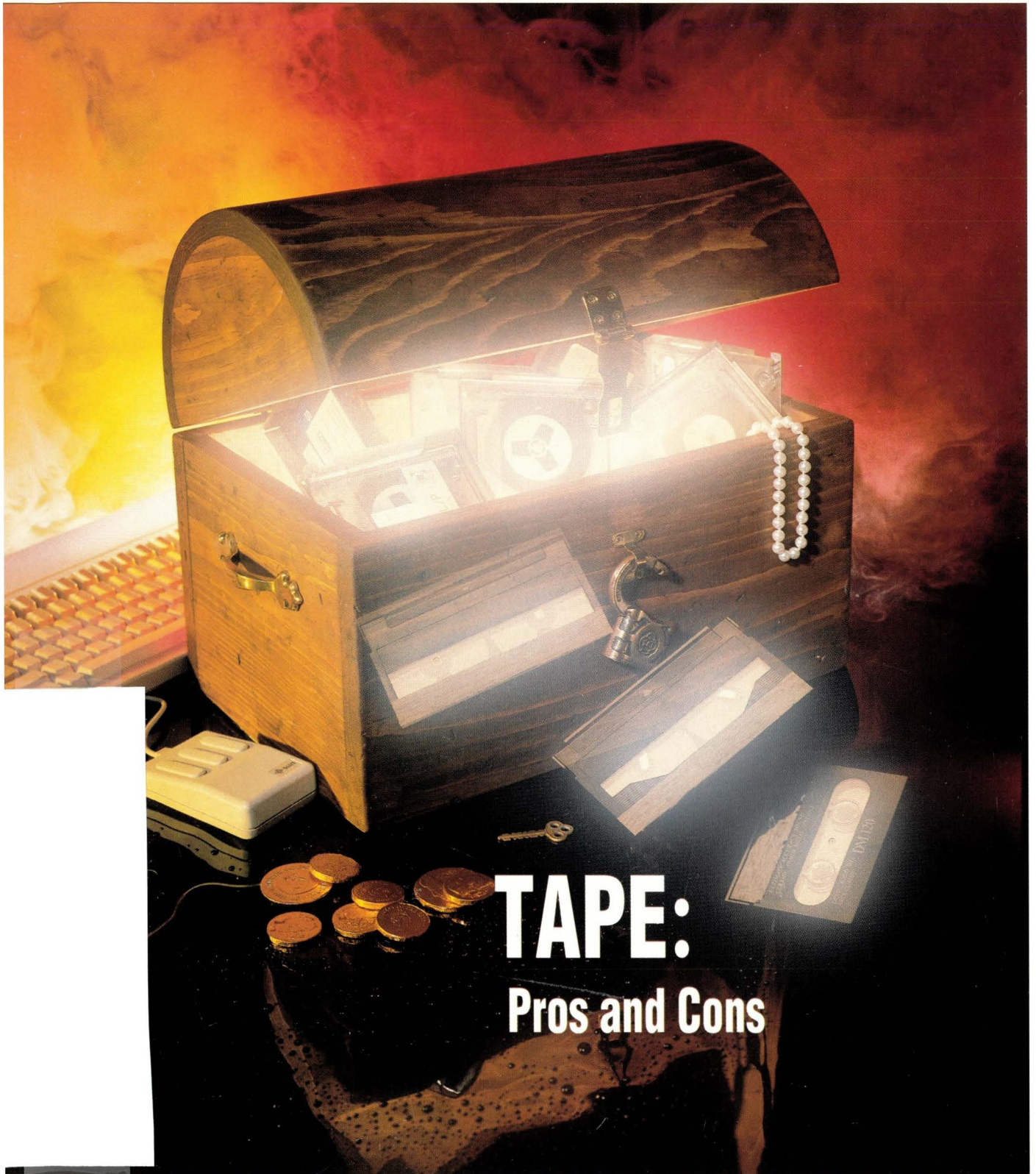


SUN EXPERT

Serving the UNIX Workstation Network

JANUARY 1993 Vol. 4 No. 1 \$5.50



TAPE: Pros and Cons

Reviews: Solaris 2.1

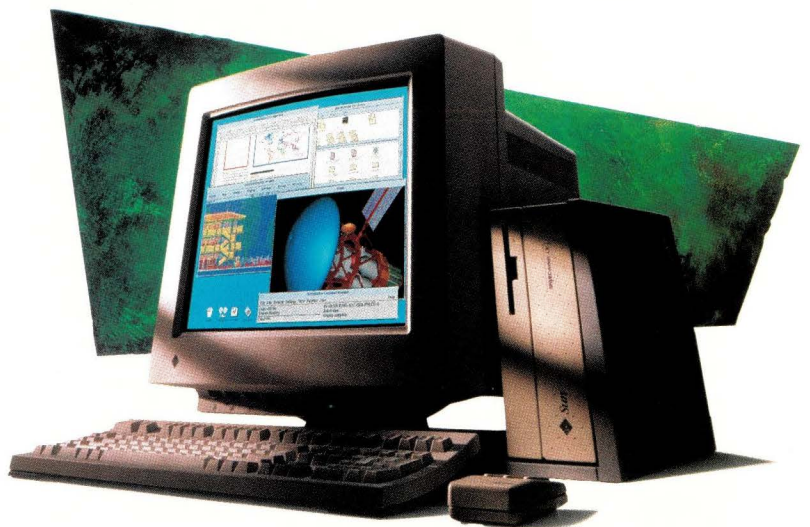
Reviews: ShowMe, NetMetrix 3.0

A highly placed engineer reveals his technical assessment of the new \$7,995, 59 MIPS, accelerated graphics, eye-popping SPARCstation LX.



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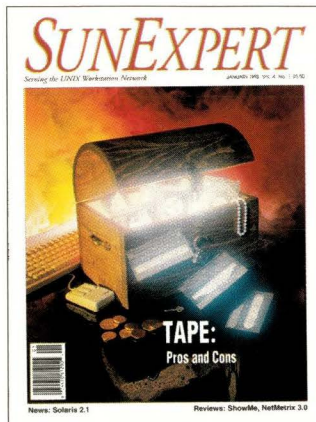
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FEATURES

- 38 **Backup** – The Backup Market – Backup can seem mundane. In fact, it is one of the most important aspects of system administration, and a battleground for fiercely competitive technologies.
Michael Jay Tucker
- 43 **Crisis in Network Data Management** – As networks grow in size and complexity, they present data-management problems beyond any encountered before.
Cindy Misicko
- 48 **Quarter-Inch Cartridge Tape Drives** – Once considered a dead end, QIC is a technology difficult to best.
Richard A. Peters
- 54 **8mm and QIC: Head to Head?** – Helical scan has its partisans too. This author argues that QIC, DAT and 8mm are actually in very different realms.
Grant Wilcox
- 60 **A Sampling of 4mm and 8mm Tape Options** – A listing of over 45 tape-backup vendors.
Maureen McKeon
- 70 **Product Reviews** – ShowMe, NetMetrix
Ian Darwin, S. Lee Henry



Cover Photography
by Dave Spencer Studio

NEWS

- 6 Includes: **Solaris 2.1: Ready for Prime Time?, Super Tuesday Revisited, Sun Takes the SI Road**

COLUMNS

- 17 **Ask Mr. Protocol – Mr. Protocol Roots Around** – What kinds of Internet services would your users be interested in? Depends on the users.
Michael O'Brien
- 24 **UNIX Basics – UUCP** – A classic (read: old) form of wide-area networking that has survived the test of time.
Peter Collinson
- 29 **I/Opener – May These Events (Part 2)** – A promised update on the state of the BSDI/UC/USL lawsuit.
Richard Morin
- 34 **Systems Administration – Help!** – Where to look for help when systems challenges rear their ugly, unfamiliar heads.
S. Lee Henry

DEPARTMENTS

- 4 **Editorial**
28 **Reader Feedback**
76 **New Products**
83 **The SunExpert Market**



ShowMe, NetMetrix 3.0

p. 70

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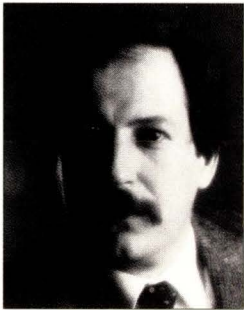
serves the UNIX workstation environment, emphasizing Sun, SPARC and Sun-compatible systems.

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Editorial

Hiding the Cost

They say it's the "ready for prime time" release of Solaris. It is Solaris 2.1, and it shipped December 7, 1992 (see this month's lead News story). However, it doesn't ship installed on the new SPARCclassic, although the machine requires it. What you see on the Classic's 200-MB disk—out of



the box—is something called JumpStart, a new automatic installation and configuration system, not the full OS image. That fact won't mean much to existing Sun customers with network services and resources at their disposal. But the new user, the PC user who is now caught in the cross hairs of Sun marketing, will need to learn very quickly about OS images, swap space, as well as a booting from CD drives.

That need is what irks me about the sales and marketing effort behind the Classic. It's billed as a full-featured workstation listing for \$4,295 (\$3,995 by the dozen) that Sun claims will appeal to the high-end PC user. Sun also touts the fact that after you figure in the hidden cost of PC ownership—graphics controller, high-capacity disks, sufficient memory, networking controller and on and on—the price is lower than a comparably equipped PC. Well, that user will be surprised.

Let's look for a second at the hidden cost of just booting a Classic. You'll need the OS, \$795; you'll need a CD player, around \$600. That's just for starters. The Classic ships with 16 MB of memory, so let's count on 32 MB of swap. The OS image is say another 160 MB or so. You're already out of disk space without applications. To me, that's not a ready-to-use system. Users will quickly discover they need more memory, more disk space and more money.

Don't get me wrong, I think the Classic is very attractively packaged and priced. But I don't understand or appreciate the misleading hype that comes with it. Sun should make its case on the merits, not meretricious marketing. The result could be satisfied customers, not disgruntled victims of marketing droids. If a company like Sun covets a market like the PC market, it should certainly go after it. But be fair to the buyer. Don't get into a battle to see who can hide the most cost. That's a shell game nobody wins.

Doug Pryor

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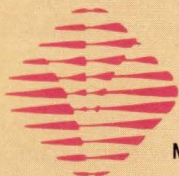
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NEWS

Solaris 2.1: Ready for Prime Time?

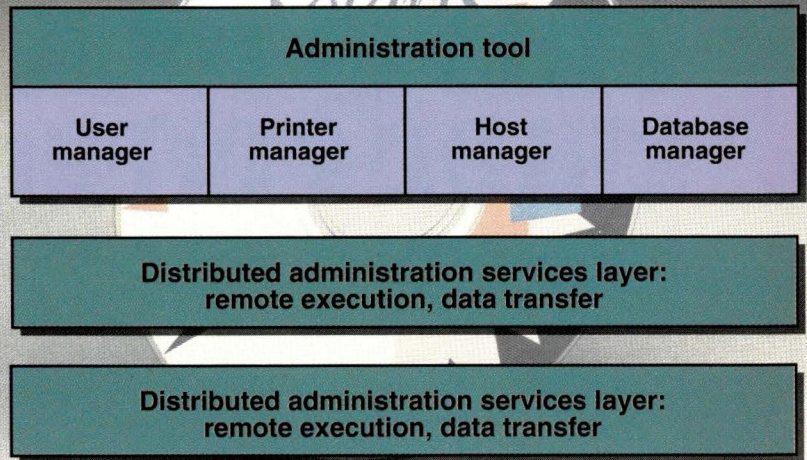
Chances are you have yet to see a copy of Solaris 2.0—or if you have, you probably haven't tried to install it. No matter: Last month, SunSoft began shipping to independent software vendors and OEMs Solaris' next incarnation, Solaris 2.1. SunSoft's No. 1 OEM, Sun Microsystems Computer Corp., was slated to begin shipping in December its SPARCclassic and SPARCstation LX, both of which require Solaris 2.1. The full end-user configuration of 2.1, including OpenWindows, requires at least 16 MB of RAM and 160 MB of disk.

"This is our ready-for-prime-time release," says Bill Coleman, SunSoft vice president of system software. "[Solaris] 2.0 only supported SPARCstation 1s and 2s and was in English only. The new version lets you cut over your whole network."

Version 2.1 incorporates "more than 1,000 product improvements" (read: bug fixes and patches), SunSoft says. It delivers up to a 40% increase in network performance, due to SunSoft's tuning of the system's Streams interface, and up to a 50% increase in "user interaction" over 2.0, based on SunSoft's own "user interactive behavior test" results.

Most importantly, 2.1 features full symmetric multiprocessing and multithreading capabilities on the system CD—not on a separate, OEM-only installable disk, as was the case with 2.0. Version 2.1 will run on the entire SPARC-based Sun product line, but not on the Motorola Inc. 68000-based Sun-3s or the SPARCcenter 2000s—the latter will require a future version of

Solaris 2.1: An Admin's View



Source: SunSoft

The user, printer, host and database manager tools are all new.

Solaris to tick. Previously unbundled modules, such as the ASET and Shield security tools, the AnswerBook on-line documentation facility and XGL graphics library, are built into 2.1. In fact, by March, SunSoft says it will have bundled 50 systems administration tools into the Solaris environment. In addition, Solaris 2.1 is fully localized for German, French, Italian, Swedish, Japanese, Korean and two versions of Chinese. Other new features include

- **JumpStart**, an automatic installation and configuration system that works on hundreds of systems across a network with no user interaction required. The SPARCclassic and SPARCstation LX will ship with JumpStart alone—and not Solaris 2.1—preinstalled on their disks. (This setup assumes access to a Solaris 2.1 CD somewhere on the network.);
- **A foundation for automatic software upgrades to future Solaris releases.** In the future, users will be able to tailor upgrades for customized systems across a network using interactive menus;
- **Online: Backup**, a backup-and-restore tool that allows systems administrators to back up data while machines are active. This tool was available as part of Solaris 1.X, but it

now incorporates new features, such as support for tape jukeboxes;

- **User Manager, Database Manager, Print Manager, Host Manager and Software Manager**, sys admin tools that simplify tasks such as adding new system accounts, changing information in the central administration database, setting up print servers, connecting client systems onto a network and manipulating third-party applications, no matter where they are located on a network.

At press time, SunSoft claimed that more than 800 of the "top" 5,000 Sun-compatible applications were being ported to the Solaris 2.X environment. Of the several ISVs contacted by *SunExpert*, few expected to ship a 2.1 version of their product before mid-1993. Publicly, SunSoft officials have said they are pleased with the 2.X application availability pace; the company line is that once the best-selling 30 or so packages become available on 2.1, the rest will follow shortly. In the interim, existing SunOS 4.X/Solaris 1.X applications can run on Solaris 2.1 in emulation mode.

Solaris 2.1 for SPARC is priced the same as 2.0, at a suggested retail price of \$795 for quantity one. Pricing and availability for the 2.1 version of Solaris on X86 were not made public

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at press time. Current Solaris for SPARC 2.0 users can upgrade to the new version for free; Sun will "push" 2.1 to all other software contract customers. Besides shipping as part of Solaris 2.1, unbundled versions of Shield and Online: Backup are available (quantity one) for \$50 and \$795, respectively.—mjf

Make Way for 600MPs

Sun Microsystems Computer Corp. has made upgrades to its SuperSPARC-based 600MP servers a whole lot less painful, simultaneously slashing prices on the series.

SMCC has enhanced and repriced the upgrades to the 600MPs. Customers may now opt for Sun's new 2.1-GB fast (10-MB/s) differential SCSI disks on enclosure exchange upgrades to the 690MP Model 120 or 41. (The Model 120 is the dual-processor, 40-MHz SPARC-based version of the 600MP line, which was introduced way back in September 1991.) At the same time, all enclosure exchange upgrades with 1.3-GB IPI disks are still available.

Sun has also reduced prices on both board upgrades to the SPARCserver 600MP and the SPARCserver 690MP Model 41 enclosure exchange (with 128 MB of memory).

Finally, SMCC has reduced prices between 7% to 17% on its 670MP and 690MP systems. It is offering several new configurations of its 690MP data center package, based on the aforementioned 2.1-GB differential SCSI-2 disks. These new configurations are

New SPARCserver 600MP Upgrade Prices

Description	List Price
SPARCsystem 330 board upgrade to dual-CPU, 64-MB SPARCsystem 630MP	\$20,495
SPARCsystem 330 board upgrade to 64-MB SPARCsystem 630MP (with SuperSPARC and SuperCache)	\$26,495
SPARCsystem 370 or SPARCserver 390 board upgrade to dual-CPU 64-MB SPARCserver 600MP	\$21,995
SPARCsystem 370 or SPARCserver 390 board upgrade to 64-MB SPARCserver 600MP (with SuperSPARC and SuperCache)	\$27,995
SPARCsystem 470, SPARCserver 490, Sun-3/470 board upgrade to dual-CPU 64-MB SPARCserver 600MP	\$20,495
Sun-3/180, Sun-3/280, Sun-3/480 or Sun-4/280 enclosure exchange upgrade to SPARCserver 690MP Model 41 with 128 MB of memory (with SuperSPARC and SuperCache)	\$26,495
Sun-3/180, Sun-3/280, Sun-3/480 or Sun-4/280 enclosure exchange upgrade to SPARCserver 690MP Model 41 with 128 MB of memory (with SuperSPARC and SuperCache)	\$59,495

Source: Sun Microsystems Computer Corp.

- 690MP Model 120 with two processors, 64 MB of memory, 4.2 GB of disk and a SunCD CD-ROM for \$70,000;
- 690 MP Model 41 with one SuperSPARC processor, 64 MB of memory, 4.2 GB of disk and a SunCD CD-ROM for \$76,000;
- 690MP Model 52 with two SuperSPARC processors, 128 MB of

memory, 8.4 GB of disk, a SunCD CD-ROM and 5-GB tape drive for \$101,500; and

- 690MP Model 54 with four SuperSPARC processors, 128 MB of memory, 8.4 GB of disk, a SunCD CD-ROM and 5-GB tape drive for \$119,500.—mjf

Sun Takes the SI Road

Sun Microsystems Inc. has added a new channel—but not a new planet—to its universe. SunIntegration Services, a group within Sun Microsystems Computer Corp., as of this month has become Sun's systems integration arm.

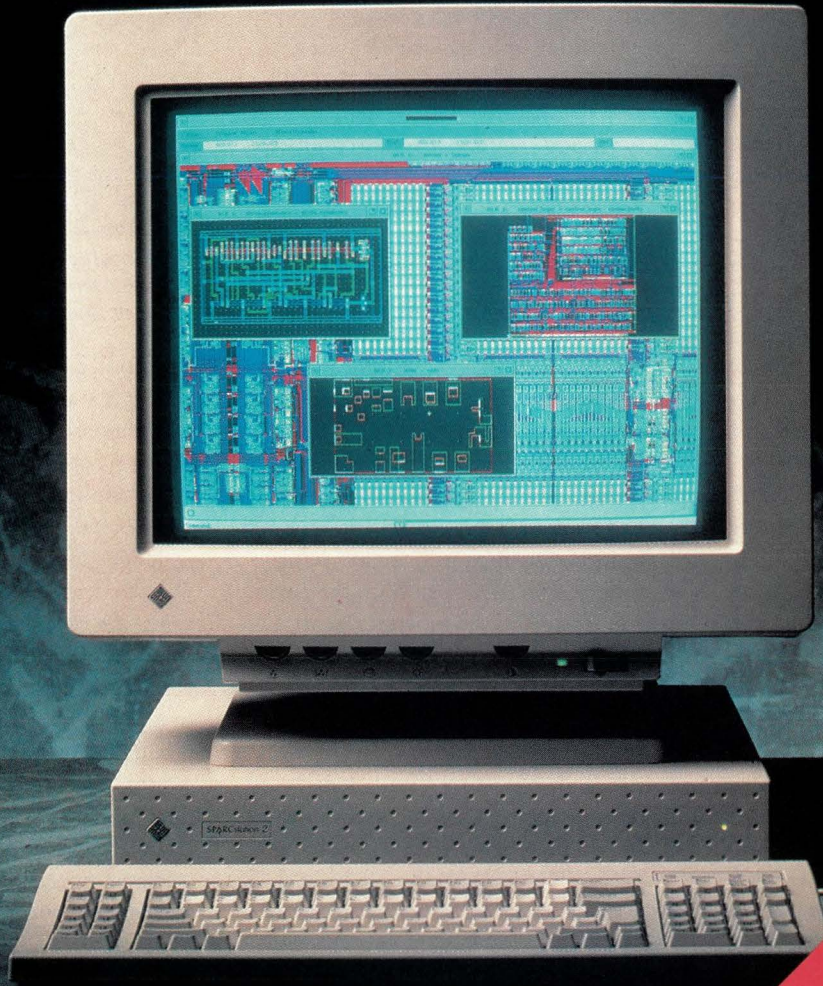
SunIntegration will both partner with other systems integrators and act as prime contractor, as the need and occasion arise. Some of the integrators with which SunIntegration intends to do business are Andersen Consulting, AT&T Network Systems, Cap Gemini Sogeti, Cambridge Technology Partners, GE Information Systems and Science Applications International Corp. The new group will also work

New SPARCserver 690MP Enclosure Exchange Upgrades

Description	List Price
Sun-3/180, Sun-3/280, Sun-3/480 or Sun-4/280 enclosure exchange upgrade to SPARCserver 690MP; 64-MB memory; 4 X 2.1-GB differential SCSI disks; 5-GB SCSI tape drive	\$53,995
Sun-3/180, Sun-3/280, Sun-3/480 or Sun-4/280 enclosure exchange upgrade to SPARCserver 690MP (with SuperSPARC and SuperCache); 64-MB memory; 4 X 2.1-GB differential SCSI disks; 5-GB SCSI tape drive	\$59,995

Source: Sun Microsystems Computer Corp.

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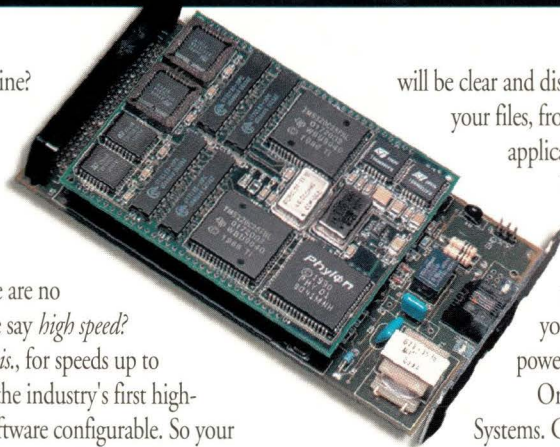


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hand-in-hand with the integration staffs at networking specialists such as Cabletron and SynOptics Communications Inc.

Among the specialties that SunIntegration plans to address are business process reengineering; enterprise-wide network integration and management; UNIX; open systems; software development, implementation and support; Sun product customization; and mainframe-to-client/server application migration. The group plans to focus on "SMCC markets with a high need for integration services," which include telecommunications, manufacturing, oil and gas, banking and finance, retail and transportation.

The group will be staffed by 50 SMCC employees and will be headed by Leon Williams, who is vice president of information resources in SMCC. Williams will continue in this position, where he helped "rightsized" Sun's U.S., European and Pacific Rim operations.—mjf

Super Tuesday Revisited

With all the hoopla surrounding Sun Microsystems Inc., Digital Equipment Corp. and Hewlett-Packard Co.'s triplicate of announcements on Tuesday, November 10, 1992, it was easy to overlook some of the fine print. In Sun's case, there were more than a few mixed messages and tantalizing teasers thrown about.

For instance, there's the matter of pricing. Up until a few days prior to the introduction of the SPARCclassic, its price was slated to be \$200 higher than the \$4,295 (quantity one) at which it made its debut. Could it have been the slew of PC price cuts made by Compaq Computer Corp. and others that led to Sun Microsystems Computer Corp.'s last-minute decision to knock the nondiscountable street price down a few more notches?

Then, there's that old bugaboo—shipment dates. Exactly when will those SPARCcenter 2000 servers ship? The eight-processor version is due out in June. But the 16-processor SPARCcenter isn't slated to ship until the second half of 1993, and the 20-processor one won't make it off the

loading docks until the first half of 1994. How these dates will affect the introduction of Sun's rumored "low-end" SPARCcenter, code-named Scorpion, is anyone's guess.

Speaking of SPARCcenter, is it a mainframe killer or the box that will save the mainframe by helping offload some of its chores? If you're confused, take heart: Sun seems to be, too. SMCC has called SPARCcenter "a mainframe-caliber system for data center applications." But SMCC officials are also on the record as saying that SMCC is not positioning the SPARCcenter as a mainframe or mini replacement, but as a mainframe front end.

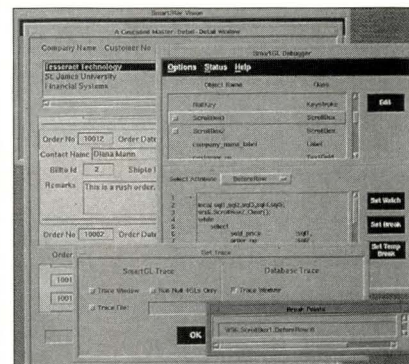
One clue regarding the future of SMCC as a big-iron vendor can be had from SMCC's careful and repeated hints about "high-availability" hardware and software that is on the horizon from Sun. (So much for Scott McNealy's ridicule of road maps and their makers.)

To date, Sun's foray into high availability has been primarily in conjunction with New York City-based systems integrator Fusion Systems Group Inc. In October last year, Fusion released High Availability for Sun (HA for Sun) software, a product it developed with J.P. Morgan, to manage a "failover," Sun's word for switching from a primary Sun server to an alternate machine. SMCC is currently billing its SPARCcenter as a "fault-resilient" rather than "fault-tolerant" machine.—mjf

New Tools for the Development Trade

Within the past few months, a number of low-profile software vendors have introduced some high-profile tools to assist developers across the programming spectrum.

Cooperative Solutions Inc., San Jose, CA, at the end of last year rolled out what it called "the first seamlessly integrated environment for deploying and managing client/server applications," *Ellipse*. In the Cooperative Solutions model, the servers run UNIX (at press time, only SunOS 4.1.2, but with AIX and HP/UX support expected soon), and the clients run Microsoft Corp.



The Smart Star Vision Development Environment includes an object browser and debugger.

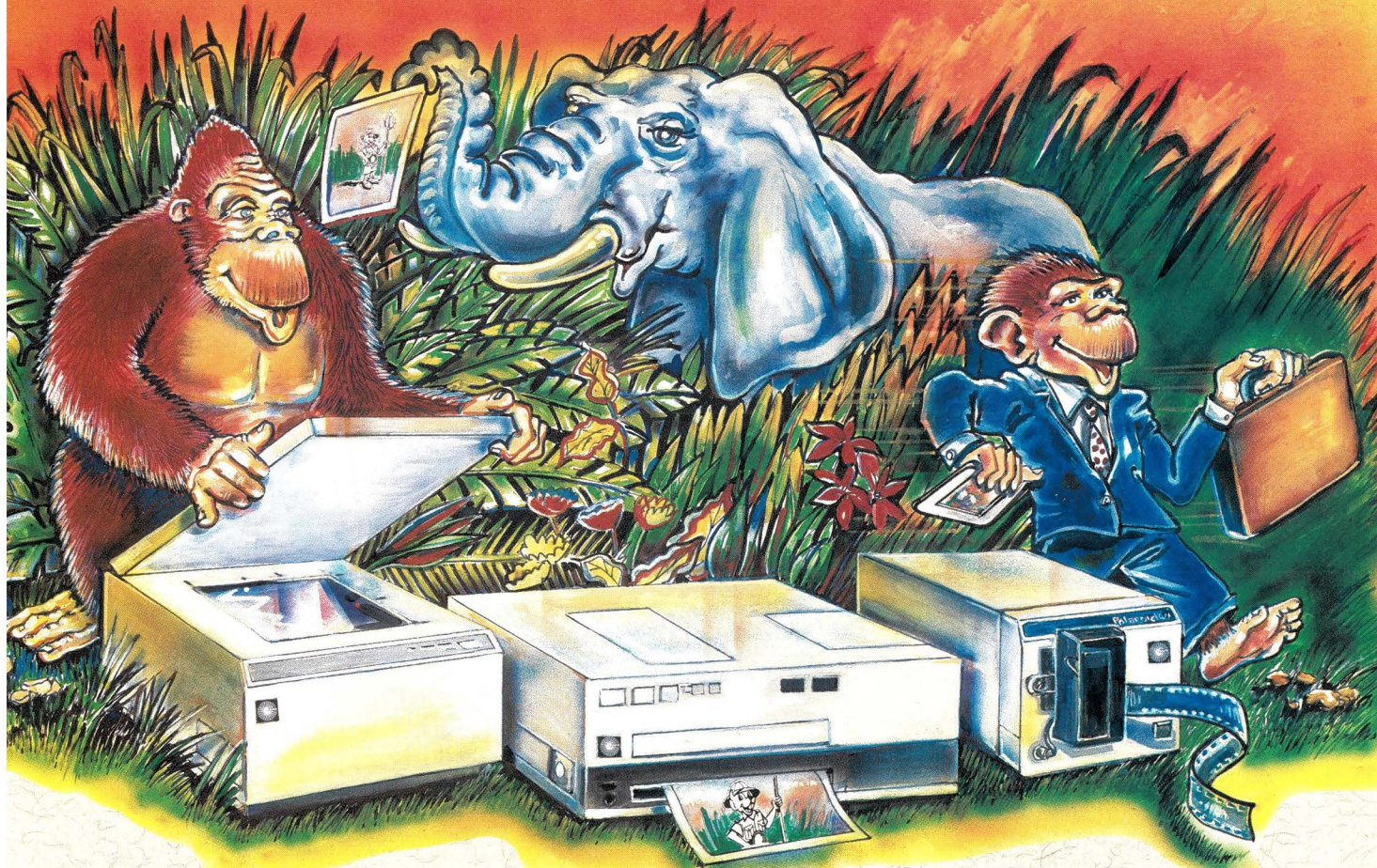
Windows or OS/2 (with Presentation Manager waiting in the wings). The server repository can be based on either Sybase or Oracle.

The application-generator-style, LAN-based development environment is designed for multiple users who want to develop basic business applications—the type that are usually found on mainframes only. The production environment partitions programs automatically so that true client/server processing (rather than just front-end processing) can occur. Both the development and production systems include configuration management, version control, release management and other relevant modules.

Cooperative Solutions' goal is to allow users "to change things like presentation services, databases, operating systems, communications services and transaction services without having to change their generated applications," explains company President and Chief Executive Officer Dennis McEvoy.

SmartStar Corp., Goleta, CA, has a somewhat similar orientation. The company's first product, SmartStar Vision, according to SmartStar, "provides the first object-oriented client/server application development environment for creating portable, SQL database applications with minimal coding." Clients supported by the environment include Microsoft Windows PCs and Apple Computer Inc. Macintoshes running X, as well as other X terminals and X systems. Servers supported by SmartStar Vision are Sun SPARC, Digital Equipment Corp. Ultrix and DEC VMS systems. The server portion contains a multiple

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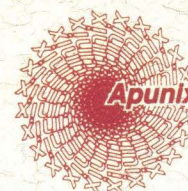
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SQL database query optimizer and distributor and supports industry standard DBMSs like Oracle, Ingres, Sybase and Rdb, along with other databases that include an internal SQL database processor using RMS for VMS or C-ISAM for UNIX.

SmartStar Vision is a rapid application development environment that integrates database objects with GUI objects. It allows the development of all windowing styles, such as scrolling, columnar displays and invoice order form displays. The only coding required to convert a prototype to a production application is to implement the basic business requirements that define the purpose of an application, and this can be done using the product's 4GL, called SmartGL. SmartStar Vision enables developers to create some fairly complex windows in minutes, the company claims, that would take several days with other GUI 4GL products and several weeks with some of the existing GUI builders.

Software Emancipation Technology (SET), Waltham, MA, is hoping to

capitalize on the success of the parametric design fever that is spreading through the CAD/CAM/CAE community. (It doesn't hurt that SET's founder and president, Dr. Vladimir Geisberg, is the brother of Sam Geisberg, the president of CAD industry darling Parametric Technology.)

The philosophy behind SET and its products is that software development is not a linear process; instead, it needs to be flexible and open to interactive, automatic change "to the lowest level of software granularity." SET's product family, called ParaSET, integrates all phases of the software-development process, including specification, analysis/design, coding, testing and maintenance. The core system consists of Para/Designer, which enables forward engineering using both structured design and object-oriented design techniques; Para/Programmer, a tool for reverse-engineering of existing software; Para/Online, a tool for creating structured text or Hypertext-based online documentation; Para/Interpreter, a debugging environment; and Para/Analyzer, a tool for analyzing and

restructuring existing source code. The tools interoperate with various other vendors' compilers, configuration management and basic UNIX utilities.

Availability of all ParaSET modules for Sun is slated for sometime this quarter. Availability for Hewlett-Packard Co., Digital Equipment Corp. and IBM Corp. workstations is expected to follow soon thereafter.—mjf

SunConnect Goes Global

Three new high-speed, wide-area network (WAN) connectivity products have been introduced by SunConnect. The three—SunLink ISDN, SunLink Frame Relay and SunLink PPP—are designed to enable applications that have traditionally been limited to use in LAN environments to run "faster and more economically over global networks," according to SunConnect.

SunLink ISDN allows remote SPARC workstation users to connect to other systems over Basic Rate ISDN. Sun says the product is ideal for advanced application users who require "real-time" or interactive access, such as desktop conferencing,



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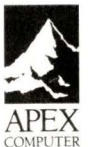
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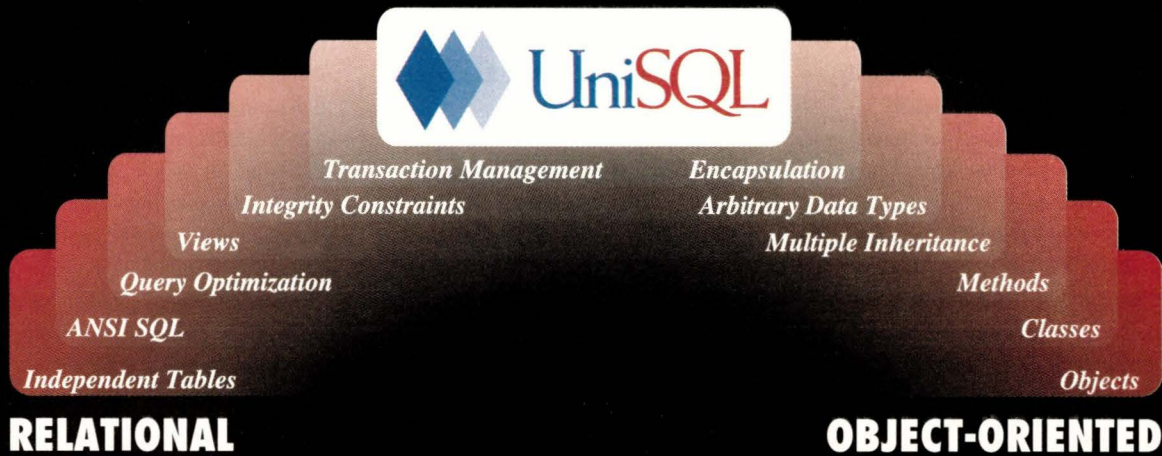
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Circle No. 37 on Inquiry Card

email and multimedia customers, who can use ISDN to transmit images and graphics at high speed.

SunLink ISDN requires Solaris 2.1 and will run on SPARC-based systems that are equipped with an ISDN port (SPARCstation 10s and LXs) and other SPARC systems that have an SBus ISDN card. Sun Microsystems Computer Corp. plans to begin offering SunLink ISDN to its customers sometime next quarter.

SunLink Frame Relay provides IP connectivity over frame relay networks at up to T1/CEPT speeds (1,022 virtual point-to-point connections over each physical frame relay connection). The product includes a SunNet Manager network-management agent that provides administrators with frame relay permanent virtual circuit (PVC) statistics.

The product runs on Sun-4-class systems running SunOS 4.1.X with SunLink HSI/S or SunLink MCP. SunConnect resellers, including Sun Microsystems Computer Corp. and SunExpress, are selling the product for \$1,150 per copy.

SunLink PPP allows SPARC hosts to route TCP/IP traffic over point-to-point links at up to T1/E1 speeds by using the Internet standard point-to-point protocol (PPP). SunConnect is positioning the product as a "cost-effective alternative to dedicated routers," and the product interoperates with routers that support standard PPP. (At press time, Sun had tested SunLink PPP only with Wellfleet Communications routers, however.) Like SunLink Frame Relay, the PPP product includes a SunNet Manager agent.

SunLink PPP runs on Sun-4-class systems running SunOS 4.1.X with SunLink HSI/S or SunLink MCP. Again, SunConnect resellers, including SMCC and SunExpress, are charged with selling the product. Suggested list price is \$1,150.—*mjf*

This Just In...

- A handful of networking vendors, among them *Sun Microsystems Computer Corp.*, have created a list of goals for implementing Ethernet net-

works at 100 Mb/s using unshielded twisted pair, 10BaseT wiring and have pledged to work together to expedite a standard for the industry. The "10/100 Mbps Ethernet Migration Objectives" are designed to provide a low-cost migration from 10 to 100 Mb/s; ensure rapid standards development by using existing interfaces where possible; preserve current Ethernet MAC layer protocols; and support existing cabling. Other members of the gang include *3Com Corp.*, *SynOptics Communications Inc.* and *LAN Media Corp.*, among others. A rival 100-Mb/s plan is being pushed by Hewlett-Packard Co. and AT&T Microelectronics and is being supported by Banyan Systems Inc., Novell Inc. and Microsoft Corp.

- *SunSoft* has ported its ToolTalk application-integration software to platforms from Cray Research Inc., Digital Equipment Corp., Hewlett-Packard Co., IBM Corp., Intergraph and Silicon Graphics Inc. All ports are available now.

- *RDI Computer Corp.*, San Diego,

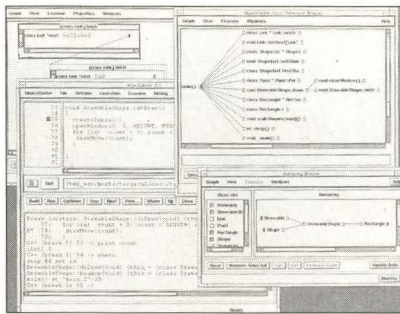


A smart way to spe

has introduced a new portable based on the SPARCstation IPC motherboard, with an active-matrix TFT color LCD display and new 450-MB hard drive. The BriteLite IPC color system retails for \$9,995.

- Notebook maven *Tadpole Technology*, for its part, has introduced a new, low-cost SPARCbook configuration and slashed SPARCbook 1 pricing. The SPARCbook LC is available in two configurations: the S1-LC, with a 180-MB hard disk, 8-MB DRAM and a gray-scale display, for \$3,950; and S1-LC/T, with a 180-MB hard disk, 8-MB DRAM and a color TFT display, for \$5,950. A 16-MB memory and a floppy disk option are available for \$950 and \$750, respectively, but only at the time of the order. Price cuts for the SPARCbook 1 range from 33% on color TFT model, to 38% on gray-scale ones.

- Version 2.0 of *CenterLine Software Inc.*'s C++ programming environment is slated to ship this quarter. ObjectCenter 2.0 now offers fast compilation through precompilation of header files.



CenterLine Software Inc.'s ObjectCenter 2.0 includes many new features, such as precompilation of header files.

It can handle large C++ apps and includes support for use and development of C++ class libraries via templates located throughout the environment. The new version includes other enhancements in debugging, object-code run-time error checking, advanced dynamic code and data visualization capabilities and support for both Open Look and Motif. List price is \$3,995. CenterLine is based in Cambridge, MA.

- At the suggestion of its customers,

SunSelect says it is repositioning PC-NFS. The difference is "we [Sun] address areas where the LAN OS vendors are weak, such as the back end of the client/server configuration and in the extensibility to WAN area," says Dave Rosenlund, product line manager for PC networking. SunSelect has taken its first steps by unveiling new packaging and volume pricing options for the product. PC-NFS is now available in 10- and 25-user packs, in addition to the 100- and 500-user packs offered previously. New list prices are \$310 per copy for the 10-user version, and \$278 per copy for 25 users. ➔

Correction

In the article "SWAN: ATM by '95 or Bust" in the October 1992 *SunExpert*, we should have indicated that Sun Microsystems Inc. manages its PBX systems with AT&T's Trouble Tracker product.

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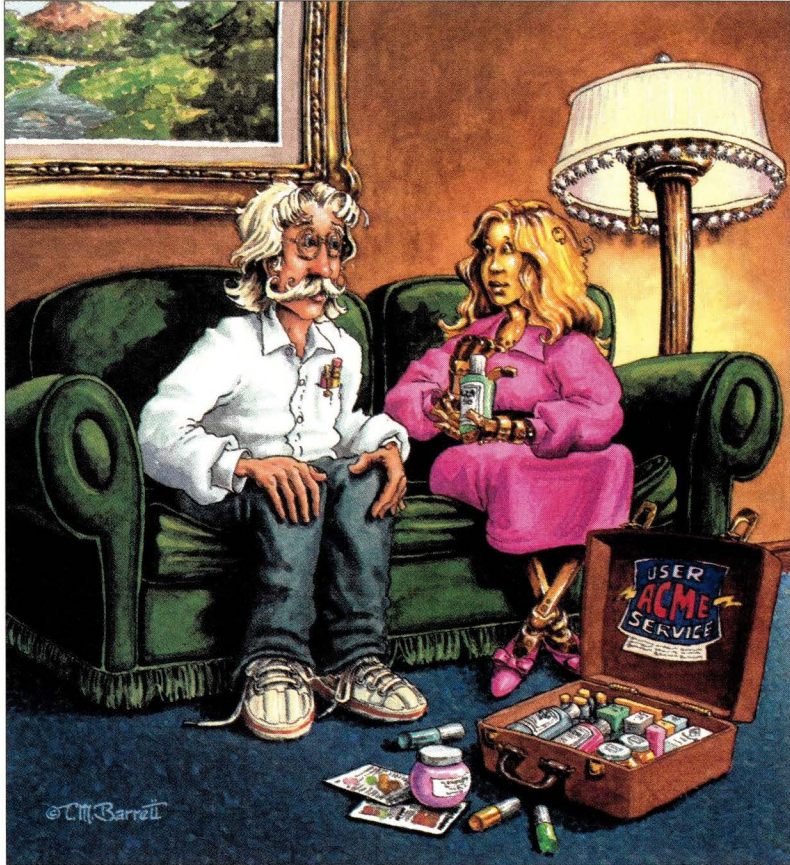


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Circle No. 20 on Inquiry Card

Ask Mr. Protocol



by MICHAEL O'BRIEN

"Today we got oyster stew. Vot you have?"

—Head of User Services

"Where's the beef?"

—The immortal Clara Peller

"You've always got to know where your towel is."

—Douglas Adams, Vol. 823 of the *Hitchhiker's Trilogy*

Mr. Protocol Roots Around

Q: You've given us all kinds of information about the Big Wide World outside our local organization, and (for the sake of argument) let's assume you've even convinced us that it's worth the effort to get some kind of external connectivity. How do we deliver this to our users? How do we convert the stuff you tell us about into something the average user could actually use?

A: Boy, you're just not going to be a pussycat this month, are you? Well, let's give it a try. Mr. Protocol is suffering from a serious case of *polytropia dingdongia*, and it'll do him good to work it off.

It would be jejune to say that the Internet supplies a wide variety of

services. (Wonderful word, that. Always somehow reminded Mr. P. of jujubes.) The point is that the services your users are interested in will depend on who your users are. If they are a fun-loving, banana-eating bunch of congenial idiots who are notable mostly as shining examples of Darwinian reversion, then throwing a few copies of the *readnews* manual page in their direction will probably be the most helpful thing you can do. In a few days or weeks, you can merely sweep up the debris and go looking for a new bunch of users. The only advice Mr. P. has for you in a case such as this one is to make sure that your office door isn't one of these poor hollow interior jobs, but a real, solid exterior door, preferably made of ironwood (though oak will do at a pinch). Keep it locked. In fact, try not to be in the

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office at all until the dust settles.

If your users are the more sober, productive type, your job will be consequently more challenging. Throw them the `rm` manual page. The higher bandwidth will keep them commensurately busy.

Oh, all right, all right, put that down! The way you're carrying on, you'd think users were worth worrying about. I mean, as if they paid the bills or something.

Organizations that have just connected to the Internet, in whatever fashion, have a delicate balancing act to follow. Presumably, having made the decision to join the network, your organization had some reason for doing so. This may have been a nebulous need for connectivity, based on all the noise and hoopla, or it may have been a very concrete reason.

Whatever the case, it is certain that management was presented with a reason that gave every appearance of being concrete, even if the facts at your level would suggest otherwise.

It is sometimes the case that the concrete reason proposed to management is in fact the real reason for joining the Internet. Such organizations give Mr. Protocol the cold collywobbles. It makes life that much easier for the folks who are given the job of providing user services, though, since the user base is directed toward some one goal or set of goals.

The question of user services is one that has always received attention in user groups organized around a single vendor, presumably because the common vendor environment provided enough similarity for interchange to be immediately useful. Up until recently, Internet connectivity has been treated as just another service among many, and there's been relatively little interchange purely on the basis of the Internet.

With the advent of distributed Internet resources, however, activity in the user services arena has been picking up substantially. In fact, user services are beginning to use the Internet as a provider tool as well as a resource to be explained.

Mr. Protocol has maundered on at length in the past about the new, distributed resources that have appeared in the last few years on the Internet. He does not propose to discuss those services in detail here, since he's done that in the past for some of them, and is reserving the rest until someone bribes him with a really *big* shipment of chocolate chip cookies, but he does wish to convey the fact that these services can materially affect how user services can be delivered.

So what services should a newly established site expect to deliver? Mr. Protocol is glad you asked.

Real user services are, of course, dependent on a real user services budget. User services are rarely budgeted *ab initio*.

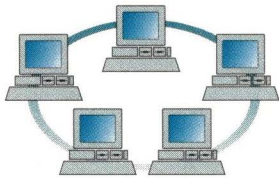
Usually, a number of independently funded projects, each created on the spur of the moment, are eventually lumped under the rubric of user services. Once created, the organization becomes self-perpetuating, at least, if it does anything like a good job. People wonder how they ever got along without it.

Mr. Protocol, cantankerous as ever, remarks that in the old days of loading your own punch cards into a machine that didn't even have an operating system, "user services" consisted of stacking the hardware manuals where people could find them, and fixing the machine when it broke. Things are somewhat more advanced today, he is forced to admit.

Today's user services organizations bridge the gap between the systems team and the user population. They



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"I invented SCCS back in 1972 but today PVCS offers much more than SCCS in control, security and productivity. It's professionally maintained and updated. I wouldn't trust my company's precious code to anything less.

PVCS is far more convenient to use than SCCS ever was, and it works transparently across OS boundaries. For features, performance, reliability and convenience, there's no comparison - PVCS is the best configuration management product on the market."

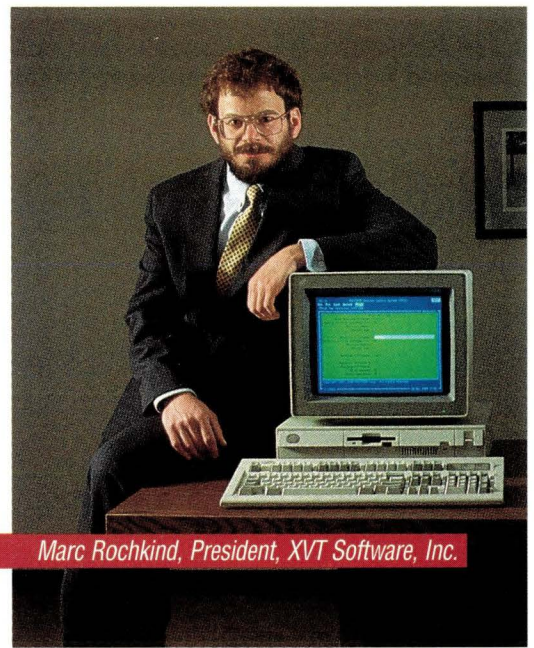
- Marc Rochkind

PVCS Version Manager 5.0 provides complete control of versions of your software and its elements, including binary files. Previous configurations are easily recovered at any time. Parallel development is made safe and productive because conflicting changes are detected and prevented or saved as a parallel development branch. You always know who made a change, when and why it was made, and what was changed. In addition, PVCS Configuration Builder can embed "footprints" containing historic information into compiled code and act conditionally on the information when it uses the code. Footprints in executable code can be read with an included utility. This greatly simplifies bug tracking.

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Marc Rochkind, President, XVT Software, Inc.

PVCS Configuration Builder is highly compatible with UNIX MAKE. The macro names are the same and the search path logic is identical. Most UNIX MAKE scripts will run without modification.

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handle everything from system documentation through user consulting to what amounts to contract programming. Mr. Protocol has no intention of telling you how to set up a contract programming shop. If people in your organization need such services, they will find you.

However, user services in many organizations has now grown beyond a purely reactive role, and become involved in outreach. "Outreach" is viewed by Mr. Protocol as a synonym

singing in your particular chorus. Nothing's more confusing than two organizations with tangential recommendations to the same user community. Pay particular attention to the library, if your organization has one. You'd be amazed what those people are up to these days.

Every user services organization, except for the culturally dispirited sort found in organizations specializing in white shirts and neckties, eventually takes on A Mission. It doesn't much

of a new resource comes in the form of a diamond in the rough. Seeing as how you're not entirely dim, you've taken Mr. Protocol's advice and gotten your office moved into the same corridor as the systems team. One of the systems types comes in. This isn't the hyperactive one; this is the one who seems to be in permanent residence elsewhere. You're never sure if he's come in to see you, or merely forgotten which is his office and decided to make the best of things in yours. As best you can make out, he seems to have discovered an interesting new application on one of his endless Internet fishing expeditions. If only he'd quit fiddling with the hole in his T-shirt and stop mumbling, maybe you could even find out what it was.

Assuming that the new service is worth promoting, how do you promote it? What sorts of tools are available to you to get The Word out to users?

Many organizations take the not unreasonable attitude that users hate to learn new systems almost as much as they hate to open envelopes from government institutions whose existence they never suspected. Therefore, they'll use delivery services with which the users are already familiar—in the worst case, electronic mail.

Alternatively, figuring that Usenet is rather ubiquitous, they will create local newsgroups on the news server machine, figuring that people can check those at the same time that they read the rest of the network news, and using the same tools, at that. Surprisingly, this can have limited success, possibly due to cultural difficulties. No one expects to find anything really worthwhile on Usenet (or at least, nothing work-related), so reading it can become haphazard. Also, the button-down types who wouldn't be caught dead reading that tripe are exactly the ones who refuse to take the time to learn how to use the rather complex news-reading clients just to read the boss's own private BBS. Mr. Protocol thinks that using newsgroups beats email all hollow for internal distribution, but he has also seen the attempt fail miserably. Possibly, sheer persistence is what's needed here.

Mr. Protocol thinks that using newsgroups beats email all hollow for internal distribution, but he has also seen the attempt fail miserably.

for "peddling." In such cases, the user services organization is, in effect, actively recruiting new users for the system, or actively promoting the use of facilities by current users.

Mr. Protocol does have a few pointers to hand out besides the obvious ("Get your budget lined up early"). The most important thing you have is documentation, generally created by other people. Create an on-line index of available documentation. Since it's generally cheaper to print one copy of the documentation and reproduce that than to print multiple copies, keep additional copies of all commonly requested documentation on file, and keep a count of the number of copies in the on-line database. That way you can make more copies before you run out.

In addition, if possible, locate the user services people right in the middle of the systems team. Mr. P. has observed that a user services team that is located on the far side of the Grand Canyon from the systems team generally has only the vaguest notion about what's currently going on.

If you're in a large organization, make sure you're the only people

matter what the mission is, so long as there *is* one. This reaction seems to stem from a basic human need to initiate action. Whether or not this is viewed as a Good Thing depends on local corporate culture. An academic setting, which by charter has nothing better to do than to reach out and torture the hapless, usually views such doings not so much with approval as with a sudden focusing of religious fervor. In a more button-down corporate setting, on the other hand, management will often view the sudden liveliness of a previously quiet organization with instinctive disapproval and irritation.

An outreach operation attempts to educate the user base about the availability of a new or underutilized resource. Often enough, these days, the target of such a program is the Internet itself. The nice part about that job is that the Internet community is finally beginning to pay attention to this area itself, leading to a sort of bootstrapping procedure whereby Internet resources are being created that can teach the use of other Internet resources.

Often your first lead to the existence

Probably the most ambitious response to the need for outreach is the campus information system. These things are popping up like weeds. Seemingly, their time has come. Usually these systems are optimized to answer questions as quickly as possible, while still supporting browsing. They do this through hierarchical, menu-oriented operation. Culturally, they are descended from the on-line library catalogs, which have been around for years.

The downside of these systems is that they do represent a new user interface. The upside is that they are far easier to learn than any of the common news-reader programs. They are menu-based and often support hypertext links.

One of the most popular bases on which to build a campuswide information system is a system called *gopher*, which has put in an appearance within the last couple of years as an extremely capable and convenient remote documentation system. Mr. P. promised not to go into the details of *gopher*, and he'll keep that promise, yes sir, at least for this month. But no treatment of user services would be complete without a brief description at least. *gopher* uses a home-brew protocol to allow information files to be transferred from a remote system to the local system, either for perusal or for permanent storage. The twin advantages of the use of *gopher* are that it is easily configured and that it can "hand off" a connection to another *gopher* server elsewhere on the network. As far as the user is concerned, he is browsing an incredibly deep menu tree, but invisibly to him he is (or may be) also traversing the Internet from end to end, being handed off from one *gopher* server to another.

These twin advantages seem to be pushing *gopher* further and further ahead of the pack, at least in the realm of campus information systems. An organization with a directory full of information can simply point a *gopher* server at it and forevermore be freed of the necessity of, say, generating a carefully crafted copy in some baroque database format on a regular basis. *gopher* is able to use the origi-

nal directory of files and in fact can deal with files in a variety of common formats, from plain text to GIF graphical images.

The other advantage of *gopher*, its distributed nature, acts as a value-added attractor in many ways. Depending on the links introduced to point to other, off-campus *gopher* databases, users may be greeted with a world far wider than just the local campus. There are more than 200 *gopher* servers currently in operation, and your users can have access to all of them, so long as you put one or two external links into your local *gopher* database, to hook in to the rest of the world. Mr. Protocol's amanuensis, within 15 minutes of first compiling a *gopher* client program, and with no instruction whatsoever on its use other than that provided interactively by the program, obtained the current home address of the professor (now emeritus) who first taught him the Greek classics 25 years ago. He figures that's a pretty wonderful Christmas present.

Chocolate Chip Cookie Hall of Fame Department

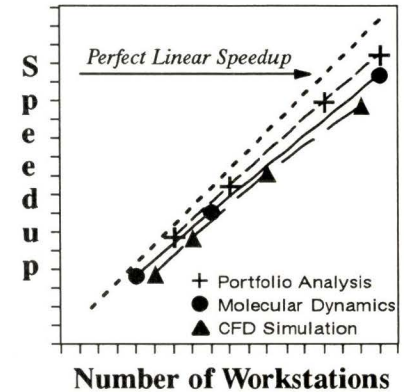
More than the usual thanks to Valerie Polichar, for putting Mr. Protocol on the *gopher*'s trail, and the trail of campus information systems in general. →

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 at an aerospace research corporation.

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

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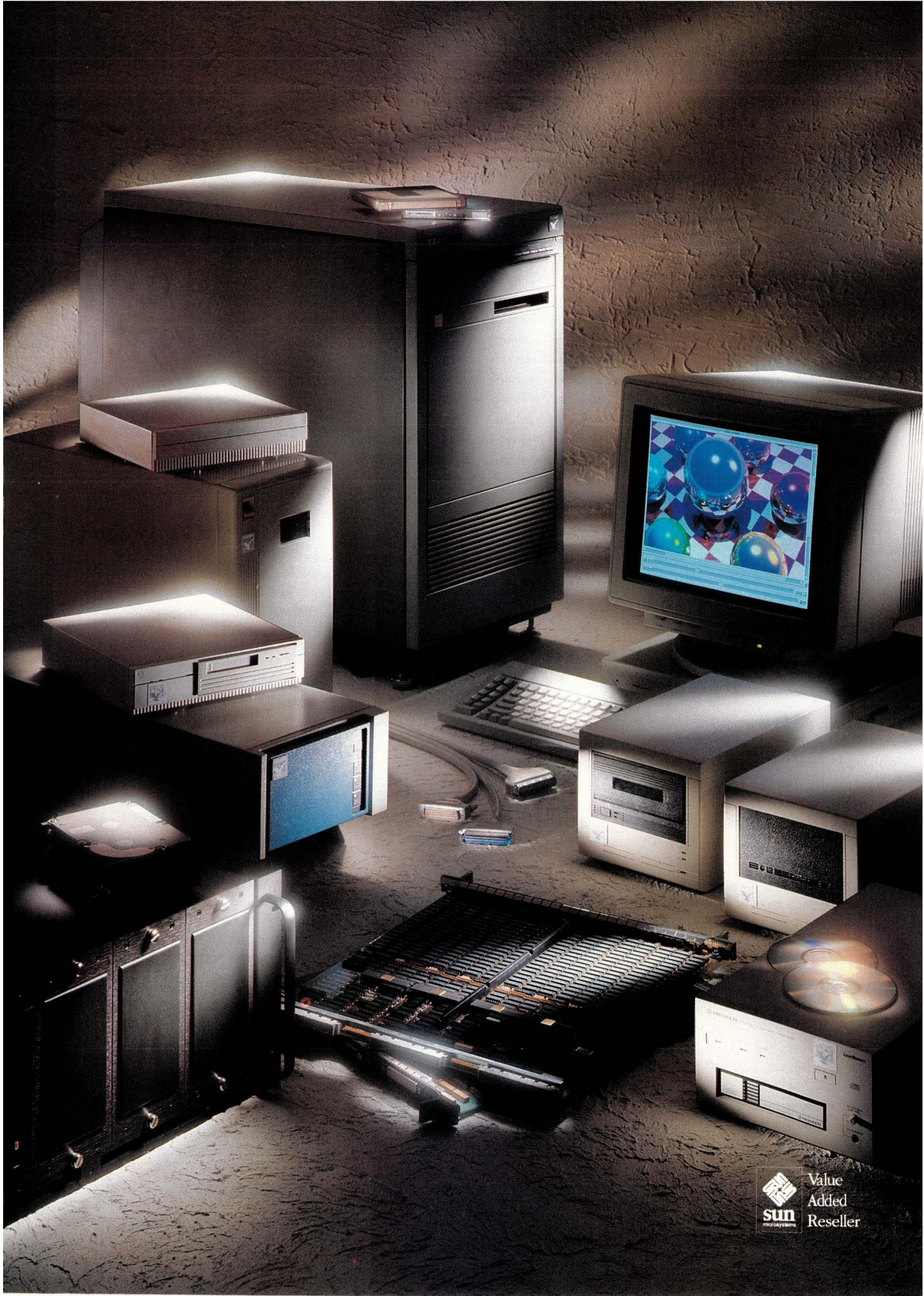
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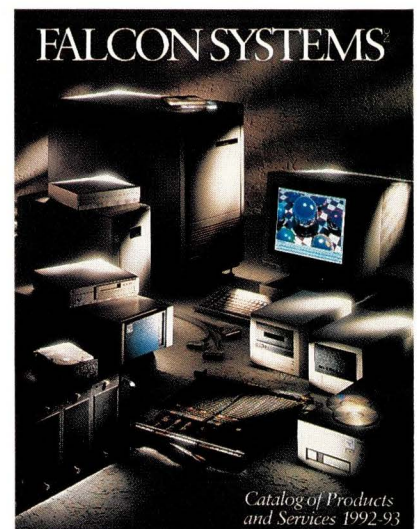
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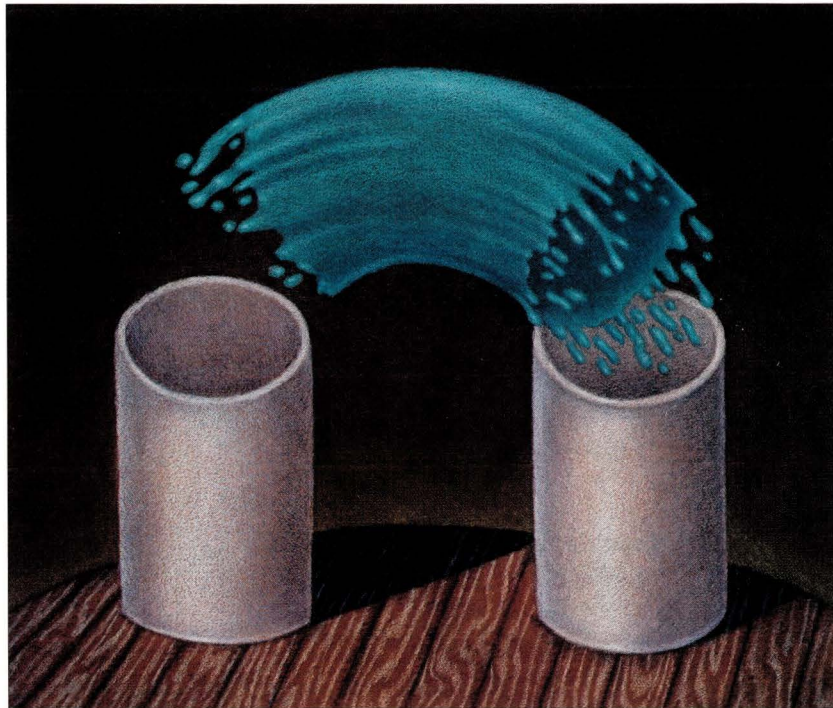


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KEITH GRAVES

UUCP by PETER COLLINSON, Hillside Systems

The UNIX-to-UNIX Copy (UUCP) system is the oldest form of wide-area networking available to the UNIX user. In fact, there was a time when AT&T was selling “networked solutions” comprising solely the UUCP package. It has survived the test of time and is still in use today because of its low entry cost. Originally designed to use the serial connections that enable terminal access to the machine, UUCP needs no special hardware or special device drivers built into the kernel. When one machine makes a UUCP connection to another, it simply logs in like a normal user, giving a user name and a password.

Copying Files

UUCP was designed at a time when networking consisted of connecting a piece of cable from the terminal port on one machine to the terminal port on another. Alternatively, a dial-out modem can be attached to the port, permitting the use of the regular phone system to connect to a listening modem on another site. In either case, a UUCP connection is “point-to-point”; that is, it starts on one machine and ends on another. To move files around, you either need to con-

nect to every machine you want to talk to, or specify hops—a list of machines needed to reach the intended destination. To copy a file to a remote machine one hop away from your machine, say

```
$ uucp myfile remote!filename
```

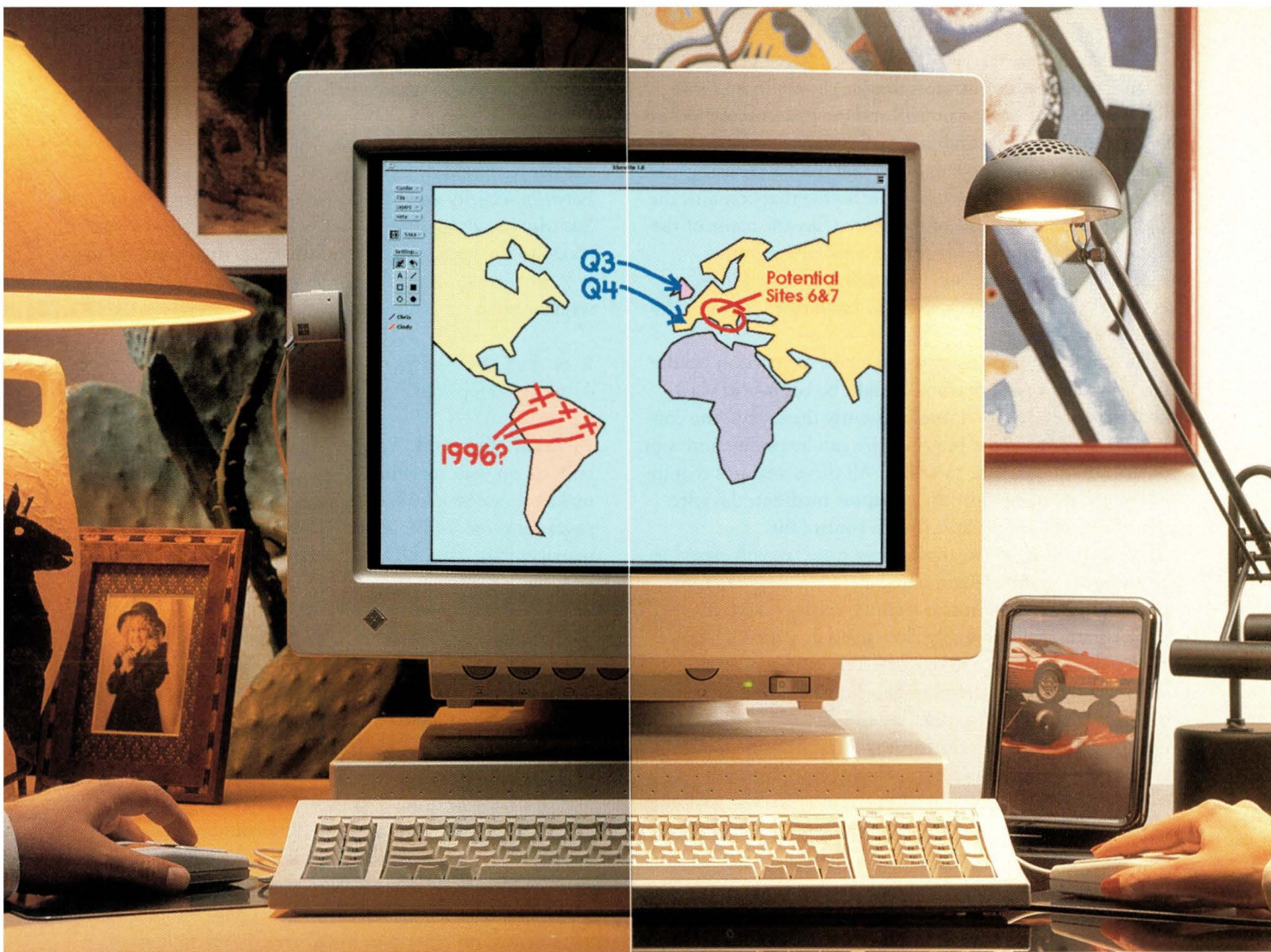
Beware that the exclamation mark means “history” to `cs`h and will need escaping with backslash. Obtaining a file from a remote machine is easy. Simply specify the remote connection first.

```
$ uucp remote!rfile lfile
```

gets the file `rfile` on the remote machine into a file `lfile` on the local machine. To send further afield, you would need to say

```
$ uucsend myfile hop!remote!filename
```

This transfers the file to `hop` and then to `remote`. You can only send files in this way. These days, this often won't work



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because system administrators disable the ability to move files like this. However, you will still see this form of address in some mail contexts and in news headers.

Let's look at what happens when you send a file using `uucp`. The command queues a control file that contains the copy direction, the name of the source file, the name of the destination file and the file permissions (among other things). At some point later, depending on how things are set up, a UUCP connection will be established between the two systems.

This can be done by using a dialer and connection via the phone system; or the machines might be connected via a direct terminal line; or, more frequently these days, the connection is made via the Internet. We can be passive and wait for the remote machine to call us. All these methods require different code to support the transport medium; the selection of the method is made from a control file.

If we are calling out to another machine, we will expect to see a normal terminal login sequence. It's possible that the `uucp` login is used, although security-conscious system administrators will probably have given us a special login and a password unique to our site. The calling program, called `uucico`, will pretend to be a human logging into the machine. In the simplest case, it will first send a newline and wait for `login:` to be printed. It will transmit the login name and wait for `Password:`. Finally, it will send the password. It uses text pattern matching to examine the responses made by the remote machine and can be programmed to reply appropriately.

Once logged in, a copy of `uucico` is used as the shell. You can see this if you log in as a UUCP user. The remote system will say `Shere` and be very unresponsive. There is a Control-P hidden before the capital S. You cannot break out from this with a Control-C, so you had better know how to drop the connection using external means.

Our `uucico` expects to be talking to a remote `uucico`. Once an initial handshake is done, the two `uucico`'s set up a virtual circuit to carry data in both directions over the connection. Serial lines are notoriously noisy, and the protocol that is used on them works hard to ensure a reliable connection. The protocol used over the Internet is lightweight because it knows that it is running over TCP/IP—a reliable end-to-end connection.

Since we called out, we have the privilege of “going first.” We look for work for this remote site and find the file that was queued. The control file is shipped to the remote machine. Note we don't just ship the data file to the destination the user specified. We move the control file, and it's up to the receiving system to request the data file.

This permits the receiving machine to make a number of security checks. The most fundamental question is whether the remote machine will allow the `uucp` user to create the file that the user wants to move. Note that the UUCP system doesn't attempt to preserve individual file ownership. It doesn't attempt to communicate any user validation information; without encryption this would be highly insecure. Instead, when you move a file to a remote machine, the file will be owned by `uucp`. The `uucp` user should not have

much privilege, so where `uucp` can access the file-store is restricted.

The slice of the file-store tree that `uucico` can see may be further restricted by a control file. Again, the balance between security and usability enters the system admin's role. Security has always been a worry. It's usual to always permit access to the home directory of the `uucp` user, conventionally `/usr/spool/uucppublic` (note the two p's). So a source sequence like

```
$ cp myfile ~uucp
$ uucp ~uucp/myfile remote!~uucp/file
```

will most often work. You may have the scripts `uuto` and `uupick` on your machine. They are designed to help to make this access a little more painless—look at their manual pages for more information. It's sometimes hard to tell a manager that, “Yes, UUCP can copy into your home directory, but we stop that happening artificially for security reasons.” Just remember that UUCP can copy out from the directory too.

We are moving the control file that was queued when the `uucp` command was called—remember? We have to worry a little about what the command file will be called on the remote machine when we copy it. It needs to have a unique name; otherwise confusion will reign. We know that our machine name is unique, at least as far as the remote machine is concerned, so all the files that we send over have our name as part of the filename. Then we ensure that all *our* files are unique by using a sequence number that is obtained from a command file. The sequence number is incremented on every use. It will cycle in the fullness of time. The cycle time should be slow enough so that the sequence number remains unique for the duration of the file transfer operation. Finally, the UUCP system needs a number of different file types and uses a file prefix to distinguish them. For example, all control files start with the letter C.; D. indicates a data file.

This care with file naming was needed in early systems because UUCP kept all its files in one directory, usually `/usr/spool/uucp`, so name clashes were possible. This mechanism just didn't scale when a site had large numbers of UUCP connections and much time was spent in searching that one huge directory looking for files. More recent UUCP implementations have some way of splitting the single working directory into manageable chunks. Some systems place all the work for a particular site under a single subdirectory named for the site. Some systems have split the directory using the file name, so when `uucico` looks for `C.hillsideA6bW3`, it will find it in the `C.hillside` directory under `/usr/spool/uucp`.

All being well, the control file will find its way to the remote machine and be interpreted as an instruction to move a file. The remote machine requests the file to be copied, and it is sent down the communications link. It is actually copied into a temporary file until it is known to be present on the remote machine. It is not placed in its final user-specified position because the line may drop during the

transfer and several attempts may be needed to ship it. Only when the remote machine has all of the file will it be put into the place that was requested by the original command line. This means that the user will either have the file or will not. The user does not see a “halfway” house, where some of the file has been transferred.

That finishes the processing of the original `uucp` command. Our machine may have other files to send and it does so. Once outbound files are gone, the connection is turned around. We ask the remote machine whether it has anything to send us. If it does, those files are shipped. Finally, the connection is dropped.

Remote Execution

UUCP springs into life when you realize that it can be used to execute a command on a remote machine. For security reasons, it is usually limited to executing just a small set of commands, often just `rmail` for receiving local mail and `rnews` to take news. The system administrator can limit the commands by editing a control file.

The ability to execute remote `rmail` commands was the start of Usenet. When using a UUCP-based mail system, I want to send mail to some remote user and will say

```
$ mail hop!remote!user
```

and type in the mail. Actually, these days I am more likely to type in a domain address and have the mail system translate that into a path to the remote machine. The end result is the same. My local mail system queues a command for remote execution using the `uux` command. My mail system will execute

```
uux - hop!rmail \( remote!user \) < file
```

where `file` is a temporary file holding the mail that I am sending. This is a little hard to read. Let's break it down a little.

```
uux - hop!.... < file
```

will queue a command that is to be run on the remote machine, `hop`, using the data taken from standard input, shown by `file`. The contents of `file` are shipped separately and fed into the command at run time.

The remaining text on the line is the command to be executed on the remote machine. We intend that the command

```
rmail remote!user < stdin
```

will be executed on the machine `hop`. The standard input to the command is taken from the file that is shipped separately.

The background process `uuxqt` will be invoked on `hop` to do the actual work of making the remote execution happen. This daemon will arrange that the `rmail` command is called with the appropriate arguments taking input from the file holding the body of the mail. The command will inject the

file into the local mail system. Since the mail is not for local delivery, `hop`'s mail system will also execute a `uux` command:

```
uux - remote!rmail user < file
```

This will send `file` as the data to be fed into `rmail` on `remote`. We ask `remote` to execute

```
rmail user < stdin
```

which delivers the mail to the user on the destination machine.

The `uux` command operates by queuing command files in a similar way to the normal `uucp` command. However, it sends three files to the remote machine. The first file contains the message that we typed in earlier, and this will be standard input to the `rmail` command. The second file contains the instructions for `uuxqt`; this contains the name of the user that queued the file and the command to be executed, among other things. Finally, there is a UUCP control file that contains the instructions to transfer the other files. It will be passed by the UUCP process to initiate the work.

When `uux` is run, the files are queued in a particular order: first, the mail data file; second, the `uuxqt` command file; and finally, the command file to be passed to the other machine. It is done in this order so we may safely abort the command at any time. The first two files are just junk to UUCP until the command file is queued. When the command file is queued, we are safe in the knowledge that all the data files needed for the `uux` action are ready and waiting. By being careful about queuing order, we can avoid the need to worry about the “state” of a queued transfer. This care with sequencing of actions continues as the files are sent to the remote machine.

As before, the `uucico` program connects to the remote machine and will send over the UUCP control file. The remote machine will request that the data file containing the mail is sent over, and this will be followed by a request for the `uuxqt` command file. Once the files are safely on the remote machine, the source files on the local machine are deleted.

We have arrived at the remote machine with a data file and a `uuxqt` command file. We know that it's a command file because it starts with `X`. Actually, this is a little clever. When it was created on the local machine, it was treated as a data file and named as `D.something`. The name of the file is changed when we copy the file to the remote machine into `X.something`. This creates an active `uuxqt` command file.

This exploits the atomicity of the basic file transfer action that copies files first into a temporary location and only puts them in place when the complete file has been transferred. When `uuxqt` finds a file called `X.something`, it knows that all the necessary pieces of the command are in place.

The `uuxqt` program is started by `uucico` or from the clock by `cron`. Its job is to look for work in files called `X.something` and execute the commands therein. It uses a lock file so only one instance of `uuxqt` is running. This method ensures that commands are executed sequentially. It also helps with

load management on the machine. It *can* prove a bottleneck on some heavily loaded systems.

More UUCP Programs

We have seen that UUCP consists of a number of different commands. There are a few more “user access” commands that are worth mentioning. First, `uuname` is used to print a list of sites that can be reached by the local machine. This is needed because the control file that contains this information (`L.sys` on some implementations, `Systems` on others) should not be accessible by mortals. It contains login names and passwords to remote machines. The `uuname` program is run with appropriate privilege to read the file. When given the `-l` (minus *ell*) option, `uuname` will print the name that UUCP calls the local machine. This is useful for writing portable shell scripts.

The `uulog` command is used to print data from the UUCP log file. Every transaction is logged in the file, and you can watch the progress (or not) of your file transfer to a remote machine. On some systems, the logfile is accessible to mortals so you can find its location and examine it with normal UNIX tools. The location depends on the UUCP implementation on your machine. On some systems it is `/usr/spool/uucp/LOGFILE`. Other systems maintain a logfile for each machine that is connected using UUCP, and the location of the logfile needs a little detective work. The main benefit of the `uulog` command is that it can be given a system to look for, so it can filter out an enormous amount

of irrelevant data from the output.

Lastly, but not leastly, let us not forget `uencode` and `udecode`. These two programs enable the encoding and decoding of binary data. The data is encoded into a text file solely containing printable characters. The file is created by `uencode`. It also contains the original file name and the permissions that were originally set on the file. These are “part” of the UUCP suite for historical reasons; in fact, they are more useful these days to a mail user who would like to send a binary file via the text-only mail system.

Further Reading

I have tried to avoid too much detail on configuring UUCP—this is covered well in the books on the subject. Two are worth mentioning. *Unix System Administration Handbook* by Nemeth, Snyder and Seebass is published by Prentice Hall. This excellent book has a good section on UUCP, modems and the like. Also, the O’Reilly book *Managing UUCP and Usenet* by Tim O’Reilly and Grace Todino is worth a read. ➔

Peter Collinson runs his own UNIX consultancy, dedicated to earning enough money to allow him to pursue his own interests; doing whatever, whenever, where ever... He writes, teaches, consults and programs using SunOS running on a SPARCstation 1+. He is the Usenix Standards Liaison. Email: pc@expert.com.

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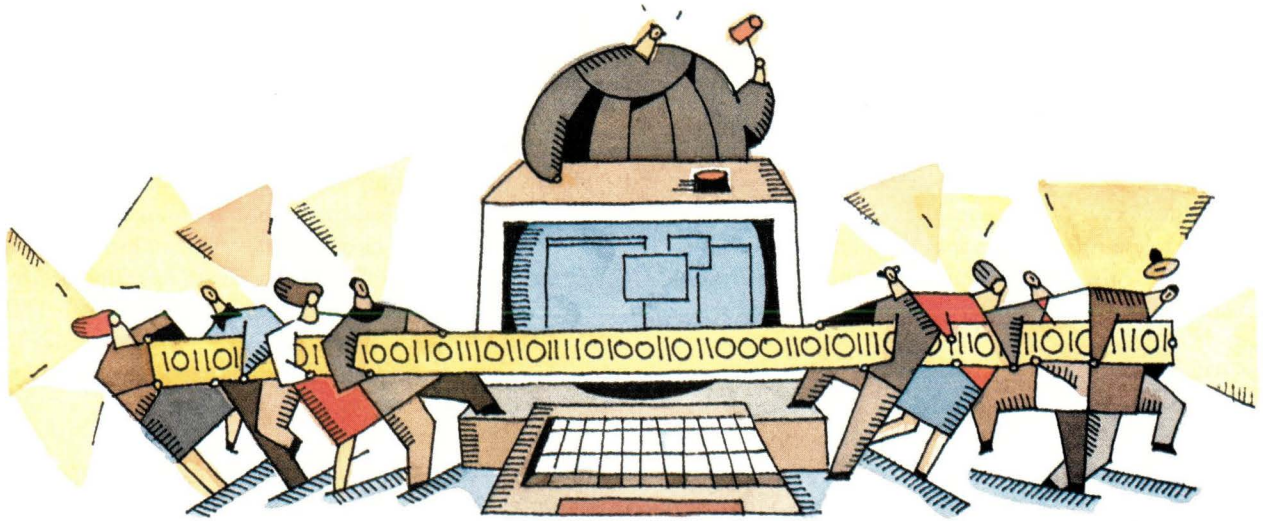
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ROBIN JAREAUX

by **RICHARD MORIN**,
Technical Editor

May These Events (Part 2)

*“Three Prayers to Bree Amal, Goddess of
Keepers of Disorderly Houses:*

*May These Events Not Involve Thy
Servant.*

*May These Events Not Cost Thy
Servant Money.*

*May These Events Leave No Trace of
Themselves in Thy Servant’s
Memory.”*

—*Casting Fortune*, John M. Ford

This month, as promised, I’m going to talk some more about the BSDI/UC/USL lawsuit. Unfortunately, there is precious little hard news to report. Discussions are progressing among the litigants, and events could easily overtake our publication schedule, but nobody is saying much right now. Consequently, I am limited to reciting (and editorializing upon) the way we got into the current mess, and where things may go from here.

In Part 1 (October 1992), I discussed the beginnings of UNIX, the BSD system and the current fracas. Here is an Ian Shoales-style synopsis for those who missed it: Ken Thompson didn’t want to go back to punched cards after AT&T got out of the Multics project. Trying to create a file system and a space travel game, he launched a multibillion-dollar industry.

Ken brought a copy of UNIX to a part of UC Berkeley, now Computer

Science Research Group (CSRG), where it caught on with the local hackers. They collected, modified and wrote new pieces and parts for UNIX. Redistributing the code to all (UNIX-licensed) comers, they turned CSRG into a major software recycling center.

In 1987, CSRG noticed that the code they were distributing was several times larger than what they had started with. They decided to split off the non-UNIX pieces, so that they could be distributed and used without AT&T licenses. They had been doing this for a few years, quite publicly, when USL (AT&T’s UNIX spinoff) decided to act.

Ignoring CSRG, USL sued (April 20, 1992) a small firm named BSDI for trademark infringement and dilution, false advertising and unfair competition. BSDI, whose staff and board include some of the staff of CSRG, sells BSD/386, a putatively UNIX-free

operating system. Based on the latest set of split-off pieces (NET/2), it is available in source form for less than 1% of the UNIX licensing fee.

The trademark infringement and dilution claims stemmed from BSDI's use of the telephone number "800-ITS-UNIX." This was cute, but it wasn't the most wonderful choice for a telephone number. Dozens of UNIX-related firms use the same suffix, however; has USL ever sued any of them?

The false advertising was embodied in BSDI's assertion that no USL license was required. (USL's complaint claimed that NET/2, and thus BSD/386, "contains software code that was copied from, based upon, or derived from, code licensed to the Regents by AT&T, such that any operating system derived from 'Networking Release 2' requires a license from AT&T or its successor, USL.") The unfair competition charge was based on the interaction of the conduct described in the preceding claims with "applicable statutory and common law."

Moving On...

USL followed up its complaint (May 1, 1992) with 43 "Interrogatories" and 37 "Requests." Not being a lawyer, I can't judge their validity or appropriateness. They seem intrusive, tedious and occasionally impossible to fulfill, but I suspect that stems from the nature of the legal process. Request No. 1 is fairly representative: USL requested

All documents constituting, evidencing, reflecting or concerning the use of, possession of, or access to any computer related products developed and/or licensed by USL or AT&T (including without limitation UNIX brand computer software operating systems) occurring at any time by any past or present BSDI personnel or by any person or entity which has performed or is now performing services for or on behalf of BSDI.

How would you handle such a request? Anyway, noting that USL never proved that a USL license *was* required (for copyright or any other reason), BSDI responded (July 13, 1992). They requested dismissal of all but the first USL claim (trademark infringement):

In its Complaint, plaintiff UNIX System Laboratories Inc. ("USL") has asserted four claims, three of which purport to set out claims for false advertising, dilution and unfair competition against Berkeley Software Design Inc. ("BSDI"). All of these claims are based upon BSDI's advertising that certain of its software—which is copyrighted by the Regents of the University of California (the "Regents")—is free of AT&T code and does not require a license from USL.

Notably absent from USL's complaint is any allegation that USL's proprietary rights have been violated by BSDI, or any allegation describing or defining USL's claimed proprietary rights, issues at the very heart of USL's false advertising claim. Apparently, USL believes it can avoid these core issues by dressing its claim for copyright or trade secret infringement in Lanham Act clothing. However, USL's failure to allege such a violation makes it impossible for its second claim for relief—for

false advertising under Section 43(a) of the Lanham Act—to withstand a motion to dismiss.

Moreover, USL's conclusory allegations based upon dilution, and upon unidentified "unfair competition" and "deceptive trade practices," fail to state any claim upon which relief could be granted. Instead of alleging any facts that could support its claim, or citing any particular statute or body of law under which it claims rights, USL recites mere legal conclusions, making it impossible for BSDI to adequately respond. Accordingly, BSDI moves, under Rule 12(b)(6) of the Federal Rules of Civil Procedure, to dismiss USL's second through fourth claims for relief.

I Say, Can UC...?

Shortly thereafter (July 24, 1992), USL amended its complaint, making BSDI's request moot. In doing so, they added 30 new defendants. The amended complaint lists Pete Wilson, Willie Brown, Bill Honig and 28 less familiar names "in their Collective Capacity as THE REGENTS OF THE UNIVERSITY OF CALIFORNIA." They also expanded their claims, to a total of 106 distinct charges. In doing so, they got a bit more specific:

Substantial portions of the source code embodied in the Networking Release 2 software and its BSDI derivative, BSD/386 Source, are based upon, substantially copied from or derived from original UNIX(R) system source code disclosed in confidence to the Regents under restrictive license agreements.

Note that USL still does not say which parts of NET/2 are involved. To my knowledge, they have never been willing to clarify this issue. Looking at the numbers, it is hard to believe that all (or even most) of NET/2 is derived from 32V.

NET/2, at 1.5 million lines of source code, is about 10 times the size of 32V. How virulent is this 32V code, anyway? Can it expand to take over a release 10 times its size? Further, NET/2 is only *part* of the full BSD release. One might reasonably assume that the pieces CSRG omitted were tainted, in their eyes, by 32V code. If we add in the rest of BSD, the ratios become even more ridiculous.

I am not asserting that NET/2 is totally free of 32V code. I have no way of knowing, not having examined either release. I am saying that USL looks pretty silly claiming (even by silence) that the entire NET/2 release is somehow tainted, and thus subject to restrictions on its distribution.

USL could clear the air greatly by saying which files are at issue (or at least which ones are not). The freeware community could then distribute and use the remaining code without fear of litigation. If USL is only interested in protecting code derived from 32V, I can see no reason why they would not do this. Otherwise, I must assume that they *intend* to cast a cloud over a large body of otherwise redistributable code. Of course, I am not the only one with dark suspicions. USL's amended complaint says:

The development and distribution of Networking Release 2 software and its commercial BSD/386 Source derivative is the

direct result of an illicit scheme on the part of the founding shareholders of BSDI to achieve financial gain by exploiting their access to CSRG's resources—including CSRG's limited right to use proprietary UNIX operating system software for educational and administrative purposes—to develop computer operating system software for commercial sale and distribution by BSDI, in violation of USL's proprietary rights in the UNIX(R) operating system.

That's a pretty long sentence, but the meaning is clear. USL claims that CSRG released NET/2 so that CSRG staff members (acting as BSDI shareholders) could use it to make money. Further, that they did this in violation of UC's agreements and USL's rights.

The Plot Sickens

This all seems pretty convoluted to me. The CSRG staff, any of whom could have gone to work for just about any UNIX vendor in the world, formed a commercial conspiracy. They then spent years doing a fake sanitization of the BSD code, releasing pieces and parts along the way.

Not content to conspire in secret, they gave dozens of talks about their efforts, deluding the world's top UNIX experts as to their motivations, techniques and goals. Eventually, they got enough of USL's code into public releases. Then they struck, forming BSDI to capitalize on their nefarious actions.

Unfortunately, however, this theory does match some of the public history. It *is* true, for instance, that some of the CSRG staff is on the BSDI staff and board. Worse, some of these relationships were kept very quiet until USL got into the act. These kinds of issues will have to be resolved, even if some folks get hurt in the process.

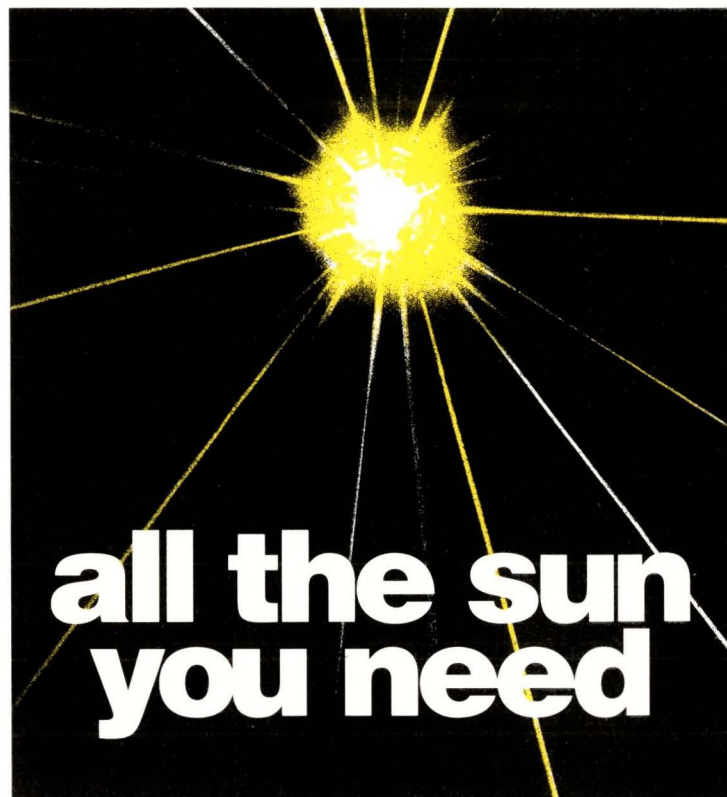
The Real Question

The motivations of the CSRG staff, like the trademark status of the U-word, are not the important issues, however. The real question is: How much of NET/2 does USL intend to claim, and how long will they tie up the remainder in litigation?

More to the point, how do we free up the innocent code for modification, study and use? Several UNIX clones (both freeware and commercial) could use the code. Freeware distributors like me would like to include it on distributions without fear of legal reprisals.

A range of folks, from undergraduate computer science students to independent hackers, would like to play with it. Finally, lots of working programmers would like to have the code around, just in case... C'mon, USL, inquiring minds need to know. ➔

Richard Morin produces Prime Time Freeware, a semi-annual CD-ROM collection of redistributable, UNIX-related source code. Between releases, he consults, writes and teaches on UNIX topics. He may be reached at Cantá Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at rdm@cfcl.com.



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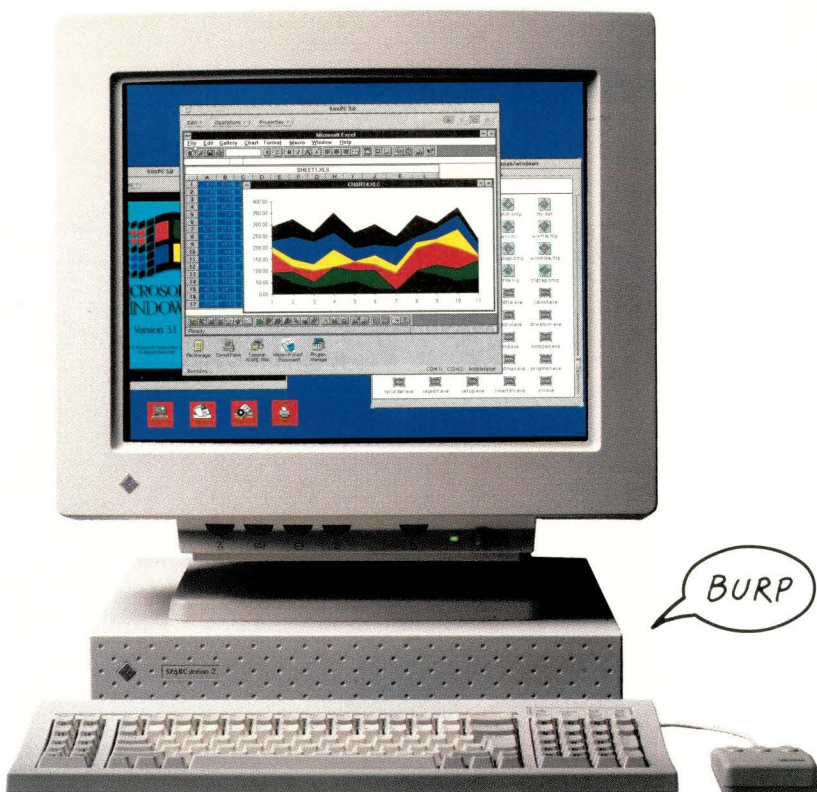
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Help!

by S. LEE HENRY

Anytime I begin to feel that I've mastered everything there is to know about Sun systems administration, I run across some new mystery—some error message I've never seen, some problem that totally evades my grasp or a question I can't begin to answer. My first reaction is always to assume that logic and reason no longer have dominion over the universe and that I should go home, hide under my bed and await the end of the world. My second reaction is to ask myself how I can begin to get my arms around this new challenge. What sources of information do I have that might shed some light? What, if anything, do I know about the issue and what can I do to learn more?

The key questions that I ask myself anytime some new problem crops up are

“What has changed?”

“Where is this message or problem coming from?”

“Have I seen anything like this before?” and

“Is it isolated to an individual user or workstation?”

These simple questions help me get into a binary mode of thinking so I can decide what to discount and what to consider of the evidence at hand.

Once I've isolated several aspects of the problem, I can gather information on the commands and tools that will help me understand and deal with the issue.

Man Pages

One of the first places to look for information is the man pages supplied with your system. Trusty man pages, supplied with every UNIX system, contain a lot of (usually current) information. Sometimes when I have nothing better to do, I scan man pages on commands I think I know inside out and discover that there are useful options I'd never used.

The subdirectories in the `/usr/man` directory correspond to the sections of the UNIX reference manual. User commands, for example, are in Section 1, `/usr/man/man1`, and maintenance commands are in Section 8 or `/usr/man/man8`. To use the `man` command, you simply type `man <command>` and don't worry about sections (which differ somewhat between the BSD and System V manuals).

The `whatis` command can be helpful in determining what command you are looking for without taking the time to bring up the entire man page. Set up with the `catman` command, `whatis` gives you one-liners on commands. The `catman` command with a `-w` option creates only the `whatis` directory. Without the option, `catman` sets up some addi-

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tional directories described below.

When you issue `man <command>`, the man page will be formatted and presented to you. Stored in `troff` format, these files can be formatted for different displays and printers on the fly. Both `nroff/troff` and the man pages themselves must be loaded on your system for this to work. On a heavily loaded system, the time to format can be considerable. To avoid the delay and CPU usage, you can preformat all of the man pages and remove the `troff` source files. This is the other use for the `catman` command; with a `-n` option, `catman` will only create the subdirectories that hold the simple ASCII preformatted files—`cat1` through `catn` (corresponding to `man1` through `mann`).



One of the most versatile and useful tools to use when you need information is AnswerBook.

The `man` command with the `-k` option is also a very useful tool. This command uses the `whatis` database and retrieves one-liners that contain whatever keyword you specify. If you want a list of all the commands that deal with man pages, you can try `man -k man`.

If you have installed application software that includes its own man pages, you can add them to your system by moving the files to the appropriate subdirectory (usually the installation directories will identify the section in which they belong) or, better, add the directory containing the application man pages to your users' `MANPATH` variable.

Man page output can also be redirected to printers or to a `grep` command if you are looking for something specific. The command `man tar | grep cv` will show you the example of using a `tar-to-tar` copy, included somewhere in the text of the man page.

Xman

The `xman` command puts a nice front end on the man pages and allows you to browse lists of available commands in each of the manual sections. You simply point and click to select the one you want to read about. Part of the MIT X distribution, this utility is passed on to you in OpenWindows. The format is about the same as using the `man` command. `xman`, however, also gives you scroll bars and a nicer font.

AnswerBook

One of the most versatile and useful tools to use when you need information is AnswerBook. With all the sysadmin, end-user, programmer and hardware manuals on one CD, AnswerBook is a must-have for every serious Sun site. AnswerBook provides access to the document collection through a top-down "Table of Contents" organization and a

document viewer tool or through a search tool that lets you enter phrases to find what you're looking for. The search returns a list of in-context finds weighted so that the best fits are at the top of the list. AnswerBook also contains hyperlinks that let you move from one document to another much more quickly than you could ever yank the hard copy off the shelf.

The only disadvantage of AnswerBook is that it must be purchased and costs a lot. A single license runs about \$500 and a site license over \$17,000. However, the time you save solving problems can make AnswerBook pay for itself.

SunSolve

A recent entry into the bag of useful tools, SunSolve provides answers to a host of common problems including answers to the classical question "Is this a known bug?" Common problems and their resolutions, bug and patch descriptions, and technical support articles are all available on this new service.

Like AnswerBook, SunSolve provides both a document viewer and a search utility. As a matter of fact, you can integrate the SunSolve document collection with AnswerBook so that you have a single entry point to both collections.

Like AnswerBook, SunSolve lets you decide how much information to install on your hard disk and how much to use off the CD. At a minimum, you will need to load 10 MB of indexing information. You might choose to install all 125 MB onto your hard disk.

SunSolve is available to Sun service customers and is periodically updated.

1-800-USA4SUN

You should not overlook Sun's support hotline when you run into a problem. Staffed by both Sun generalists and product-specific experts, this source of help will often provide useful answers and leads.

The cost of this service depends on the number of Suns that you maintain under a Sun service agreement and the type of service that you buy. Personalized service is available (a service representative is assigned to your account), but I have found that, except for very new customers, this level of service is not useful. The personal representatives tend to have general rather than product-specific expertise, which more senior system administrators require when chasing down a problem.

OSS

Another service for Sun support customers, the Online Support System (OSS) provides dial-up access to bug reports and patches. Available as part of the Sun software service, OSS allows you to query the bug database and order patches on line.

Sunergy

Free to Sun customers (or maybe only the first 5 million!), Sunergy is a mixed bag of services. From live satellite broadcasts to technical publications and white papers, Sunergy promises to deliver current information on interesting

topics. A quarterly newsletter will be emailed to subscribers. I don't yet have any information on the depth or value of this information, but will be calling (800) 84-SUNERGY (outside United States/Canada: (415) 336-5847) or emailing a request to sunergy_information@Sun.COM to get hooked up.

Mailing Lists

Another way to get information on Sun and UNIX issues, is to subscribe to special-interest electronic mailing lists. Of the more than 700 lists available, a number are of interest to Sun users. If you have an Internet connection, you can subscribe to and receive (or in some cases be deluged by) email.

To find out what interest lists are available, you should ftp the file `netinfo/interest-groups` from `ftp.nisc.sri.com`. Keep in mind that some of these lists are "moderated" and some are not. Moderated lists are first read by the moderator and often the contents are gisted at the top; these are similar to newsletters and are usually mailed out to recipients each week or each month. Unmoderated lists, on the other hand, result in a flurry of messages from any of the list participants. You will even receive requests from other participants when they wish to be dropped from the distribution.

UNIX-Wizards is one of the moderated lists from which I've garnered quite a lot of useful information. Another, the SunFlash newsletter, contains product information and announcements of interest to the Sun community.

Newsgroups

Available through Usenet, netnews is supported on UNIX as well as non-UNIX systems. There are well over a thousand newsgroups available; some are Sun-specific (like `alt.sys.sun`). Netnews works something like a hierarchical bulletin board. You must have software to read the news available on your system. If you do, the file `/usr/local/lib/news/newsgroups` or `/usr/local/news/lib/news-groups` should list the groups available to you.

FTP

Many valuable tools—from small utilities to large, commercial-quality software—are available for free downloading via anonymous ftp. The login convention for hosts supporting anonymous ftp is to login as anonymous with your address (e.g., `vail@mcgill.edu`) as the password. You can then issue a limited set of commands (e.g., `pwd`, `ls`, `cd`) and retrieve files of interest with ftp's `recv` or `get` command. In general, the file name will indicate the format of the file.

Most files will be in compressed tar or shar format. Once downloaded, these files will need to be uncompressed and broken into separate files with a `tar xvf <filename>` or `/bin/sh <filename>` command.

Conferences

If you can afford to travel (or happen to live in or near one of the cities where conferences are generally held—like Washington or San Jose, CA), don't neglect conferences.

Tricks and techniques for managing Sun networks, accommodating heterogeneity and using SunOS more effectively are among the mainstays of conferences like the Sun User Group conferences held each December in San Jose. Usenix's LISA conferences, geared to administrators of large UNIX networks, are also a source of valuable insight and clever techniques for making your job easier and more fun.

Attending conferences also gives you an opportunity to meet with people who face the same challenges you do. I have never met a UNIX system administrator who couldn't teach me something, and some of my favorite tricks I learned by casually looking over somebody's shoulder. Sun/UNIX conferences are a great opportunity to learn a lot of new tricks and gain new and valuable perspective on your role as a system administrator.

Many conferences offer tutorials, usually the day before the first day of the conference proper. These tutorials pack a lot of information on key issues into a single focused day and are usually well worth the price of admission.

Local Users Groups

If you live near a large city or university, there may be a local users group that meets nearby. These groups usually meet every month or two and provide information on new tools, insights into problems and help on a variety of topics. These local groups are extremely useful because you get to know other administrators well enough to call them and ask, "Have you ever seen this before?" when you're at your wit's end. Local groups also provide a focal point for Sun and other vendors to tell you about new tools and provide you with answers to questions and concerns you may have.

Hey, Don't Forget Me!

Another source of helpful information on SunOS wizardry and new products, magazines like *SunExpert* and the newspaper-like tabloids tell you what's going on in the Sun/UNIX community and provide valuable insights to help you make good decisions. ➔

S. Lee Henry is on the board of directors of the Sun User Group and is a systems administrator for a large network of Suns in the federal government. She also runs The Next Page Inc., a consulting firm specializing in software documentation.

It's In the Mail

Excited, confused, inspired or irritated by something you read in *SUNEXPERT Magazine*? We would be happy to hear from you. Our email is always available to answer questions directed at our columnists: Michael O'Brien, Peter Collinson, Richard Morin, Peter Salus and S. Lee Henry. For the sake of brevity and type fit, we may edit letters, but we will try to respect the ideas. So, let us hear from you at dpryor@expert.com.

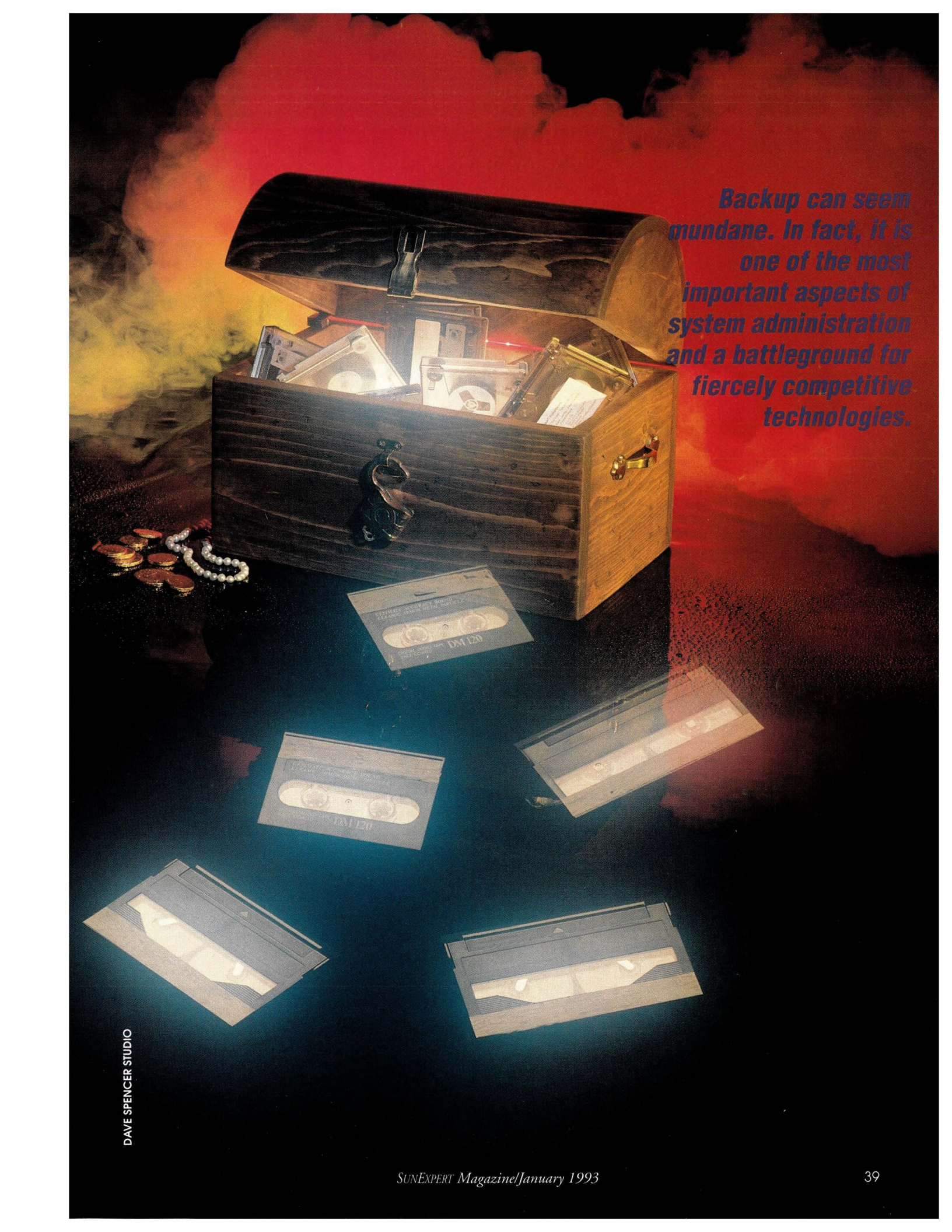
THE BACKUP MARKET

by MICHAEL JAY TUCKER, Executive Editor

Backup, the business and technology of safeguarding one's data and applications against accidental loss, remains one of the most vital and least appreciated of all the computer arts. Hardly dramatic, little understood by the end user and easily overlooked, backup is valued only when primary storage fails and panic-stricken eyes turn tearfully to the systems administrator.

This issue of *SunExpert* contains a special section on backup. In it, multiple articles discuss some of the technical and managerial issues involved. First, Cindy Misicko, a technical marketing engineer at Epoch Systems Inc., writes about what she believes to be an imminent crisis in data management as networks grow beyond the ability of conventional techniques to effectively manage them. Then, in part two, Richard A. Peters of Tandberg Data Inc. launches a vigorous defense of quarter-inch tape, a technology that has been widely dismissed as obsolete even though it remains one of the most popular backup methods around. Finally, Grant Wilcox of Exabyte Corp. makes an equally vigorous defense of 8mm tape, which also has fiercely devoted partisans and equally ferocious detractors.

But what does the backup market look like at the moment? In general, say the industry pundits, backup is dominated by three tape formats—quarter-inch cartridge (QIC), 8mm tape and 4mm, or digital audio tape (DAT). Behind these three, but coming up fast, are the various optical technologies.



*Backup can seem
mundane. In fact, it is
one of the most
important aspects of
system administration
and a battleground for
fiercely competitive
technologies.*

DAVE SPENCER STUDIO

Tape remains the most popular medium for backup, but there's tape and then there's tape. QIC, DAT and 8mm are very much fighting it out tooth and nail. "There is ongoing battle between those three [tape technologies]," says Fara Yale, senior industry analyst at market research firm Dataquest Inc. "Though no one is really winning yet, they are still struggling for mind share and market share."

Of these, QIC is the oldest and perhaps best known of the contenders. While its demise was widely predicted after the introduction of inexpensive 8mm and DAT alternatives, it has actually held its own. Users continue to buy QIC for a variety of reasons—not the least of them being its familiarity and its perceived fault tolerance. Raymond C. Freeman, president of market research firm Freeman Associates Inc., Santa Barbara, CA, estimates that in 1992 there was an installed base of 8,217,000 QIC drives in the world, whereas there were only 458,000 8mm systems and 423,000 DAT drives.

However, 8mm is still the critics' choice. "I think 8mm is a natural companion for workstations," says Freeman. "When you compare 8mm to DAT, 8mm wins in capacity, performance and price." He believes that

DAT is still only struggling to gain a toehold in the market. "Four millimeter is scrapping like hell to establish a position," he notes. "It hasn't got it yet."

Freeman is not wholly pessimistic on DAT, however, and says that DAT could get market share someday. In fact, Stan Corker, director of removable storage research at International Data Corp., is bullish on the technology. "In the last year or so, there's been quite a lot of growth in 4mm," he says. "Almost all the major manufacturers have introduced 4mm drives...about the only one who hasn't is Sun."

Optical disk, meanwhile, remains the unknown variable in the backup equation. After initial predictions that it would displace tape almost in toto, optical in fact lingered in niche markets. Tape simply continued to underprice it, and the economics of backup are simple and unforgiving—what is least expensive is most attractive.

However, now, says IDC's Corker, "Optical is beginning to turn the corner...over the last year or so, there's been a lot more interest in optical." Freeman agrees but argues that optical's place in backup may not be as an archival medium. "Backup is still primarily the province of tape," he says. "Optical is making inroads, but more in the near-line storage area."

One place where optical doesn't seem to be winning a lot of support is optical tape, which had been seen as an important new medium as little as a year ago. "It is basically not a mainstream technology," says Freeman. He notes that almost the only area where the technology has found a niche is in the storage of very large data sets, such as satellite telemetry data. Some other industry observers, however, suggest that could change if and when digital video and television become widespread.

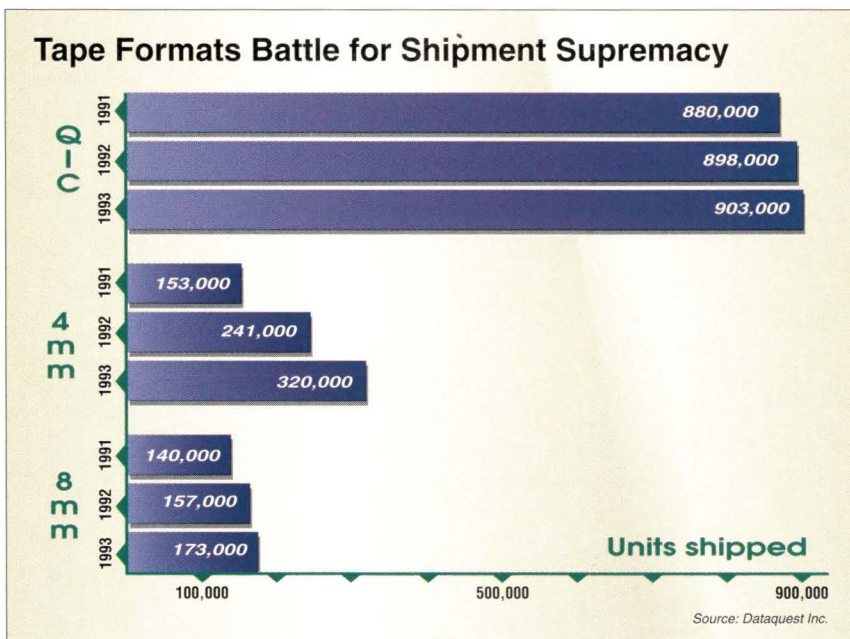
IDC's Corker thinks that large library units may be where optical is really meant to be. "Where optical can excel is in the jukebox." Indeed, in terms of backup technology, the real story for backup in 1993 may not be the medium but rather the method, as jukebox solutions (using disk or tape) become more common. Freeman notes that optical jukes already have as companions 8mm jukeboxes and that "DAT will soon be out with autoloaders and smaller tape libraries...and QIC will do the same."

The frontier for these systems is in their software, as developers struggle to make backup increasingly automatic. Says Corker, "What we're going to see over the next few years is the development of software to make these machines completely unattended... we're going to see the jukebox become a black box."

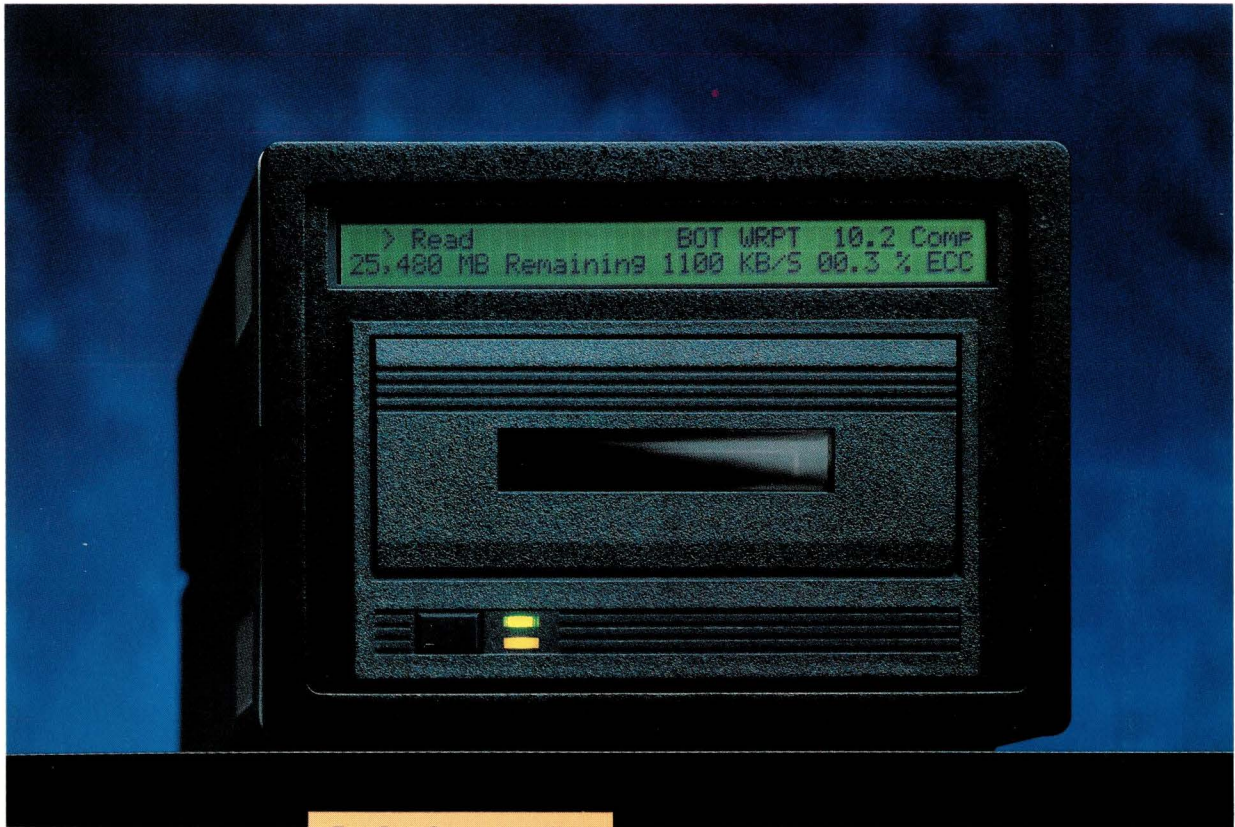
But regardless of its color, the box will probably contain more than one kind of media. None of the contenders—8mm, QIC, DAT, optical—will score a definitive win. In fact, Dataquest's Yale notes that the most important trend in the backup industry is that of companies purchasing one another, so that they might have access to technologies other than the one they currently market. "It is becoming more and more a market of companies broadening their product lines," she explains.

Why would an 8mm tape vendor want a DAT product line? Or a DAT company a QIC offering? "It shows," she answers, "that a single technology does not satisfy everyone's needs."

Tape remains the most popular medium for backup.



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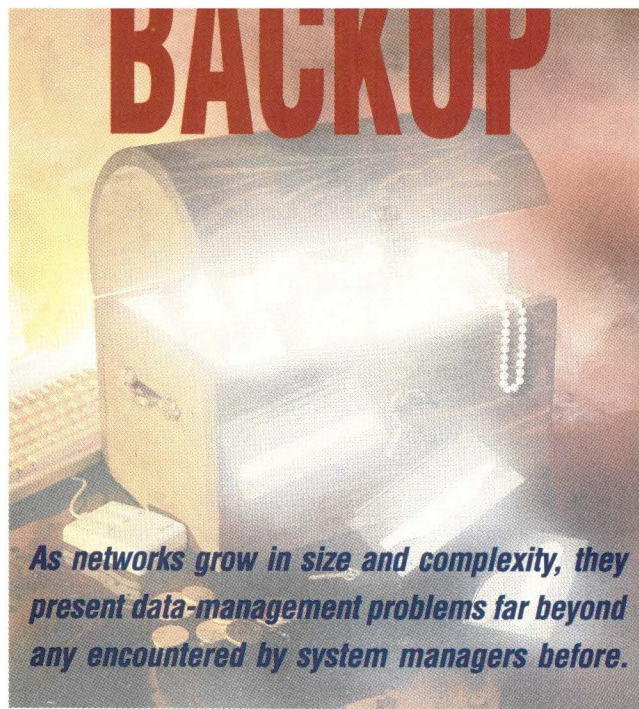
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CRISIS IN Network Data Management

by CINDY MISICKO, Epoch Systems Inc.

In open-systems environments today, networks are bigger, workstations are faster and applications more data-intensive. The result? Data is being generated at an explosive rate.

There is so much data, in fact, spread throughout the network that it cannot be managed with traditional data-administration tools. More and more money is being spent on network storage, but performance, reliability and data integrity are declining, and user and administrator productivity suffers.

Incomplete Promises of Open Systems Computing

Despite the promise of open systems computing, it is still an incomplete solution. Workstation networks have made possible a wide range of applications such as image storage and retrieval, complex simulations and seismic data interpretation, which process and generate extremely large amounts of data. And standards enable hundreds of different vendors' products to interoperate in a very flexible network. The network as a whole has become more powerful than the sum of its computing components.

But these great gains in computing capability are undermined by a lack of centralized system-administration tools. Compared with the carefully honed procedures of mainframe operations designed to preserve and protect important data, open systems networks are limited by rudimentary tools. These tools, designed for manual disk-by-disk administration, scale poorly to current needs. In fact, it now costs more to administer a megabyte of network data than to purchase the same amount of disk space. Consequently, MIS administrators are reluctant to let mission-critical applications

be placed in open systems computing environments. The only solution to this problem is to establish a set of standards for the centralized management of network data.

Uncontrolled Data Growth

Massive computing power on the desktop has enabled distributed applications that once only the largest mainframes could handle. These applications generate extremely large amounts of data at each desktop, causing an insatiable need for disk storage.

A recent study of the Sun User Group commissioned by Epoch Systems Inc. quantifies the scope of the growth problem. The average network grew by 6.9 GB in 1991 and will grow by 8.6 GB in 1992. The result—a fast-approaching crisis in network data management in which hundreds of additional filesystems across the network will require archiving, backup and recovery.

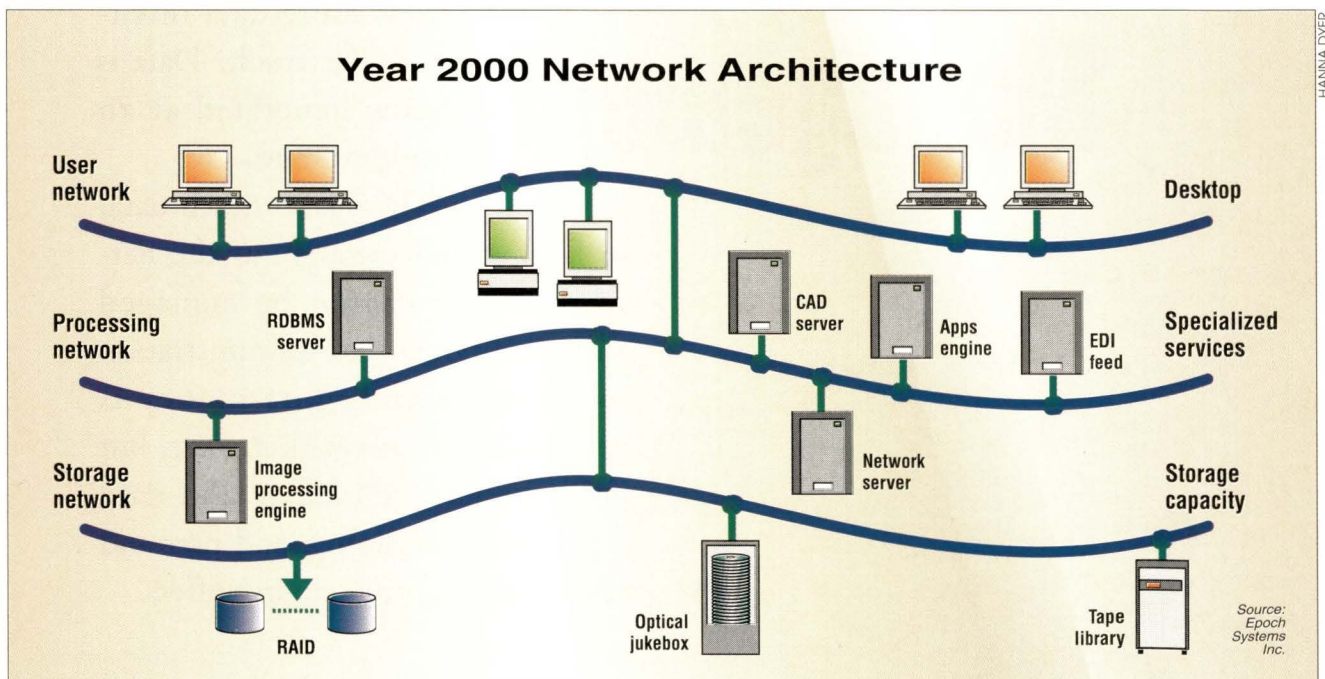
The warning signs of the storage crisis come when network administrators find themselves buying more disk drives, only to discover they need additional servers to centralize data and control distribution and access. They must then invest more time and

money in backup mechanisms to protect the data. Network performance erodes while the mass of data continues to grow, and still more disks are required.

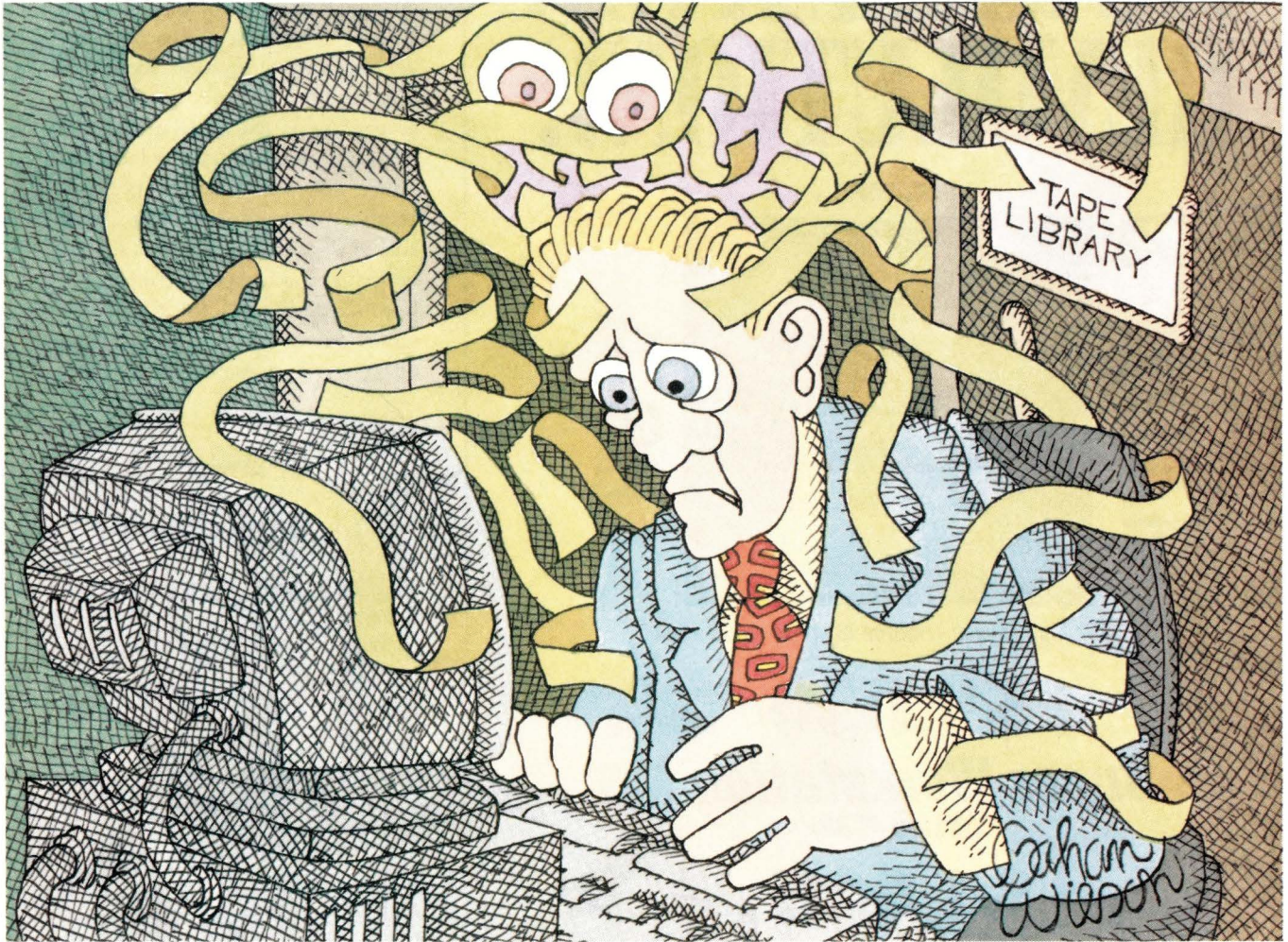
Existing backup and recovery mechanisms are very difficult to expand. Even when backup has been done, recovery from system crashes becomes so difficult that network administrators encourage users to recreate files whenever possible. Such a solution costs more per hour than any other method of recovery, forcing users to repeat their work and delaying completion of projects. In disaster situations, administrators are forced to attempt recoveries but don't have the mainframe-class tools they need to do the job. Recovery may take days or weeks to complete, but hard work does not guarantee the safe return of lost data.

New system-administration tools address portions of the problem, but they are standalone solutions, lacking integration with other tools needed for efficient network data management. When problems occur, the nonintegrated and unrelated tools compromise data integrity just because they were not designed to work together.

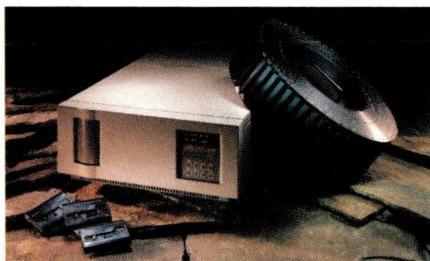
Networks currently operate on user and server levels, but they may soon operate on three levels. Servers and their storage will be physically and logically separated on the network, giving users and applications unprecedented flexibility in placing data on the media best suited for its actual use.



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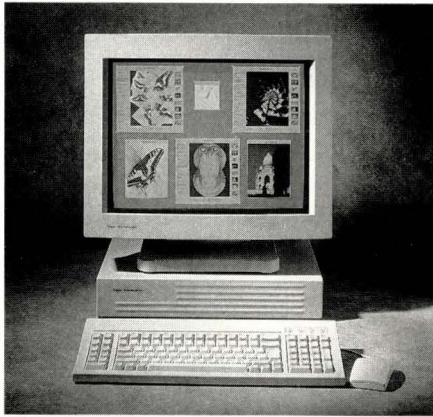
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BACKUP

Obstacles to Data Management

Locating data at a user's desktop and guaranteeing quick access to it requires a new management approach to network data administration. Ideally, data that must be quickly or frequently accessed by an individual user should be placed on the user's own local workstation disk, while shared data should be placed on a server where it is available to all users. Inactive data should be archived to inexpensive media to free local and shared disk space for more current work, but it must remain on-line, easily available for reference.

Network administrators need tools to handle this sheer volume of data.

This scenario for efficient data location is blocked by two factors:

- Users apply pressure to add more local workstation disks to the network. Why? Remote NFS access to files over Ethernet, for example, is too slow for the capabilities of the current crop of high-performance workstations.
- Disks distributed throughout a network are chronically short of free space. On average, more than 80% of the data on any magnetic disk on a typical network has not been touched in 30 days. More than half has not been accessed for several months. Only 20% of the disk contains active data, and virtually no new space exists for new information. Users live with the irony that new files are usually heavily fragmented—requiring more of the performance-robbing disk seek operations needed to access them—while older files, which are stored contiguously, can be read much more quickly.

Still, no user wants to delete older data or archive it off-line, submitting it to arbitrary decisions to remove important information in order to cre-

ate space for new data. Most would rather buy more disk storage, which exacerbates the administrative headaches by adding mount points and more administration overhead.

Eventually, uncontrolled network data growth takes its toll. Even systems and staff that can still function under the current staggering increases in capacity will be hard pressed to operate at all under the weight of a growth rate that is projected to be four times higher in 1995.

An Integrated Solution

Will this trend change anytime soon? Probably not for organizations that use traditional administration techniques. However, there is a solution—integrated network data management. This highly automated approach manages data distribution, performs archiving functions without user intervention, makes all data available on-line, and performs unattended and reliable backups, independent of the specifics of operating systems.

This long-term, strategic approach to network data management allows network administrators to regain control of the data generated in today's open systems networks. Network data management is a standards-based and integrated approach to four key areas: networkwide hierarchical storage management (HSM), networkwide backup, on-line archiving, disaster recovery and library management. The benefits of this strategy include the following:

- Maximizing network performance, administrator productivity and user productivity;
- Minimizing network storage costs;
- Providing automatic, centralized management of network's data;
- Scaling from small work groups to large enterprisewide networks.

Future of Network Data Management

While many advances in network computing have been championed in the UNIX environment, network computing is now a pervasive solution that is common in enterprisewide networks. Network administrators need tools to handle this sheer volume of data, and these tools must be applica-

ble across a variety of environments.

The future of data management in network environments includes the logical mapping of data management over the physical network architecture:

- User level: users enter or access information and manipulate it from their desktop.
- Processing level: servers become increasingly specialized and operate in a dataless state. Servers may shed their attached disks, leaving data servers in control of filesystems on the storage level.
- Storage level: data-storage systems once attached to servers exist on a separate level, yet remain under network control. Automated network data management software on a data server can move data to and from a wide range of storage systems depending on frequency of use, access performance requirements or other parameters under the control of administrators.

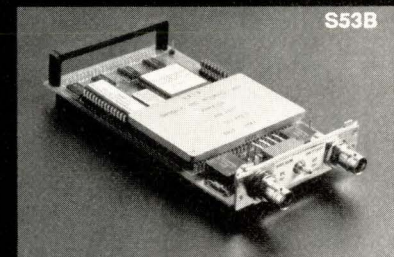
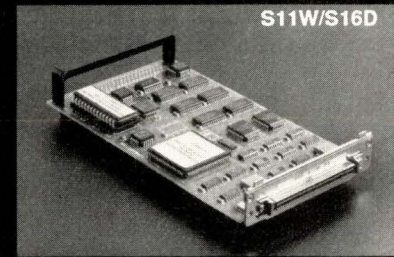
Epoch Systems currently offers network data-management solutions. In conjunction with Storage Technology Corp., Epoch has begun developing a network data management architecture based on the three-level network model shown above. It spans desktop, midrange, mainframe and supercomputing environments, and allows administrators to exercise the same comprehensive control of data once associated with mainframe-level tools.

In an effort to offer the most flexible, open systems solution for enterprisewide network needs, these vendors will also incorporate existing relevant standards as the basis for their technology and will migrate to new standards as they become accepted in the commercial marketplace.

Administrators need tools of this class to handle the sheer volume of distributed data generated in an enterprise network. Ultimately these tools must be applicable at every level of networking to ensure that data throughout the enterprise is secure and safe.

Cindy Misicko is a technical marketing engineer at Epoch Systems Inc. She has been in the industry in development and marketing positions for 12 years.

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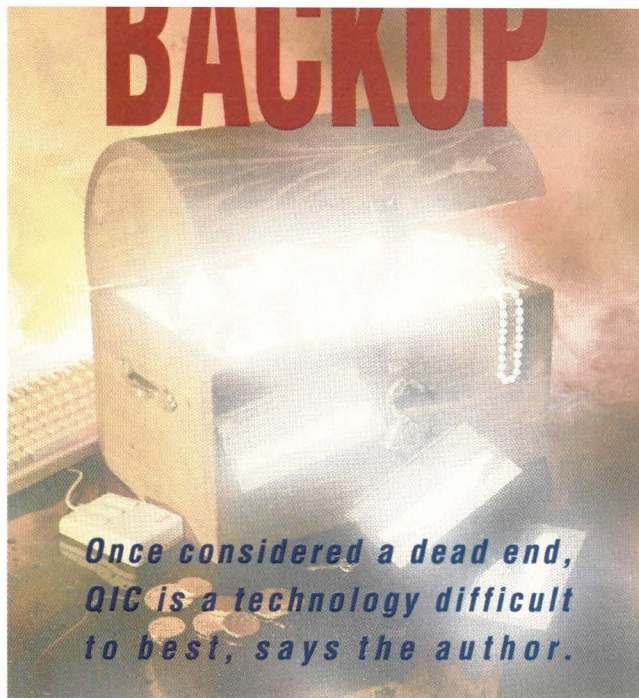
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by **RICHARD A. PETERS**, Tandberg Data Inc.

Thought by some to be a dead-end technology, quarter-inch cartridge (QIC) tape has emerged as the leading technology in the 1- to 2-GB capacity range, leapfrogging digital audio tape (DAT) drives in storage capacity, performance and data reliability. This article presents the outlook for QIC technology and shows the outlook for capacity and speed improvements over the next few years.

Quarter-Inch TAPE DRIVES

QIC tape drives and tape backup systems are available now in gigabyte capacities, with performance suited to the needs of LAN backup. Moreover, QIC technology is the preferred method for backup and accounts for more than 70% of tape drive unit shipments. QIC is compared with competing helical-scan tape technologies in general and DAT in particular. More than 8 million QIC drives are now installed and more than 1.5 million drives were shipped in 1991, compared with about 150,000 DAT units (see Table 1).

QIC and Price/Performance

The truth is, all tape technologies and tape media are not the same. Performance, compatibility and reliability are issues to consider. And, very importantly, some tape media require special handling and storing in order to ensure data protection. Without this special handling and storing, you run a huge risk of losing all or part of your data.

Like DAT, QIC tape drives have capacities of more than 2 GB without the need for data compression. Data compression nominally doubles capacity and data rates and is applicable to both QIC and DAT in the same way.

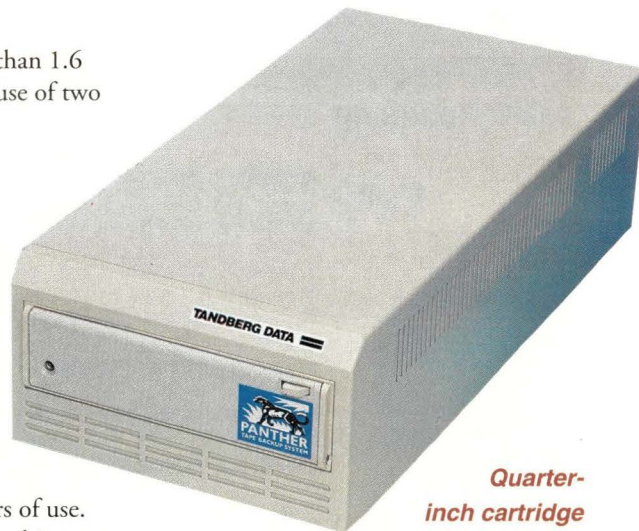
As shown in Table 2, QIC is faster than DAT and has comparable file access times. The inherent data rate advantage of QIC makes it the clear winner for LAN backup in the giga-

to 144. Data rates of more than 1.6 MB/s are possible through use of two parallel data channels.

Advantages of QIC

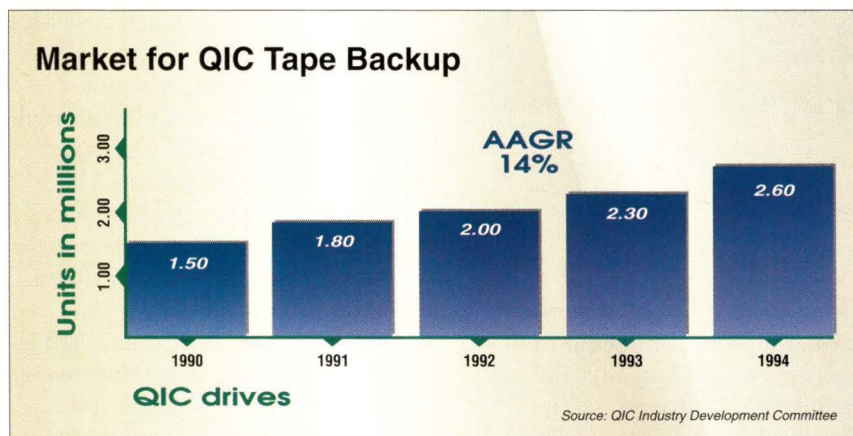
QIC technology has a number of other important advantages for LAN backup applications. Among these are:

- Data reliability: Advanced technology features give data reliability equivalent to less than one error in more than 110 years of use.
- Compatibility: QIC tape drives can read tapes from previous-generation products and can write formats to at least the most recent generation.
- Interchangeability: QIC tape backup solutions meet industry standards in media, physical size, electrical inter-



Quarter-inch cartridge (QIC) systems, like this one from Tandberg Data Inc., remain a favorite for backup. The author argues that QIC offers significant advantages over more complex helical scan approaches.

Table 1



byte range. And QIC costs less than competing helical-scan technologies on a per-box basis. At 2-GB capacities, QIC is nominally 25% less expensive than DAT.

Because of the need for a rotating head in the tape drive, helical scan is more complex than the linear-scan technology of QIC and offers no inherent technical advantage; indeed helical scan was invented to allow for "freeze frames" in the video world.

Because of greater tape area and lower data densities, QIC technology has more room left for capacity and performance increases in next-generation products (see Table 3). The move from 2 to 10 GB comes through the addition of a servo with an accompanying increase in data tracks from 30

face, functional interface and data-recording formats.

• Software: Tape backup software for QIC is comparable to DAT solutions. A number of industry-standard packages are available.

• Superior tape media: QIC products come in only one grade, developed specifically to withstand the rigors of rapid starts and stops of computer storage. The QIC tape is of much higher quality than the metal particle (MP) tape used in helical-scan tape drives.

Table 2

Backup Tape Technologies	QIC	4mm DAT	8mm Video
Capacity (MB)	2,000	2,000	5,000
Data rate (KB/s)	300-800	183	500
1-GB backup time (minutes)	56-21	93	35
Access time (seconds)	25	30	20
Form factor	5 1/4-inch HH	3 1/2-inch	5 1/4-inch FH
Recording technology	linear	helical	helical
Tape area (square inches)	2,850	533	1,365
Megabytes per square inch	.75	3.75	3.66

Source: Tandberg Data Inc.

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QIC Roadmap

Item	1 GB	1.35 GB	2 GB	10 GB	35 GB
Capacity (MB)	1,000/1,250	1,350/1,690	2,150	10,000	35,000
Data rate (KB/s)	200/300	600	800	1,600	3,300
Data tracks	30	30	30	144	216
Compatibility	yes	yes	yes	yes	yes
File access time (seconds)	25	25	25	30	30

Medium*	GFO	GFO	GFO	GFO	BF
Reed Solomon ECC level	2	6	6	6	6
Servo	no	no	no	yes	yes
Heads	ferrite	ferrite	both	thin film	thin film
Flux changes/inch	45K	38K	51K	51K	75K
Bits/inch	36K	51K	68K	68K	150K
Tape length (feet)	760/950	760/950	950	950	950
Available	now	now	now	1993	1996

* GFO = gamma ferric oxide BF = barium ferrite

Source: Tandberg Data Inc.

Table 3

QIC has these advantages at least partly because of its history. The most popular computer tape technologies—including ½-inch reel tapes and QIC tapes—were invented specifically to meet the demands of data recording and storage. These tape technologies are largely immune to the hazards of heat, humidity and debris. In many cases, just the opposite is true of the media technology used in the helical-scan technologies of 4mm DAT and 8mm.

The tapes for these technologies are based on MP tape formulations designed originally for audio- and video-recording applications, not for long-term computer data storage. As a result, these tapes are now being used and stored in applications and environments for which they were never intended.

Users, then, should know the facts when considering MP tape technologies such as the DAT or 8mm video

formulations. The pure iron particles used in MP tape, when exposed to temperature and humidity extremes, are subject to oxidation, which changes the magnetic state. Thus, recorded data can be altered or destroyed under environmental fluctuations, either in storage or shipment. The ferric-oxide formulations used in QIC aren't subject to the same limita-

Table 4

Error Correction in QIC and DAT

	QIC	DAT
Recorded errors/million bits	1	10,000
Times ECC evoked/hour of operation	38	514,000

Source: Tandberg Data Inc.

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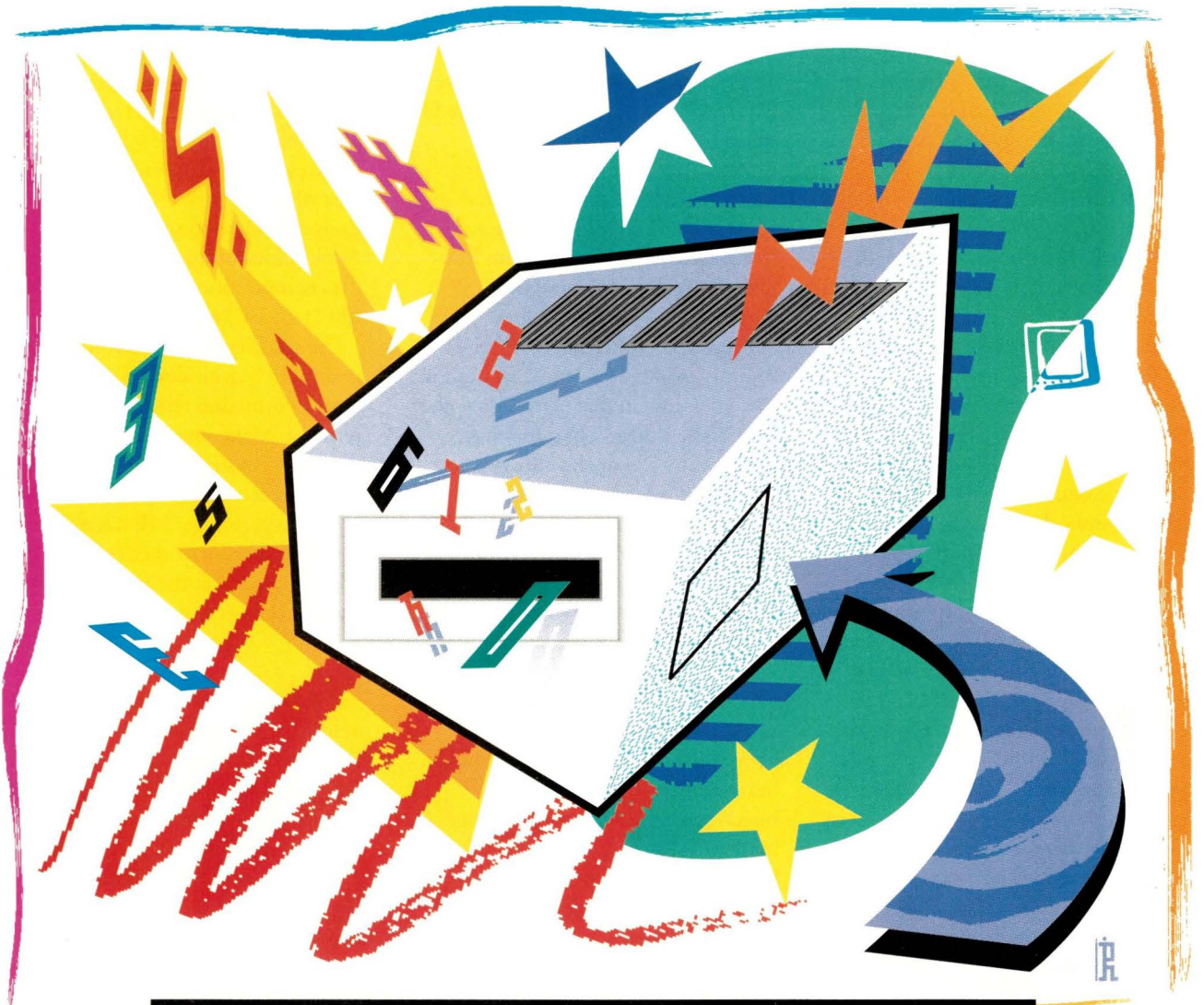
tions as MP tape. Ferric-oxide tapes are based on a very stable technology, since the magnetic pigment has already been oxidized.

The use of iron particles requires some sort of surface treatment to minimize the oxidation effects, increasing the cost of the media. Many consumer cassettes lack this treatment and can find their way into computer tape drives, sometimes with unpleasant effect. Some MP formulations, because of the coarse nature of the surface, have been known to produce excessive debris, clogging the recording heads on the rapidly rotating drum needed in helical-scan technology.

QIC and Simplicity

Helical-scan tape drives are much more complicated and intricate than tape drives using the QIC technology. Helical-scan drives have many more moving parts and motors, creating significantly higher heat buildup, which endangers the stability of MP tape, as well as increasing the chances of mechanical problems. Claims are made that smaller form-factor 4mm tape drives have less heat buildup. This is just not true because the electronics and moving mechanical parts are more tightly packed and heat dissipation is more difficult.

Moreover, while DAT claims "gentle tape handling," the actual situation is that with QIC drives there is less chance for tape accidents. For example, in a QIC tape drive, there is no danger of fragile tape being drawn into a rotating mechanism and winding around a drum spinning at 2,000 rpm, as is the case with DAT.



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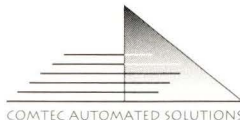
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With DAT tape drives, the tape must be drawn from inside the cassette and wrapped around the drum, resulting in a long and arduous tape path. But, with QIC tape drives, the tape is not pulled into the drive. The head/tape interface is simple and smooth, and the tape path is always protected in an enclosed package. QIC tapes are fully self-contained, and the media is never exposed to outside debris and contaminants.

Head wear in helical-scan tape drives is also a major concern. The relative head-to-tape velocities for most QIC and DAT drives are comparable at about 120 inches per second (ips), but the media used in QIC drives is smoother and the heads in QIC drives are much more rugged.

For example, the Tandberg Data Inc. TDC 4200, 2-GB capacity and 300-KB/s data rate (50% faster than DAT), has a head-to-tape relative velocity of only 80 ips, resulting in less head and media wear. The head is rated for a 10,000-hour life (much greater than DAT), and it can be replaced in the field.

The read/write heads of a DAT drive are mounted on a rapidly spinning drum and are raised above its surface. As the drum spins and the tape moves across it, the flying heads flick at the edge of the tape with the possibility of dislodging particles from it.

Powerful error correction codes (ECC) and other measures are necessary to protect against catastrophe in DAT. Some DAT suppliers even incorporate a built-in "bonker" to purge debris from the heads during tape drive operation.

As shown in the Table 4, DAT records raw errors 10,000 times more often than QIC and requires ECC intervention every 7 milliseconds. Powerful ECC is not a feature of DAT technology; it is a necessity increasing drive cost and using up to 40% of the tape area just for correcting errors created by using a basically inferior recording technology.

Corrosion in high-humidity and pollution-ridden environments is not a problem with QIC, as it is with DAT due to its use of MP tape. The

key area of concern is humidity in the storage environment.

Unfortunately, not all users are aware of the restrictions on the use of MP tape. A recent survey of users of 8mm helical-scan tape systems showed that more than one third store their tapes in uncontrolled environments. The danger of exposing metal-based tapes to these environments was demonstrated in a recent laboratory test of 8mm tapes.

In this lab evaluation of archival stability, some 8mm tapes showed up to a 15% loss in magnetic signal after only eight weeks. That does not mean that 15% of the data was lost: You could lose all of the data in such an instance. If you already use a DAT or 8mm tape system, you should take a number of steps to improve data security. While these steps do not guarantee the life of your data, they will certainly add to it.

As shown in Table 5, store MP tapes at temperatures below 104° F and below 60% relative humidity. Higher heat conditions have shown an increase in error rate due to changes in binders, solvents and distortion of the base film. Do not leave MP tapes in the tape drive when not in use. The high operational temperatures of the

drive could cause problems to the tape, even if it is not moving.

Of course, the best way to avoid potential problems with MP tape is to opt for the proven QIC tape technology. LANs requiring very high capacity, in excess of 2 GB, are really the only area where the risk of MP formulations should be considered. Applications of up to 2.2 GB (without data compression) are best served by QIC tape backup systems.

The stability of the recording media is absolutely critical to reliable long-term information retention and retrieval. Make sure your data is safe, secure and available. The U.S. government has certified ferric-oxide media for archival storage; MP has not been certified. Be sure to check out all of your options. Ask the right questions and take all necessary precautions.

Richard A. Peters is the vice president of marketing for Tandberg Data Inc., Westlake Village, CA. He has held positions with the Quarter Inch Cartridge Drive Standards Inc. organization, a group devoted to the development of QIC standards. He also spent 12 years in international management consulting.

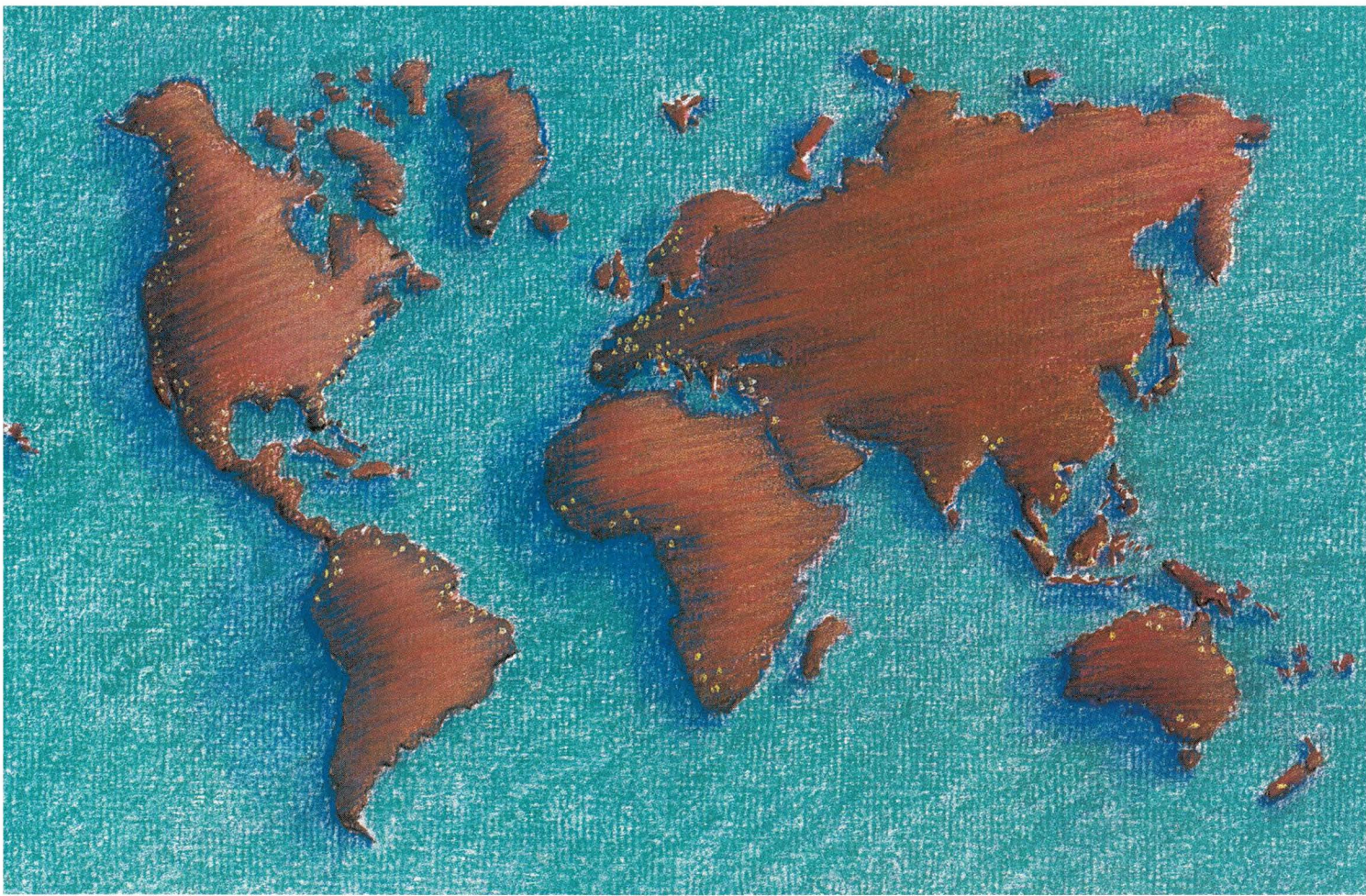
Table 5

QIC and DAT Media Specifications	Media type*		
	QIC GPFO	DAT MP	8mm metal
Operating temperature (°F)	41 to 122	41 to 104	41 to 104
Storage temperature (°F)	23 to 115	41 to 90	41 to 90
Operating humidity (%)	20 to 80	20 to 80	20 to 80
Storage humidity (%)	20 to 80	20 to 60	40 to 60

* GPFO = gamma particle ferric oxide
MP = metal particle

Source: Standard QIC Data Cartridge Specifications
4mm ANSI Doc # X3.206-100X (1/28/91)
8mm ANSI Doc # X3.202-199X (1/28/91)

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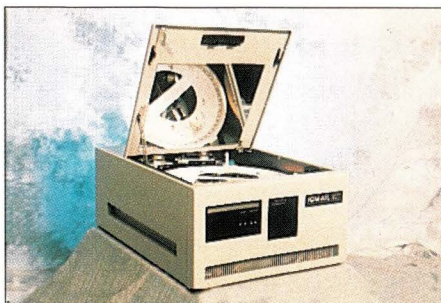


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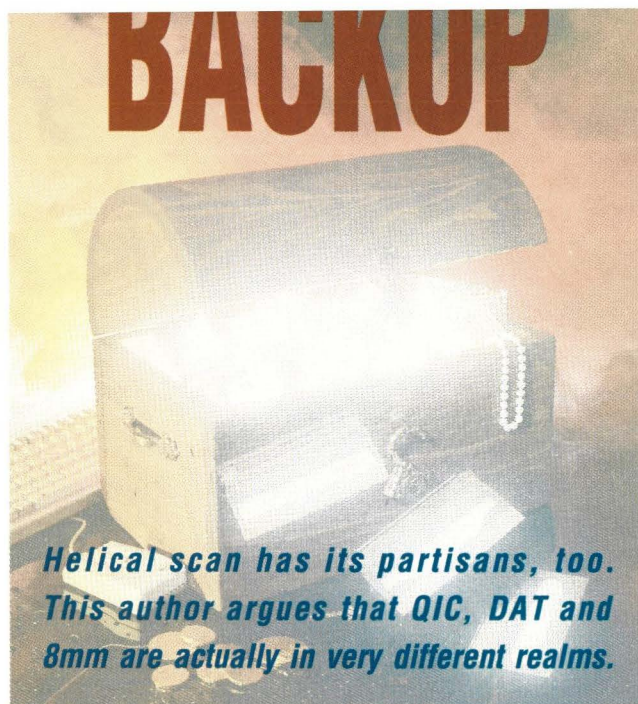
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by **GRANT WILCOX**, Exabyte Corp.

Very few technology advances have affected the data-recording industry as has 8mm helical scan. Within a few short years, multigigabyte 8mm technology advanced digital-tape-storage capacity by an order of magnitude and set entirely new standards of expectations for the future. Because of its unique capabilities, 8mm technology has been adopted by a significant majority of large system users, establishing it as a worldwide de facto standard.

At affordable prices, the highly sophisticated 8mm technology was introduced to an extremely wide audience of data-storage users, with all levels of expertise. Previous generations of high-capacity tape drives were found only in computer rooms with trained operators. Now, everyone from a novice computer user to computer room professionals regularly use multigigabyte tape devices.

8mm and QIC

HEAD TO HEAD?

THE SUN ENQUIRER

Volume XXII No.19

Special Edition

One Dollar

8MM TAPE DRIVE TELLS ALL!

Built-In Display Reveals The Most Intricate Details Of Backup.



After delivering the keynote address at a recent trade show, the TTI 8501 granted The Sun Enquirer an exclusive backstage interview.

Sun Enquirer: We hear your built-in display is the greatest thing since transistors replaced tubes!

8501: Well, I wouldn't go that far. But DP managers sure love it. It tells you if there's enough unused tape in a cartridge to complete your backup. It lets you know if the tape is in good condition. And it even reminds you when it's time to install a cleaning cartridge.

Sun Enquirer: That's terrific! But fill us in on some basics. What's your speed and capacity?

8501: I can hold five gigs on a standard 8mm cartridge and my sustained data transfer is up to 500 kilobytes per second.

Sun Enquirer: How about your average seek time?

8501: In high-speed search mode I can find any file on a tape

that contains 5,000 megabytes in about 60 seconds.

Sun Enquirer: That's fast! But I think our readers would really like to know if you're still doing work with some of the top CPUs in the business?

8501: You better believe it! I'm compatible with all kinds of SCSI-based systems. Not to drop names, but some of my best friends are VAXes, Sun SPARCstations and servers, IBM PCs and RS/6000s, HP/Apollos, and Macs.

Sun Enquirer: Boy, you really do get around! Is it hard to get along with so many different hosts?

8501: Not really. You see, the engineers at TTI designed me with 12 little switches on my back panel. By changing the settings I can speak almost any language.

Sun Enquirer: That must really come in handy in a multi-host environment. Do those switches do anything else?

8501: Of course! Besides setting the emulation, they change my SCSI address and let the user choose options like fast file search, short file mark enable and more!

Sun Enquirer: I suppose those switches also help you get along with 2.3 gigabyte 8mm drives?

8501: You got it. I can read tapes that were written by 2.3 gigabyte drives and write tapes in EXB-8200 mode, so they can be read by any 2.3 gigabyte drive.

Sun Enquirer: Mr. 8501, thank you for talking with us today. If folks want to learn more about you, what should they do?

8501: Either call (714) 693-1133 or drop me a line at TTI. I take all my calls and I always answer my mail. Well, gotta' go, but I hope I'll be talkin' to you soon!



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Circle No. 36 on Inquiry Card

It is difficult to do a head-to-head comparison between quarter-inch cartridge (QIC) products and 8mm helical-scan tape products. There are very obvious cost and performance differences that make each technology attractive to very different market segments. For example, QIC products originally replaced floppies in backing up standalone personal computers and workstations. This mar-

ket has expanded to include coverage of small business systems such as the System/36 and Application System/400 and small PC networks. The primary QIC application, data backup, has been joined by software distribution on the same platforms.

Helical-scan 8mm tape products, because of their multigigabyte-per-cartridge capacities and high perfor-

mance, address a much wider range of the large capacity needs of most computer systems, from low end to high end—providing unattended backup for PC local-area networks, workstations such as all of the Sun Microsystems Inc. SPARCstations, networks, midrange computers and even main-frame environments. Eight-millimeter digital tape products are built one upon another, each new product providing capacities and transfer rates that complement and are read-/write-compatible with preceding products.

Perhaps more competition exists between high-capacity QIC drives and the 4mm helical-scan digital audio tape (DAT) drives that were introduced in 1988. Although their transfer rates are slower than the high-capacity QIC drives, DAT drives use very low-cost compact cartridges—the smallest tape media available—and with helical-scan recording technology, achieve a very high areal recording density. They provide a multigigabyte capacity in a small, low-cost package. DAT media costs less than half of data cartridge media on a cost-per-megabyte basis.

Down to Basics

There are three magnetic tape recording techniques used today: parallel tracks with a linear motion (half-inch reel-to-reel and 3480), serial track(s) with a serpentine motion (quarter-inch drives) and helical-scan (8mm, VHS and 4mm digital audio tape). All of these drives are available in streaming mode—recording data continuously as opposed to stopping and starting at each data block. The big differences are in how the read/write heads are configured and how the tape transport operates.

The first two use stationary read/write heads that record a number of semi-infinite tracks, which, in the case of serpentine, go back and forth multiple times across the length of the tape. To achieve sufficient head-to-tape recording velocity, tape is moved at a high rate of speed across the head. Motion control maintains tape position with respect to the head. To increase capacity, more heads are added, tape speed increased or more tape is packed into the cartridge.

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Circle No. 27 on Inquiry Card

Quarter-Inch Cartridge Technology

Serpentine drives do a multipass of the tape, recording only one or two tracks per pass. Over the last decade, QIC drives established a very large market for backing up disk capacities under 150 MB—especially in the PC arena. Because of their per-drive cost-effectiveness, they have oftentimes been used to back up workstations even though multiple cartridges are necessary. However, QIC media costs are high because most of the tape path mechanics are mounted directly in the cartridge, resulting in QIC's highly touted low-drive cost but high cost per megabyte.

QIC drives do enjoy the advantage of many manufacturing resources, broad availability of product and buyer acceptance. More than 10 million units are installed. Their low unit cost and backward compatibility contribute to their popularity, most of which is for small systems.

The number of QIC drives shipped is extremely large. Yet, of all QIC drives shipped in 1991, 82% stored less than 300 MB per cartridge. According to Freeman Associates Inc., Santa Barbara, CA, these were about equally split between quarter-inch cartridge and data cassette groups. Of the rest, the 300 MB to 1.3 GB group is expected to grow from 124,700 units (12% in 1991) to a peak of 446,000 units by 1994. With less than 6% share, shipments of the 1.3-GB-plus QIC drives are predicted to grow from 300 units in 1991 to 807,000 by 1997. All of these numbers correlate well with today's trend toward larger disk capacities and smaller form factors on standalone PCs and workstations.

The QIC market is further marked by a strong transition of demand from 5¼-inch form factor drives to 3½-inch units. In 1991, 3½-inch models accounted for 52% of unit shipments, says Freeman Associates, but only 36% of the revenue. The large size of the DC600 cartridge will impede its competitiveness in 3½-inch form-factor applications.

To summarize, QIC's lower performance, lower capacities and higher per-megabyte costs tend to keep it from directly competing with 8mm. Its size, per-cartridge capacities and

low per-unit costs make it perfect for addressing its market.

8mm Technology

Helical-scan technology, used in both 4mm and 8mm drives, is architected such that the read/write heads are mounted on a rapidly spinning drum oriented at a slight angle, with tape moving slowly by it. Data is written in

long stripes traversing the tape. Motion control comes from servoing on each track—much like a magnetic disk. Because of this, the technology can read and write at extremely high areal densities. Since tape speed is 100 to 300 times slower than stationary-head devices, less strain is put on the tape during start/stop operations, permitting smaller, simpler transport mechanisms.

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Expansion Products	Add SBus Functionality SBox SBus expansion chassis, 4 slots Dual SBox 8 slots PC Media Compatibility FD525 5.25 or 3.5 inch stand-alone SCSI FD350 FLOPPY drive w/ PC compatibility	New Media	Image Capture/OCR FirstScan II 24-bit color scanning with ScanJet IIc, grayscale with IIp FirstScan HP ScanJet Plus support OCR for SPARC Systems Quick, accurate text entry from text image files, point-and-click using OPEN LOOK

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Circle No. 4 on Inquiry Card

When Exabyte Corp. first shipped digital 8mm helical-scan tape subsystems in 1987, the company increased per-cartridge tape capacity five times on the just-announced 525-MB quarter-inch cartridge. The media required $\frac{1}{3}$ less physical storage space, and, more important, cost $\frac{1}{4}$ as much per megabyte. The 2.5-GB drives were the first small form-factor, multigigabyte tape drives on the market and, for the first time, the industry had a single-cartridge capacity large enough to perform unattended system backups.

Two years ago, a 5-GB 8mm drive started shipping. Compared with the largest capacity QIC drive (1.35 GB), this drive offers 270% more capacity, accesses data 108% faster and is 91% less expensive on a cost-per-megabyte basis. It boasts a continuous transfer rate of 30 MB per minute (nearly on par with that of the 1.35-GB QIC drive) and a search rate of 37.5 MB/s (more than twice as fast) resulting in an average seek time of only 85 seconds over 5 GB of data. The 8mm drive advantages include its field-proven reliability, "perfect data only" error-correction scheme, extendible technology, downward compatibility, a stable manufacturer, data grade media and worldwide standardization

Eight-millimeter tape products, like these from Exabyte Corp., are uniquely well suited for workstations and networks.



through the European Computer Manufacturers Association (ECMA) and the International Standards Organization (ISO). Recently, an arithmetic data compression capability was added, boosting both capacity and performance on average by a factor of two. The 8mm drives have also been packaged in a $\frac{5}{8}$ -inch half-height form factor, boasting an 80,000-hour mean time between failure (MTBF).

In September, Exabyte announced a 10,000-fold increase in the data reliability specification on all 5-GB and half-height 8mm drives, increasing the bit error rate from 10^{13} to 10^{17} . It equates to the probability of encountering one hard error when reading 2.6 million 5-GB 8mm cartridges.

Over the course of the last five years, 8mm drives have been attached to just about every kind of computer system in over 90 different system environments. The spectrum runs from desktop 80286-based LANs, workstations, minis and superminis, up through mainframes, and includes all major operating systems. Large system manufacturers have implemented 8mm on multiple platforms staying with one type of tape drive for low-end systems as well as high-end systems, and deriving the benefits of using one media for

both. More than 450,000 8mm drives have been shipped.

Exabyte recently acquired 4mm manufacturer R-Byte in order to address the market segment below that of 8mm and above that of QIC. The 4mm drives will allow Exabyte to address a broader spectrum of the multigigabyte tape market. DAT and the high-capacity QIC drives do tend to overlap in the marketplace. However, DAT's smaller form factor combined with its 2-GB capacity give it a competitive advantage that half-

height $\frac{5}{8}$ -inch QIC drives cannot yet match. According to Freeman Associates, DAT's growing acceptance will impact the QIC market.

Near-On-Line Tape Storage

To facilitate tape's use in near-on-line applications, 8mm products have been integrated into a series of cartridge-handling subsystems, whereas QIC drives have not. The amount of robotics intelligence available determines whether or not cartridges can be accessed in a random fashion. Exabyte offers a 580-GB subsystem that has bar-code identification of 116 8mm data grade cartridges, occupies a space about the size of a four-drawer file cabinet and has enough capacity to store the equivalent of 8,000 filing cabinets worth of information. A fully configured, estimated end-user subsystem cost is about 32 cents per megabyte. The company recently announced a 60-cartridge, two-drive version that is also field upgradeable to the larger system.

Interchangeability

Tapes will always be subject to some level of physical damage, whether from use or wild excursions in temperature and humidity. And they can simply be dropped. Damage may occur in small areas or over the entire tape. Tape may get stretched at beginning of tape and end of tape. Tape edges may get warped. All of these affect the linearity of tracks.

A commonly expressed concern is over 8mm's initialization period for every cartridge. The 35-second load time allows the 8mm drive to recalibrate its adaptive servo system to each individual tape. The way 8mm is architected maximizes the interchangeability of the media. Tapes written on one 8mm drive are readable by another drive. More important, even tapes that are damaged or worn can be read by different drives.

When writing a new tape, the 8mm drive spaces forward from the physical beginning-of-tape and writes a section of servo-adjust signal that ends at the logical beginning of tape or start-of-data, a point that is 18 inches from the physical beginning of tape. This length of skipped tape is exposed to wear over a lifetime of loads and unloads.

During subsequent loads, the 8mm drive spaces forward to the servo-adjust area, reads it and automatically aligns its servo positioning to the servo pattern of the subject tape.

This methodology gives 8mm its exceptional ability to read tapes recorded by different units and tapes with different physical characteristics such as substrate thickness, age and wear. If an off-track situation occurs due to stretched tape or tracks that are no longer straight, 8mm has the ability to read the data through its adaptive off-track and track-offset error recovery. This is interchangeability. While loading, 8mm automatically sizes the cartridge and determines the length of the tape in use.

Unattended Backup

Because disk drive capacities have grown so rapidly and form factors have shrunk so quickly, the amount of labor needed to monitor simple data backups, to change and label each tape has dramatically increased. This process is typical of the larger capacity systems that were using low-capacity QIC technology for backup.

Eight-millimeter helical-scan technology has been successful because it supports unattended backup—the ability to load a tape drive, initialize the system and perform multigigabyte backup operations with no people around. Unattended backup represents an increase in convenience and system availability. Ultimately, it results in a dramatic reduction in cost of ownership.

Changing Tape Technology

Magnetic tape was initially used as a processing medium and later, capitalizing on its transportability and cost effectiveness, as an archival and interchange medium. Tape excels in its position because, although sequential in access, it offers the lowest cost per megabyte of any data storage technology. Today, backup is by far tape's most common use. Of all existing tape technologies, digital 8mm helical-scan tape drives provide the most reliable, cost-, size- and performance-effective medium for unattended backup of large quantities of data.

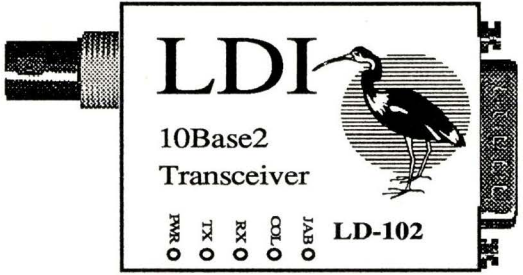
Eight-millimeter technology is extendible in both capacity and perfor-

mance. The 2.5-GB drive started at a very conservative operating point and has already been followed by the 5-GB drive, doubling performance and capacity. Exabyte has plans for advancing 8mm technology to provide 67 GB on a cartridge without compression and to achieve a transfer rate of 6 MB/s by the year 2000.

The small, self-threading, machine-identifiable 8mm cartridge offers the lowest cost of ownership available today. They are easy to use, offering low per-megabyte costs of less than 1/10 of a cent. Near-on-line tape storage is accomplished through the use of reasonably priced robotics-manipulated cartridge-handling subsystems and libraries. Eight-millimeter drives are sold in more than 30 countries worldwide. They have passed stringent product test requirements and have been integrated by more than 50 major system OEMs. -->

Grant Wilcox is director of product marketing for Exabyte Corp. in Boulder, CO.

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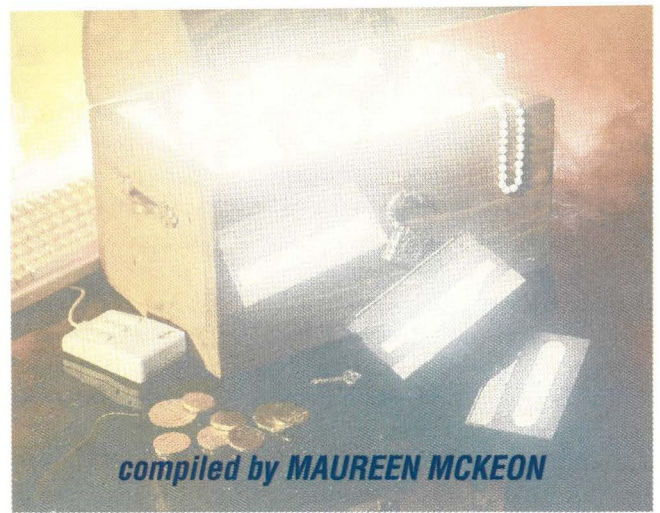
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4mm and 8mm Tape Options



Company/Manufacturer Model	Capacity (GB) uncompressed	Tape size (mm)	Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
ACL Inc. , 1234 Sherman Drive, Longmont, CO 80501 Circle 200														
ACL-600 Stackloader														
Exabyte	35	8	SCSI	—	100,000	—	—	—	—	—	tabletop, rack	ACL	1,000	1,995
ACL-420i Library														
Exabyte	150	8	SCSI	—	100,000	—	—	—	—	—	tabletop, rack	ACL	—	call
Acropolis Systems Inc. , 1575 McCandless Drive, Milpitas, CA 95035 Circle 201														
ASI-3S-DAT														
Archive	2	4	SCSI	183	40,000	—	512	—	Legato	—	standalone, rack	—	—	1,695
ASI-5L-E5T														
Exabyte	5	8	SCSI	500	40,000	—	1,000	—	Legato	SunOS	standalone, rack	Sun	—	2,995
Advanced Digital Information Corp. , P.O. Box 2996, Redmond, WA 98073-2996 Circle 202														
DAT 8000														
ADIC	2	4	SCSI-2	183	50,000	30	1,000	—	NetWare, ArcServe	yes	standalone, rack	—	3,500+	3,490
1200C Auto Changer														
ADIC	24	4	SCSI-2	183	50,000	30	1,000	—	NetWare, ArcServe	yes	standalone, rack	—	1,500+	11,750
Apunix Computer Services , 5575 Ruffin Road, Ste. 110, San Diego, CA 92123 Circle 203														
3200														
WangDAT	2	4	SCSI	500	50,000	18	1,000	device driver, Apunix Network Backup Daemon, Apunix Fast Archiving Utility	—	SunOS	matchbox, minitower, rack	ASJ	2,000	call
35480														
HP	2	4	SCSI	500	50,000	18	1,000	device driver, Apunix Network Backup Daemon, Apunix Fast Archiving Utility	—	SunOS	matchbox, minitower, rack	ASJ	1,000	call
8500														
Exabyte	5	8	SCSI	500	40,000	90	1,000	device driver, Apunix Network Backup Daemon, Apunix Fast Archiving Utility	—	SunOS	shoebox, minitower, rack	ASJ	3,000	call
10i														
Exabyte	50	8	SCSI	500	40,000	90	1,000	device driver, Apunix Network Backup Daemon, Apunix Fast Archiving Utility, Quickchange Software	—	SunOS	standalone	ASJ	100	call

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4mm AND 8mm TAPE OPTIONS

Company/Manufacturer Model	Capacity (GB)	Tape size (mm)	Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
Apunix Computer Services (continued)														
CHS120 Exabyte	600	8	SCSI	500	40,000	90	1,000	device driver, Apunix Network Backup Daemon, Apunix Fast Archiving Utility	—	SunOS	shoebox, minitower, rack	ASJ	—	call
Archive, Ardat Division, 1650 Sunflower, Costa Mesa, CA 92626 Circle 204														
4324NP/RP/XT Archive	2	4	SCSI	366	80,000	—	1,000	—	Cheyenne, Legato, Sytron, Dantz	Sun, IBM, HP, DEC, Compaq	internal, external	Archive	100,000	call
4590 NT/XT Archive	10	4	SCSI	183	40,000	—	512	—	Cheyenne, Legato, Sytron, Dantz	Sun, IBM, HP, DEC, Compaq	internal, external	Archive	3,000	call
Artecon Inc., 2460 Impala Drive, Carlsbad, CA 92008 Circle 205														
DSUO-300C1 HP	2	4	SCSI	366	50,000	—	1,024	DumpTool	—	SunOS	standalone	Artecon	—	2,895
DSUI-300B1 Exabyte	2.3	8	SCSI	250	20,000	—	1,024	DumpTool	—	SunOS	standalone	Artecon	—	3,595
DSUI-300B2 Exabyte	5	8	SCSI	512	20,000	—	1,024	DumpTool	—	SunOS	standalone	Artecon	—	5,395
ATS, 1160 Ridder Park Drive, San Jose, CA 95131 Circle 206														
3100 WangDAT	2	4	SCSI-2	183	60,000	30	768	NovaStor	—	—	internal, standalone	—	—	call
3200 WangDAT	2	4	SCSI-2	183	60,000	30	768	NovaStor	—	—	internal, standalone	—	—	call
HP 35470 HP	2	4	SCSI-2	183	50,000	30	—	NovaStor	—	—	internal, standalone	—	—	call
EXB-8200 Exabyte	2.5	8	SCSI	246	40,000	37.5	256	NovaStor	—	—	internal, standalone	—	—	call
EXB-8500 Exabyte	5	8	SCSI	500	40,000	37.5	—	NovaStor	—	—	internal, standalone	—	—	call
EXB-10i Exabyte	50	8	SCSI	500	40,000	37.5	1,000	NovaStor	—	—	internal, standalone	—	—	call
HP 35480 HP	8	4	SCSI-2	732	50,000	30	—	NovaStor	—	—	internal, standalone	—	—	call
Automated Systems Methodologies Inc., 16100 Fairchild Drive, Boatyard #V105, Clearwater, FL 34622 Circle 207														
Jackal ASM	2	4	SCSI, SCSI-2	233	50,000	—	512	Nsure	—	SunOS	standalone, internal, external	—	—	2,695
Aviv Corp., 4 Fourth Ave., Burlington, MA 01803 Circle 208														
ACT 470 SS-SB WangDAT, HP	2	4	SCSI	732	50,000	30	1,000	STS/Firmware	Quick Restore, Networker	SunOS, VMS, HP AUX, Ultrix	tabletop, shoebox, rack	DEC	494	2,665
ACT 820 SS-SB Exabyte	2.5	8	SCSI	246	25,000	—	256	STS/Firmware	Quick Restore, Networker	SunOS, VMS, HP AUX, Ultrix, AIX	tabletop, shoebox, rack	DEC	1,285	3,195
ACT 850 SS-SB Exabyte	5	8	SCSI	500	40,000	37.5	1,000	STS/Firmware	Quick Restore, Networker	SunOS, VMS, HP AUX, Ultrix, AIX	tabletop, shoebox, rack	DEC	835	4,450

4mm AND 8mm TAPE OPTIONS

Company/Manufacturer Model	Capacity (GB)	Uncompressed Tape size (mm)	Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
Aviv Corp. (continued)														
ACT 870 SS-SB														
Exabyte	5	8	SCSI	500	50,000	37.5	1,000	STS/Firmware	Quick Restore, Networker	SunOS, VMS, Ultrix	tabletop, shoebox,	DEC	37	4,660
Box Hill Systems Corp., 161 Avenue of the Americas, New York, NY 10013 Circle 209														
DTAC														
Box Hill	2	4	SCSI	366	40,000	37.5	1,000	device drivers, utilities	Legato, Alida	SunOS	rack, quint enclosure	Box Hill, third party	1,000	call
ET2														
Box Hill	2.5	8	SCSI	246	40,000	2.5	256	not required	Legato, Alida	SunOS	rack, quint enclosure	Box Hill, third party	1,000	call
ET5														
Box Hill	5	8	SCSI	500	40,000	37.5	1,000	not required	Legato, Alida	SunOS	rack, quint enclosure	Box Hill, third party	1,000	call
ET5C														
Box Hill	5	8	SCSI	1,000	40,000	37.5	1,000	not required	Legato, Alida	SunOS	rack, quint enclosure	Box Hill, third party	1,000	call
DSAC FileBox (Media Changer)														
Box Hill	24	4	SCSI	366	40,000	37.5	1,000	device drivers, utilities	Legato, Alida	SunOS	rack, quint enclosure	Box Hill, third party	1,000	call
EC1-ET5C BreadBox (Media Changer)														
Box Hill	50	8	SCSI	1,000	40,000	37.5	1,000	device drivers, utilities	Legato, Alida	SunOS	rack, quint enclosure	Box Hill, third party	1,000	call
EC4-ET5C IceBox (Media Changer)														
Box Hill	570	8	SCSI	1,000	40,000	37.5	1,000	device drivers, utilities	Legato, Alida	SunOS	standalone	Box Hill, third party	1,000	call
CMS Enhancements Inc., 2722 Michelson Drive, Irvine, CA 92715 Circle 210														
SSE-DAT/SSE-DAT20														
CMS	1.3-2	4	SCSI	183	60,000	—	—	—	—	SunOS	standalone, subsystem	Sun	—	call
SSE-CXB/SSE-CXB50														
CMS	2.3-5	8	SCSI	262.5	80,000	—	256	none	—	SunOS	standalone, subsystem	Sun	—	call
COMTEC Automated Solutions Inc., 10000 Old Katy Road, Ste. 150, Houston, TX 77055 Circle 211														
ATL Model 10 (Automated Tape Stacker)														
Exabyte	50	8	SCSI	500	40,000	37.5	1,000	SCSI robotic drivers	Legato, ACSC	SunOS, AIX	standalone	Comtec	45	8,000
ATL Model 54 (Automated Tape Library)														
StorageTek	270	8	SCSI, serial	500	40,000	37.5	1,000	CAS toolkit for robotic interface	Legato, ACSC, RAXCO	SunOS, AIX, SGI, DEC, HP	standalone, rack	Comtec	20	35,000
ATL Model 116 (Automated Tape Library)														
Exabyte	560	8	SCSI	500	40,000	37.5	1,000	SCSI robotic drivers	Legato, ACSC	SunOS, AIX	standalone	DEC	5	60,000
Contemporary Cybernetics Group Inc., Rock Landing Corporate Center/11846 Rock Landing, Newport News, VA 23606 Circle 212														
CY-8200														
Exabyte	2.5	8	SCSI, Pertec, parallel port	—	60,000	—	1,000	proprietary	NetWare, VINES, LANTASTIC, UNIX	SunOS	standalone, internal, rack	—	—	call
CY-8205														
Exabyte	2.5	8	SCSI, Pertec, parallel port	—	60,000	—	1,000	proprietary	NetWare, VINES, LANTASTIC, UNIX	SunOS	—	—	—	call
CY-8500														
Exabyte	5	8	SCSI, Pertec, parallel port	—	60,000	—	1,000	proprietary	NetWare, VINES, LANTASTIC, UNIX	SunOS	standalone, rack	—	—	call

4mm AND 8mm TAPE OPTIONS

Company/Manufacturer Model	Capacity (GB) uncompressed	Tape size (mm)	Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
Contemporary Cybernetics Group Inc. (continued)														
CY-8505 Exabyte	5	8	SCSI, Pertec, parallel port	—	60,000	—	1,000	proprietary	NetWare, VINES, LANTASTIC, UNIX	SunOS	standalone, rack	no	—	call
Data General Corp., 4400 Computer Drive, Westboro, MA 01580 Circle 213														
6762 Data General	1.3-2	4	SCSI-2	183	20,000	—	—	—	Legato	DG/UX, AOS/VS-II	rack, deskside	Data General	—	5,500
Delta Microsystems Inc., 111 Lindbergh Ave., Livermore, CA 94550 Circle 214														
1200T HP	1-2	4	SCSI	183	40,000	40	512	device driver, BudTool	BudTool	SunOS	standalone, desktop, rack	Delta	100	8,595
5000T Exabyte	5	8	SCSI	480	20,000	50	256	device driver, BudTool	BudTool	SunOS	standalone, desktop, rack	Delta	1,700	12,495
10 Tape Jukebox Exabyte	50	8	SCSI	480	27,000	60	—	device driver, BudTool	BudTool	none	standalone, desktop	Delta	250	29,695
12 Tape Jukebox ADIC	24	4	SCSI	—	50,000	90	—	device driver, BudTool	BudTool	none	standalone, desktop	Delta	20	30,000
60 Midrange Tape Jukebox Exabyte	300	8	SCSI	480	27,000	60	—	device driver, BudTool	BudTool	none	standalone	Delta	10	100,000
116 Tape Jukebox Exabyte	580	8	SCSI-2	480	27,000	60	—	device driver, BudTool	BudTool	none	standalone	Delta	50	127,286
Diverse Logistics Inc., 2862 McGaw Ave., Irvine, CA 92714 Circle 215														
DBSO TT1 DLI	16	4	SCSI	380	—	—	512	not required	SGL	SunOS	tabletop	DEC, TRW, Novadyne	—	5,928
DBSO RM1 DLI	16	4	SCSI	380	—	—	512	not required	SGL	SunOS	rack	DEC, TRW, Novadyne	—	6,495
Dynamic Computer Products, 63 Commercial Ave., Garden City, NY 11530 Circle 216														
3T20GH Dynamic	2	4	SCSI	185	50,000	30	1,000	not required	DBR, Legato	SunOS	desktop, rack	—	—	1,395
3T80GH Dynamic	2	4	SCSI	740	50,000	30	1,000	not required	DBR, Legato	SunOS	desktop, rack	—	—	1,495
5T23GE/DC Dynamic	2.5	8	SCSI	750	20,000	—	256	not required	DBR, Legato	SunOS	desktop, rack	—	—	2,520
5T50GE/DC Dynamic	5	8	SCSI	1,500	20,000	—	256	not required	DBR, Legato	SunOS	desktop, rack	—	—	3,565
ECCS Inc., One Sheila Drive, Bldg. 6A, Tinton Falls, NJ 07724 Circle 217														
SUIDX-1300-S WangDAT	1.3	4	SCSI	—	40,000	—	—	—	—	SunOS	standalone	ECCS	50	2,495
X812LE Exabyte	5	8	SCSI	512	30,000	—	—	—	—	SunOS	rack	ECCS	50	2,995
SUIDX-2600-S WangDAT	1.3	4	SCSI	—	40,000	—	—	—	—	SunOS	standalone	ECCS	50	3,000
SUI73TUR-S Exabyte	2.3	8	SCSI	—	30,000	—	—	—	—	SunOS	standalone	ECCS	60	4,995
SUI52TUR-S Exabyte	5.2	8	SCSI	—	30,000	—	—	—	—	SunOS	standalone	ECCS	60	5,995

4mm AND 8mm TAPE OPTIONS

Company/Manufacturer Model	Capacity (GB) uncompressed	Tape size (mm) Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
Epoch Systems Inc. , 8 Technology Drive, Westboro, MA 01581 Circle 218													
Epoch-2 Backup Server													
Exabyte	5	8 SCSI	450	40,000	37.5	128 MB	Epoch Backup Client/Server, Epoch Library Manager	Epoch Migration	SunOS, Iris, HP-UX, Ultrix, AIX, etc.	rack	—	500+	49,900
Exabyte Corp. , 1685 38th St., Boulder, CO 80301 Circle 219													
EXB-4200													
Exabyte	2	4 SCSI, SCSI-2	233	50,000	—	1,000	—	—	—	—	—	1,000	950 (OEM)
EXB-4200C													
Exabyte	2	4 SCSI, SCSI-2	233	50,000	—	1,000	—	—	—	—	—	1,000	1,050 (OEM)
EXB-8200													
Exabyte	2.5	8 SCSI	246	40,000	—	512	—	—	—	—	—	300,000	1,275 (OEM)
EXB-8205													
Exabyte	2.5	8 SCSI-2	263	80,000	—	1,000	—	—	—	—	—	1,000	1,470 (OEM)
Falcon Systems Inc. , 5816 Roseville Road, Sacramento, CA 95842 Circle 220													
FX-8861													
Archive	2	4 SCSI-2	732	80,000	20	—	not required	—	SunOS	standalone, internal, external, autoloader	Falcon, Archive	250	1,550
FX-35470A													
HP	2	4 SCSI-2	—	50,000	30	—	½-inch reel, QIC commands	—	SunOS	standalone, rack	Falcon, HP	250	1,550
FX-9961													
Archive	2	4 SCSI-2	732	80,000	20	—	not required	—	SunOS	internal, external, autoloader	Falcon, Archive	250	1,900
FX-8200													
Exabyte	2.5	8 SCSI	—	40,000	—	256	not required	—	—	standalone, rack	Falcon, Exabyte	250	1,990
FX-8500													
Exabyte	5	8 SCSI	—	40,000	—	1,000	not required	—	SunOS	standalone	Falcon, Exabyte	250	2,995
FX-8500C													
Exabyte	5	8 SCSI	—	40,000	—	1,000	not required	—	SunOS	standalone	Falcon, Exabyte	250	3,400
F.E. Pro , 9700 W. 76th St., Eden Prairie, MN 55344 Circle 221													
EXB-8500													
Exabyte, WangDAT	5	4, 8 SCSI	500	50,000	—	1,000	not required	Legato, ArcServe	SunOS	standalone, rack, etc.	Sun	1,500	175
Fintec Peripheral Solutions Inc. , 15520 Rockfield #1, Irvine, CA 92718 Circle 222													
DC Series													
Exabyte, HP, Cipher Data, Archive	1.2	4, 8 SCSI	800	—	—	—	standard host	—	—	desktop, rack	—	—	call
General Microsystems Inc. , 3220 118th Ave., S.E., Ste. 100, Bellevue, WA 98005 Circle 223													
HS/T 220-HH													
Exabyte	2.5	8 SCSI	1,200	40,000	19	1,000	device driver, modeset, directory, tapema	optional	optional	desktop, rack	various	—	3,600+
HS/T 220-5													
Exabyte	5	8 SCSI	500	40,000	37.5	1,000	device driver, modeset, directory, tapema	optional	optional	desktop, rack	various	—	4,200+

4mm AND 8mm TAPE OPTIONS

Company/Manufacturer Model	Capacity (GB) Uncompressed	Tape size (mm) Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
General Microsystems Inc. (continued)													
HS/T 220-5C													
Exabyte	5	8 SCSI	2,500	40,000	37.5	1,000	device driver, modeset, directory, tapema	optional	optional	desktop, rack	various	—	5,200+
Hewlett-Packard Co. , Filton Road., Stoke Gifford, Bristol, BS12 6QZ, United Kingdom Circle 224													
HP 35480A													
HP	2	4 SCSI	183	50,000	30	1,000	not required	not required	SunOS	internal, external	—	—	call
C1532A													
HP	2	4 SCSI	510	200,000	30	1,000	not required	not required	SunOS	internal, external	—	—	call
IGM , 4041 Home Road, Bellingham, WA 98020 Circle 225													
ATL 5000 (Autochanger)													
IGM	270	8 SCSI	1,000	30,000	37.5	2,000	ATL UNIX Toolkit	Legato, Unitree, Archive. UIS BACKUP.UNET	—	tabletop, rack	Novadyne	100	5,800
Intel Corp. , 5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124 Circle 226													
StorageExpress EL/XL													
Intel	2.2-5	4, 8 SCSI	500	40,000	37.5	1,000	ArcServe	ArcServe, NetWare	NetWare	standalone, rack	—	—	9,995+
Introl Corp. , 2817 Anthony Lane South, Minneapolis, MN 55418-3254 Circle 227													
1300T													
WangDAT	1.3	4 SCSI	183	20,000	—	—	SCSI flex DAT software driver	—	SunOS, IRIX	standalone, rack	Introl	20	call
8000T													
WangDAT	1.3	4 SCSI	183	60,000	—	1,000	SCSI flex DAT software driver	—	SunOS, IRIX	standalone, rack	Introl	20	call
2300T													
Exabyte	2	8 SCSI	246	20,000	—	256	SCSI flex DAT software driver	—	SunOS, IRIX	standalone, rack	Introl	40	call
5000T													
Exabyte	5	8 SCSI	500	40,000	—	1,000	SCSI flex DAT software driver	—	SunOS, IRIX	standalone, rack	Introl	20	call
Lago Systems , 141 Albright Way, Los Gatos, CA 95030 Circle 228													
LS/380L (tape library)													
Lago	270	8 SCSI, serial	500	30,000	—	—	—	Advanced Archival, Legato, General Atomics, UniTree, SW Moguls	SunOS, AIX	standalone, rack	—	200	45,000
Laguna Data Systems , 23151 Alcade Drive, Ste. B-3, Laguna Hills, CA 92653-1419 Circle 229													
Autodat													
Laguna	16	4 SCSI	183	20,000	20	—	Velocity Backup	—	—	standalone, rack	—	75	8,995
EXB-10													
Exabyte	2.3-23	8 SCSI	183	20,000	20	—	—	Velocity/landtape	—	—	—	5	16,995
Maynard Electronics (an Archive Co.), 36 Skyline Drive, Lake Mary, FL 32746 Circle 230													
Archive ST2000i/e													
Archive	2	4 SCSI, SCSI-2	183	40,000	—	512	not required	Legato, BudTool, Solo Scheme Xfire	SunOS	standalone, internal	Maynard	—	2,000+
Archive ST4000DATi/e													
Archive	2	4 SCSI, SCSI-2	183	40,000	—	512	not required	Legato, BudTool, Solo Scheme Xfire	SunOS	standalone, internal	Maynard	—	2,250+

4mm AND 8mm TAPE OPTIONS

Company/Manufacturer Model	Capacity (GB) uncompressed	Tape size (mm)	Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
Mountain Network Solutions Inc. , 240 E. Hacienda Ave., Campbell, CA 95008 Circle 231														
2100 SA														
Exabyte	2.2	8	SCSI	246	40,000	—	—	not required	Legato	SunOS	standalone	Mountain, DEC	20,000	6,695
National Peripherals Inc. , 1111 Pasquinelli Drive, Ste. 400, Westmont, IL 60559 Circle 232														
NPC32300S														
Exabyte	2.5	8	SCSI	—	20,000	—	256	—	—	SunOS	standalone, rack	NPI	—	1,775
NPC35000S														
Exabyte	5	8	SCSI	—	30,000	—	1,000	—	—	SunOS	standalone, rack	NPI	—	2,745
NCR , Peripheral Products Div., 3718 N. Rock Road, Wichita, KS 67226-1398 Circle 233														
6091-2300														
Exabyte	5	8	SCSI	500	30,000	—	1,000	device drivers	Sytos, ArcServe	UNIX, DOS, Novell	standalone	NCR	10,000	8,950
Optima Technology Corp. , 17526 Von Karman, Irvine, CA 92714 Circle 234														
MiniPak 2000DAT														
HP	2	4	SCSI-2	183	50,000	36	1,000	—	—	SunOS	standalone	Optima	1,200	1,795
Diskovery 2000DAT														
HP	2	4	SCSI-2	183	50,000	36	1,000	—	—	SunOS	standalone	Optima	1,200	1,795
MiniPak 8000DAT														
HP	2	4	SCSI-2	732	50,000	143	1,000	—	—	SunOS	standalone	Optima	600	2,195
Diskovery 8000DAT														
HP	2	4	SCSI-2	732	50,000	143	1,000	—	—	SunOS	standalone	Optima	600	2,195
Concorde 5000T														
Exabyte	5	8	SCSI-2	500	40,000	37.5	1,000	—	—	SunOS	standalone	Optima	—	2,995
Parity Systems , 110 Knowles Drive, Los Gatos, CA 95030 Circle 235														
PS5000														
Exabyte	5	8	SCSI	—	40,000	37.5	1,000	not required	Legato	SunOS	desktop, rack, stacker	—	—	call
Peripheral Solutions , 151-B Harvey West Blvd., Santa Cruz, CA 95060 Circle 236														
RB100														
R-Byte, Exabyte	2	4	SCSI	233	50,000	20	512	not required	Remote Diagnosis	—	internal, external	—	1,000	call
EXB-8200														
Exabyte	2	8	SCSI	246	40,000	18	256	not required	—	—	internal, external	Exabyte	5,000	call
EXB-8500														
Exabyte	5	8	SCSI	500	40,000	18	1,000	not required	—	—	internal, external	Exabyte	5,000	call
EXB-10i														
Exabyte	50	8	SCSI	500	40,000	18	1,000	not required	—	—	external	Exabyte	5,000	call
Peripheral Technology , White House Offices, 41 Rowley Lane, Littleover, Derby, DE3 7FT, England Circle 237														
8200/8500														
Exabyte	2.3	8	SCSI	—	20,000	—	256	—	—	SunOS	desktop, rack	Sun	400	2,000
R-Squared , 11211 East Arapahoe Road, Ste. 200, Englewood, CO 80112 Circle 238														
EX820														
Exabyte	2.5	8	SCSI	—	40,000	—	256	—	—	—	various	various	—	call
EX8205														
Exabyte	2.5	8	SCSI	—	40,000	—	1,000	—	—	—	various	various	—	call
EX850														
Exabyte	5	8	SCSI	500	40,000	37.5	—	—	—	—	various	various	—	call

4mm AND 8mm TAPE OPTIONS

Company/Manufacturer Model	Capacity (GB) uncompressed	Tape size (mm)	Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
R-Squared (continued)														
EX850C Exabyte	5	8	SCSI	—	40,000	—	1,000	—	—	—	various	various	—	call
8mm Tape Library Exabyte	50	8	SCSI	500	40,000	18	—	turbo backer	—	SunOS, AIX	standalone	various	—	call
8mm Tape Library Exabyte	580	8	SCSI	500	40,000	18	—	turbo backer	—	SunOS, AIX	standalone	various	—	call
Recognition Concepts Inc. , 5200 Canvair Drive, Carson City, CA 89706 Circle 239														
ExaSTORE 1 Exabyte	2.5	8	SCSI, VisiNET	250	—	—	—	VIP & VIK software	—	SunOS, UNIX, DEC, DOS	standalone, rack	—	20	call
ExaSTORE 10 Exabyte	5	8	SCSI, VisiNET	500	—	—	—	VIP & VIK software	—	SunOS, UNIX, DEC, DOS	standalone, rack	—	20	call
Sea Change Corp. , 6695 Mill Creek Drive, Unit 8, Mississauga, Ontario, Canada L5N 5R8 Circle 240														
EXT2300 Exabyte	2.5	8	SCSI	246	40,000	—	256	—	—	SunOS	standalone	Sea Change	200	3,140
EXT5000 Exabyte	5	8	SCSI	500	40,000	37.5	1,000	—	—	SunOS	standalone	Sea Change	50	4,345
SiGNAL Computer Products Inc. , 411 Massachusetts Ave., Acton, MA 01720 Circle 241														
TB-100 SiGNAL	2	4	SCSI	300	50,000	20	512	not required	—	—	standalone	SiGNAL	—	1,425
TB-4300 SiGNAL	1.3	4	SCSI	500	50,000	20	512	not required	—	—	standalone	SiGNAL	—	1,795
SA-8200 SiGNAL	2.5	8	SCSI	—	40,000	—	256	not required	—	—	standalone, desktop, rack	SiGNAL	—	1,995
SA-8500 SiGNAL	5	8	SCSI	400	40,000	—	1,000	not required	—	—	standalone, desktop, rack	SiGNAL	—	3,195
SA-8500C SiGNAL	5	8	SCSI	400	40,000	—	1,000	not required	—	—	standalone, desktop, rack	SiGNAL	—	3,250
Sony Corp. , Computer Peripheral Products Co., Magnetic Storage Products Div., 655 River Oaks Pkwy., San Jose, CA 95134 Circle 242														
SDT-2000 Sony	2	4	SCSI-2	183	50,000	—	1,000	—	Legato	SunOS	standalone, rack	—	—	call
SDT-4000 Sony	8	4	SCSI-2	732	50,000	—	1,000	—	Legato	SunOS	standalone, rack	—	—	call
Spectra Logic , 1700 North 55th St., Boulder, CO 80301 Circle 243														
STL-6000 Tape Library Spectra Logic	100	8	SCSI-2	500	40,000	37.5	1,000	—	Spectra Logic, FortuNet, Palindrome	—	tabletop, rack	Spectra Logic	—	17,260
STL-8000 Tape Library Spectra Logic	200	8	SCSI-2	500	40,000	37.5	1,000	—	Spectra Logic, FortuNet, Palindrome	—	tabletop, rack	Spectra Logic	50	27,680
Tecmar , 6225 Cochran Road, Solon, OH 44139 Circle 244														
ProLine DAT 2000S WangTek	2	4	SCSI	183	50,000	—	1,000	Preserves	Networker, BudTool, Backup CoPilot	SunOS	standalone	Tecmar	—	4,595

4mm AND 8mm TAPE OPTIONS

Company/Manufacturer	Model	Capacity (GB) uncompressed	Tape size (mm) Interfaces	Transfer rate (KB/s)	MTBF (hours)	Seek rate	Cache size (KB)	Software provided	Other vendor software	Native OS support	Mounting	Service providers	Installed base	Price (\$)
Tecmar (continued)														
Datavault 4000														
WangDAT	4	4	SCSI	183	60,000	—	1,000	—	Networker, BudTool, Backup CoPilot	SunOS	standalone	Tecmar	—	5,395
THS-2200														
Exabyte	2.2	8	SCSI	246	30,000	—	512	—	Networker, BudTool, Backup CoPilot	SunOS	standalone	Tecmar	—	6,995
THS-5000														
Exabyte	5	8	SCSI	500	30,000	—	1,000	—	Networker, BudTool, Backup CoPilot	SunOS	standalone	Tecmar	—	8,895
Transitional Technology Inc., 5401 E. La Palma Ave., Anaheim, CA 92807 Circle 245														
CTS-8501														
TTI	5	8	SCSI	500	40,000	90	512	—	BudTool, Legato, BRU, Flashback II, Apunix backup daemon, LoneTar	SunOS, Solaris	standalone	TTI, DEC	4,000	call
CTS-8201														
TTI	2.5	8	SCSI	246	40,000	—	256	—	BudTool, Legato, BRU,	SunOS,	standalone	TTI, DEC	6,000	call
Series 10i														
TTI	50	8	SCSI	500	40,000	90	512	—	BudTool, Legato, BRU, Flashback II, Apunix backup daemon, LoneTar	SunOS, Solaris	standalone	TTI, DEC	123	call
Trimarchi Inc., P.O. Box 560, State College, PA 16804 Circle 246														
DATback (TN-0160000-0)														
Archive	2	4	SCSI	183	120,000	—	1,000	—	—	SunOS, UNIX, Ultrix	tabletop, rack	—	1,000	2,495
TN-01Q0000-0														
Exabyte	5	8	SCSI	500	40,000	37.5	1,000	—	—	SunOS, VMS, Ultrix, UNIX	tabletop, rack, stacker	—	500	4,495
Ether DAT (TE-0360000-0)														
Archive	2-14	4	SCSI, Ethernet	129	120,000	—	1,000	Virtual Tape	TCP/IP support	SunOS, VMS, UNIX, Ultrix	tabletop, rack	DEC	150	10,500
Ether Tape (TE-01Q0000-0)														
Exabyte	5	8	SCSI, Ethernet	230	40,000	37.5	1,000	Virtual Tape	TCP/IP support	SunOS, VMS, Ultrix	tabletop, rack	—	500	14,000
WangDAT Inc., 140 Technology Drive, Irvine, CA 92718 Circle 247														
DAT 2000 SSe														
WangDAT	2	4	SCSI	183	50,000	30	512	Legato	various	SunOS	standalone	WangDAT	—	3,095
DAT 4000 SSe														
WangDAT	2	4	SCSI	732	60,000	30	768	Legato	various	SunOS	standalone	WangDAT	—	3,195
ZZYX Workstation Peripherals, 5893 Oberlin Drive, San Diego, CA 92121 Circle 248														
35470A														
HP	2.3	4	SCSI	—	50,000	30	—	—	—	SunOS, Solaris	standalone	—	—	1,795
35480A														
HP	8	4	SCSI	—	50,000	30	—	—	—	SunOS, Solaris	standalone	—	—	2,195
8200														
Exabyte	2	8	SCSI	246	40,000	—	—	—	—	SunOS, Solaris	standalone, rack	—	—	2,195
8500														
Exabyte	5	8	SCSI	—	40,000	37.5	—	—	—	SunOS, Solaris	standalone, rack	—	—	2,995
10i														
Exabyte	2.5-50	8	SCSI	—	40,000	—	—	—	Legato, AMASS, VJuke	SunOS, Solaris	standalone	—	—	3,695



First Impressions: ShowMe

"I won't believe it until you show me."

—My five-year-old

by IAN F. DARWIN

What You See Is What Everybody Gets

Think about the last time you tried to tell somebody over the phone or by email about a problem with an X application. Maybe you could painstakingly describe the problem step by step. Maybe you used *snapshot*, then uuencoded and mailed a snapshot of the screen. Or maybe you just went nuts trying to document the process.

Now imagine you have a camera you can point at any section of your screen, and click repeatedly, and put text annotations or drawings onto, and have the other person see the ongoing screen image in almost real time. That's what ShowMe is all about.

A low-cost conferencing software package, ShowMe lets users at several locations exchange ideas and graphics, a sort of distributed electronic chalkboard.

What It Is and Does

ShowMe lets you share images across a network. As SunSolutions' ad says, "ShowMe brings SPARC users together on the network. No flights. No conference rooms. No stale donuts. ...". And the product lives up to the claims, whatever you think of the hype.

Start it up and you get a blank window with some window gizmos at the

left. Draw some lines with the mouse; it tracks the cursor on your screen and on the screen of everyone who's in your conference. Copy a region of your screen; everybody sees it. Annotate as you go. Don't even click to type; just move the pointer to a clear spot and begin typing, just like a real chalkboard. After all, who ever heard of a chalkboard that you had to click on before you could write on it? ShowMe behaves more or less like any draw program, except that what you see is what everyone else in the conference gets. And, like the UCB talk program, it's full-duplex; you can be annotating one part of the screen while somebody else is drawing a picture someplace else. You can have lots of people on-line at once, and they all see everything. Color is

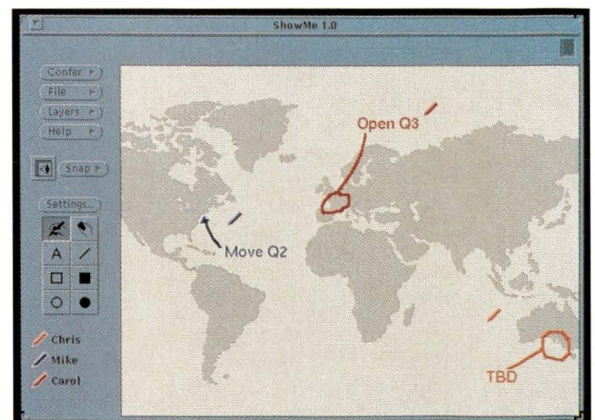
used to denote who said or did what.

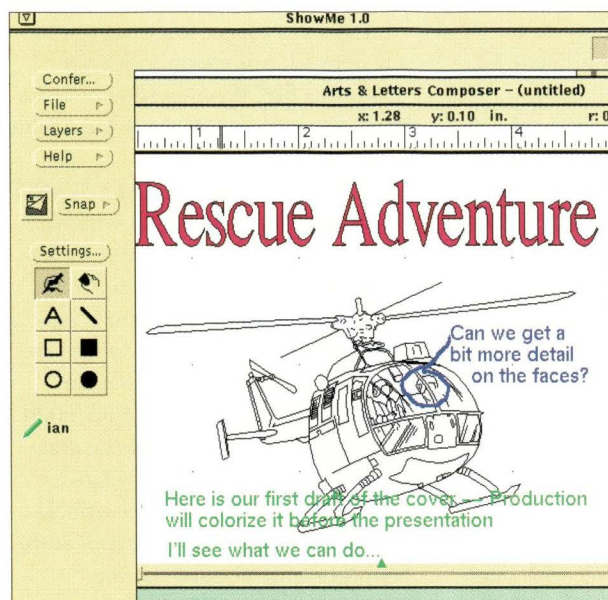
You can only have one copy running per CPU, not one per (logged-in) user. Perhaps it ought to know about users and machines like OpenWindows' calendar program, *cm*, and in a different way like UCB talk. If it did, it could run on a server (though I guess Sun wants it to run only on workstations) and could allow two users each to have their own conference. But maybe this would be a step away from the program's present simplicity.

We tried it out on two screens, one of them monochrome. A pleasant surprise, this: Monochrome works fine, subject to its limitations. Colors are dithered, and you can draw only in black or white.

Grabbing a region of your screen is

SunSolutions' ShowMe allows groups to view and collaborate on documents, spreadsheets and images over a TCP/IP network.





With ShowMe, when you click on the Snap Through image, the display window becomes transparent. You can then move the entire ShowMe window around.

easy: Click the left button on the Snap button and you get a target cursor; sweep out a rectangular area of the screen, and a copy of this rectangle follows your cursor. Move it to where you want it in the ShowMe window, click the pointer button again, and your rectangle replaces what was there.

Too much stuff on the display? No problem, just use the eraser to white out what you don't need. Not only that, there are two "layers," or bit planes, the top one for interactive scribbling and the bottom for bit maps. And you can drop in a bit map from programs like Snapshot (a standard part of OpenWindows). You can drop it either in the drop target or in the drawing window. Drop it in: Like dropping a bomb, it blows away the entire previous image and replaces it with the new bit map. Drag it out: It's copied to application. You can also use the "File" menu's "Load" item to load a raster file. No matter how you load your bit map, the window will automatically resize if appropriate (if the bit map is larger than will fit). To push hard on it, I loaded a 1,400-by-900 raster file on a standard-size (1,152-by-900) screen. While it worked, I was a little disappointed that I didn't get scrollbars. Not really necessary: You can move windows larger than your screen under `o1wm`, but then you can't see the left-hand side of the screen and its controls. The 1.1 version of this product will apparently feature either

panning or scrollbars.

There is no "undo"; it just keeps a bit-map image that everyone updates. Sun's `iconedit` program has undo, but it's solving a much smaller problem. Adding undo to ShowMe would probably not be trivial, given the networked nature of the beast.

Drag a Window...

The Snap Through feature of ShowMe allows you to take snapshots of sections of your screen, annotate them and have your conference mates see it all as it appears.

You click on the Snap Through image and the display window becomes transparent. You then move the entire ShowMe window around (using the normal `o1wm` technique of clicking the left pointer button and holding it while you move the window, then releasing it). If you're happy with where the image landed, click on the Snap button. Otherwise, reposition and try again. The other people will be warned that you're doing it, so they don't try anything too fancy. When you click on Snap, the image from the transparent "Active Window" is copied into the "bottom layer" of the image and sent to everyone.

To show a sequence of operations, just click on Snap Through again. While the window is transparent, the windows underneath it can be accessed normally: moved, resized, given focus, etc. In short, you can do whatever

setup you need in order to make your point. When all the stage is set and the players lined up, just click on Snap again and the image is updated for everybody.

Instead of a Properties Window, there is a less-formally-named "Settings Window," which lets each participant choose his or her own color, pen width, etc. And it lets you provide your own name, which is good for using a guest account, but potentially bad for security. You are notified of the login and host of each person as they join (and usually as they leave) a conference.

The drawing commands are simple but effective: freehand draw, freehand erase, rectangle and oval. The last two can be either hollow or filled (both are on the control panel) and can be constrained (rectangle draws squares, oval draws circles) by a keyboard modifier.

Overall, it does what it should.

Installation and Licensing

Installation is trivial. For the demo version, insert the demo floppy and run the `extract_unbundled` program. The demo version takes only about 600 KB, 500 for the ShowMe binary, and the rest for the help handbook (which, by the way, got installed read-only by the demo package) and the spot help file (`showme.info`). Other than the help handbook being read-only, it installed perfectly and ran the first time.

The demo version, of course, uses no licensing. The full version comes on CD-ROM and installs with `cdm/cdmanager`. This media kit includes the license daemon. ShowMe uses Highland's FlexLM product, by the way, which Sun seems to have "transitioned" to, away from SunNet License. If you also have SunPro's compilers licensed, you can use the same running copy of the license daemons for the compilers and ShowMe. Licenses float; any workstation on your network can have access. There is an optional mechanism in place for reserving license(s) by user or by machine.

In short, installation is easy, and licensing is too, but you have yet another licensing daemon running on your system.

ShowMe

Company

SunSolutions

Address

2550 Garcia Ave.
MS: MTV02-208
Mountain View, CA 94043

Phone

Call (800) 647-8333 for
free demo disk.

Best Features

A nice little program, it does one thing well: a distributed chalkboard. The human interface has been well thought out to make it useful for casual users, much more so than the average "user-friendly" X application. It seems to make intelligent use of network bandwidth. Reasonably priced.

Needs Improvement

No audio, but a new version is slated to include SPARCstation audio (see "Sun's View"). Handling of very large raster files—will support panning or scrollbars. Should come with a free T1 network connection :-)

Price

\$349 quantity-one floating license, media and documentation.
Additional floating license, \$319.
10-user, \$2,870. 25-user, \$5,975.

Circle 145

Imaging Technology: X Window System, Printing...

We wondered how ShowMe was able to get the transparent window. Maybe it uses NeWS? But that's on the way out, right? Let's ask the computer. `ldd` is a command that Lists the Dynamic Dependencies, that is, the program libraries that have been linked dynamically to make a binary (see Listing 1). The first message is just

a warning that our C library is a bit behind the times—we're running 4.1.1, not 4.1.2, a k a Solaris 1.0, as the installation notes require. We've shown you that ShowMe runs on 4.1.1; we had no problems with it other than getting that same `ld.so` warning each time we started up ShowMe.

The remaining messages show that the program was linked with XView, OLGX (a graphics engine used by XView and by `olwm`), the X library, and the C and dynamic linking libraries. Hey, this binary should run on Solaris 2.0. Let's try it. But first, let's go deeper into how the technology works.

Just to rule out NeWS, let's try running it from a SPARCserver with our display set to a lowly 3/50 running the MIT X server. Some of the output from `xdpinfo`, a display information utility for X, is shown in Listing 2.

The remainder of the `xdpinfo` was boring so we cut it. But note: This MIT server works with ShowMe, and this server supports the Shape extension. Wonder if that's it? Let's `strings` the binary and see. Yup, we found this:

```
SHAPE
XLib: extension "%s" %s on
display "%s".
unknown
missing
```

Seems that they use the SHAPE extension, not NeWS, to make a transparent window. But is there any PostScript in there at all? Yes, there are a few PostScript functions defined, but they seem to be used only in printing. With a license, you can save the screen image explicitly or by dragging from the drop-and-drag target; in either case, what you're saving is just what this tool works in, a SunRaster file. And printing, similarly, prints the

entire screen image. You can print to any network printer and can even "print to a file" if you need to save the PostScript commands that would print a session.

Of course you can only get a SPARC binary of this program. But what will it show you if you try to point its output window at another vendor? As mentioned, it worked fine on a Sun-3/50 with the MIT server. So next we set the `DISPLAY` variable to make ShowMe output on an IBM RS/6000. It worked, but the icons for the draw tools showed up in reverse video—a very minor wrinkle. A larger wrinkle was that the Pen Color swatches in the Settings menu all came out the same—in my OpenWindows WindowColor setting—making it difficult to choose colors.

We tried it on an IBM X terminal with a 2-bit gray-scale display, and it totally refused to run. However, we forgive it, for it failed gracefully, putting up an Open Look Notice explaining the problem.

Our next try—an Intergraph Clipper—was less successful. First, it locked the server with the Notice about being a demo copy. We killed and restarted it, using `-Wfsdb` to disable server grabs. Then it ran OK, though we got the ill-sounding message:

```
XView warning: Problems setting
default modifier mapping
(Server package)
```

And the tool icon colors were reversed on the Intergraph, as on the IBM. Must be something about vendors that begin with "I." Once past this, however, it ran fine.

The final try was a monochrome NCD X terminal, which worked fine except that some of the bit maps were

Listing 1. Determining Dependencies

```
testhost% ldd showme
ld.so: warning: /usr/lib/libc.so.1.6 has older revision than expected 7
lxview.3 => /usr/openwin/lib/libxview.so.3.1
lolgx.3 => /usr/openwin/lib/libolgx.so.3.1
lX11.4 => /usr/openwin/lib/libX11.so.4.3
lc.1 => /usr/lib/libc.so.1.6
ldl.1 => /usr/lib/libdl.so.1.0
testhost%
```


black-white reversed. This is a common problem with XView programs on the monochrome NCD X terminals, for some reason.

The bottom line is that we tried it on several non-Sun servers and it worked, as long as the server supported either monochrome or 8-bit color.

Problems? Documentation?

There is both Open Look spot help (hit the HELP or F1 key over any control) and a "HelpViewer" on-line help file, which is printable PostScript (HelpViewer shows the introductory on-line documentation when you start an uncustomized OpenWindows ses-

sion). The full version includes a user manual, although the program is so easy to use, you hardly need it.

The people who work on this product are very committed to it. There is even a menu item for sending your comments as email directly to the group at Sun that works on the product.

Sun's View

David Gedye manages an Advanced Development group in SunSoft. He builds prototype collaborative applications and tests them in real work groups. Previously he was with Sun Microsystems Labs, where he and his group devised the program that became ShowMe. I caught up with him at the CSCW'92, the ACM's Conference on Computer Supported Cooperative Work, in Toronto the first week of November 1992.

Dave's focus is on all aspects of computer-mediated collaboration. ShowMe was designed not just to be "easy to use," though I think it does that quite well. It was also designed to step around some of the "problems of adoption" that much software faces. People won't use software if it is harder to use than the work it replaces, of course. But they also won't use it if it infringes on the personal power or office politics of the users—remember that for a long time upper managers wouldn't have a computer on their desk because only underlings used them; a different set of considerations applies today with email, conferencing, etc., but one that must be taken into consideration, Gedye says. The goal with ShowMe was to make it easy for anyone to contribute, without interfering with the social processes that shape a work group.

Another term Gedye uses is "shared reference." In one physical location, such as a conference room, everyone has the same visual reference: the clock on the wall, the room colors, the painting or window view, and most importantly, each other's facial and vocal interaction. In trying to distribute human collaboration, we have to make as much of that as possible visible. And hence we have to discuss audio and video, and why they're not included in ShowMe just yet. Audio, first, is generally easy to provide by an alternate, and familiar, technology: the telephone. Most offices that have an Internet link also have a telephone, and they can be used in parallel. When using ShowMe at a distance, we found the telephone helpful. We also like the fact that ShowMe didn't constrain the cursor to the window, but let it roam over the controls. This makes it a natural to say "use this button here" while waving the cursor over a control on the left-hand side of the window—the person at the other end shares visual and aural reference; they can see and hear what you mean.

"It's harder than you think," he maintains, to do reasonable audio conferencing over a computer network. End-to-end delay and acoustic echo are the main problems. His group does it in their lab, but so far their quality doesn't match that of the phone company. "Those guys had a bit of a head start."

Then what about video? Not yet, says Gedye. "Cheap desktop video conferencing" is coming, but it's not ready for prime time yet. His lab has built some SBus-based cards using off-the-shelf chips, and even though these boards use a proprietary compression scheme, he maintains that successful products must embrace the international standards in this area, especially the CCITT H.261 (also known as Px64), a standard for real-time encoding and decoding that is being used already in some products. Look for Sun to provide these. Interestingly, the frame rate for minimal live video seems to be around 10 frames/second—not as good as TV's 24, but OK for communication—which can be shown to fit in the 128-KB/s range, which will be available with ISDN. Looking into the future, then, you can see that Sun will probably provide some kind of video compression hardware. In the best of all worlds, it would be built-in, just as the ISDN facilities are built into the SPARCstation 10 and the new LX. "Do remember, though, that I'm in Advanced Development," Gedye reminds me, "and none of this represents any sort of commitment to product status." True, but it all sounds so convincing—and so full of promise!

Other ideas include software support for "distance learning." A distributed classroom, after all, is just group collaboration on a large scale with one or a few people doing most of the talking. With a fast network in place, you could consider broadcasting lectures. Workstation users then can tune in the parts that interest them, but leave the conference without tripping over anybody's books or coats on the way out the door when their interest wanes. And there are, of course, a wide range of social and privacy issues that need to be worked out. Do you want your company's meetings being intercepted and watched over the Internet by your competitors? The research world is turning its attention to such issues—both technical and social/ethical—and it is at conferences such as the one where I met David that many of the details are being worked out. —*ifd*

Listing 2. Ruling Out NeWS

```

testhost% xdpinfo -display picture:0
name of display:  picture:0.0 version number:  11.0
vendor string:  MIT X Consortium
vendor release number:  4
maximum request size: 16384 longwords (65536 bytes)
motion buffer size: 0
bitmap unit, bit order, padding:  32, MSBFirst, 32
image byte order:  MSBFirst
number of supported pixmap formats:  1
supported pixmap formats:
    depth 1, bits_per_pixel 1, scanline_pad 32
keycode range:  minimum 8, maximum 132

SHAPE
Xlib: extension "%s" %s on display "%s".
unknown
number of extensions:  4
    SHAPE
    Multi-Buffering
    MIT-SUNDRY-NONSTANDARD
    DEC-XTRAP default screen number:  0
number of screens:  1

```

Working at Home?

The unstated implication of Sun's advertising is that you can use the product over very long-haul networks, to hold faceless meetings. So we tried it out over a 14,400-baud SLIP line (serial line IP). Now you have to be careful to set this kind of review up carefully. We didn't want the X protocol packets going over the SLIP line, only the information packets between one copy of ShowMe and another. So we installed the program on two machines, and had one person at each end, also talking by telephone.

That's right, telephone. Version One of ShowMe does not support the SPARCstation's built-in audio. To work around this, Sun's demo script (on paper, provided with the demo copy) suggests using the telephone, so we did. It's a sure bet that a future version will support audio (see Sun's View).

But part of the intended audience for this product is the work-at-home crowd. Many of these home-workers don't have two phones at home, let

alone a T1 line from their basement office into the corporate backbone. While I can't speak for the future audio version, I can report that the present graphics-only version works fine on a SLIP line over V.32/V.42 dial-up modems. It does allow use of a numeric IP address, in case your host tables are out of date. Response time was quite acceptable, though there were pauses of up to 10 seconds which are presumably the result of other activity over this link (we had a UCB "talk" going concurrently over the same link, and email was flowing in both directions, and somebody was logged into a machine on our side, and so on).

Competition

The idea of using computing workstations for networked whiteboards is not new. Douglas Englebart (widely credited as the inventor of the "mouse" pointing device) made a movie about this topic in 1971 at Stanford. (or was it SRI?). So it isn't surprising that there

are several such programs in existence today.

A Sun program named ChalkTalk uses the NeWS protocol, and was distributed in source and binary form with OpenWindows 3.0. It features similar shared drawing but can't grok bit maps. Given the recent Adobe announcement and the release of ShowMe by Sun, it is likely that ChalkTalk will be discontinued.

Another commercial product is Communique! from InSoft, Grantham, PA. InSoft's product has a bit of a head start; it includes audio and live video. Another product, called FarSite from DataBeam Corp., Lexington, KY, is being promoted as an electronic meeting solution.

Summary

I've enjoyed using this program. It's fun to use, and unlike a lot of other stuff, it doesn't get in the way of using the computer to share information across the network.

Ian Darwin may not exist at all.

Rumor has it that he is, after all, just an emulation. Email can be sent to his input redirector at ian@sq.com or uunet!sq!ian.

NetMetrix**by S. LEE HENRY**

Tools to visualize network activity have long manifested themselves as heavy cases of hardware lugged around by only the most ardent of technodweebs or dedicated PCs sitting off in a corner. No more. Metrix Network Systems' suite of network monitoring and analysis tools brings network analysis into the awaiting embrace of the average network administrator and on his own workstation.

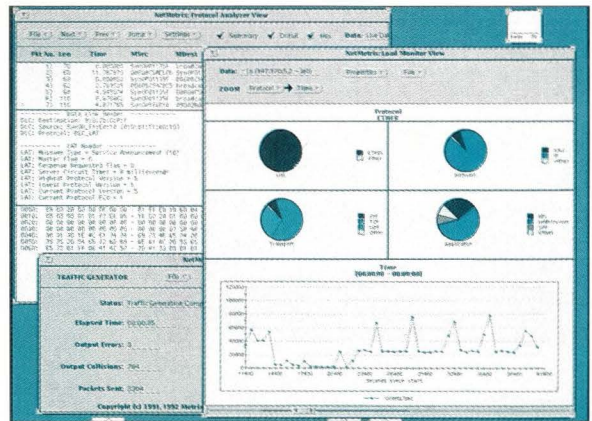
A suite of five software-only tools, the newest release of the NetMetrix software can monitor any segment of an internetwork and display the results on an X display anywhere else on the network. This flexibility, coupled with the software's intuitive graphics and ability to analyze and correlate net-

work statistics, make it an indispensable tool for large, especially multivendor, networks.

NetMetrix 3.0 supports a distributed architecture with continuous real-time monitoring of Ethernet, token-ring and FDDI network segments. With TCP/IP, DECnet, AppleTalk, Internet/Sequenced Packet Exchange (IPX/SPX), XNS, SNMP and RMON (SNMP standard for remote LAN monitoring) support, the software lends itself to just about anything you'd ever want to throw on your network.

My first encounter with the Metrix software was a couple of years ago when it relieved me of having to walk lopsided down the halls of my office carrying my old Hewlett-Packard Co. 4972A Protocol Analyzer. Not only have I found the Metrix software far easier to use than the HP, but the easier-to-understand breakout of packet data has allowed me to get a good mental "baseline" of what constitutes normal activity for my site. Ever since the software was upgraded to run on my OpenWindows desktop, I haven't

NetMetrix 3.0 includes five software tools to monitor multivendor internetworks.



found anything about it that I haven't liked. It's considerably faster and more flexible than any of the PC-based tools that I have looked at, and it runs at my desk. The five software tools that constitute the current version of the software include the Internetwork Monitor, Protocol Analyzer, Traffic Generator, Load Monitor and NFS Monitor (for Ethernet, 4- and 16-Mb/s token ring, and even FDDI segments!).

This newest release also includes a Trend Analysis Tool so that you can look at long-term traffic trends from daily monitoring and, if you like, email a report to your network administrator with daily statistics in a format that you specify, plus a Network Configurer that lets you do "what-if" analyses of network configurations to aid in placing bridges and routers.

The Internetwork Monitor collects data from RMON agents on each segment and provides complete end-to-end visibility of the multisegment network. Traffic patterns can be seen at every layer of OSI stack. The software is fully compatible with RMON. This means that you can count on interoperability with other vendors' RMON-compatible products.

The NetMetrix Protocol Analyser comes with seven-layer decoders for all major protocol suites: TCP/IP, NFS/SunRPC, DECnet, DEC LAT, SNA, Novell NetWare, XNS, Banyan VINES, AppleTalk and OSI. Pre- and post-capture filtering can be done at any layer in the stack.

The Traffic Generator can be used to simulate load for testing.

The Load Monitor measures and graphs traffic by parameters such as

source, destination, time interval, protocol and packet size. An especially powerful feature allows you to correlate statistics to pinpoint load patterns.

The NFS Monitor displays statistics in terms of calls/second and response time.

Easy to integrate into network management environments like SunNet Manager, IBM NetView/6000 and DECmcc, NetMetrix comes with integration schemas for these products.

One especially slick approach is to put NetMetrix on a portable RDI BriteLite or Tadpole SPARCbook—a network troubleshooter's dream.

Prices start at \$1,995 per tool, decreasing with the number of licenses that you buy. You can also set NetMetrix up to run under a floating license. This makes it easy for more than one network administrator to use it and easily allows you to upgrade to a newer/faster host. Both Open Look or Motif versions are available.

So...does your network administrator care about the activity of individual nodes, traffic statistics for given network segment, wish he could easily pinpoint the heaviest traffic on your network, or visualize load over time?

NetMetrix is a very serious tool for network administration. A free demo is available if you call Metrix. ➡

S. Lee Henry is on the board of directors of the Sun User Group and is a system administrator for a large network of Suns in the federal government. She also heads her own company, The Next Page Inc., which specializes in software documentation.

NetMetrix

Company
Metrix Network Systems Inc.

Address
One Tara Blvd.
Nashua, NH 03062

Voice
(603) 888-7000

Fax
(603) 891-2796

Best Feature
Easy to use and understand

Worst Feature
Don't get much exercise anymore

Price
Each single tool \$1,995, lower per-unit cost with additional licenses

Circle 146

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 at the end of the magazine.

Image Processing Product

Datacube has introduced an image processing system that may be used with or without a Sun workstation. The MaxTD Target and Development Systems are meant for OEM buyers who wish to produce imaging applications that they will later incorporate in other systems. To this end, the MaxTD Development product is a

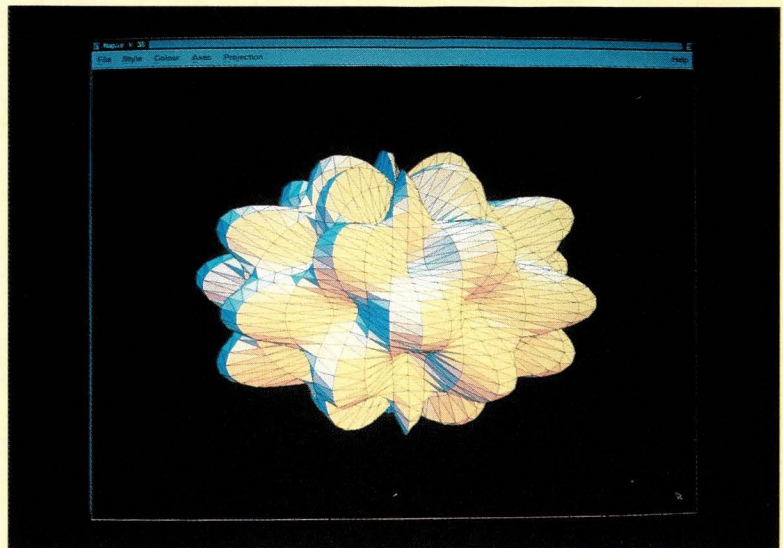


tower unit that can attach to a Sun and provide a development environment that includes the company's MaxVideo 200 image processor, 24 MB of virtual image memory, a VME controller and a SCSI hard disk. There is also an extensive selection of software tools included with the box.

With MaxTD, the developer can download to an embeddable MaxTD Target system. This includes a MaxVideo image processor, the Lynx real-time operating system and various connectivity options. Pricing on the development platform ranges from \$30,000 to \$40,000, depending on configuration. Pricing on target systems begins at \$11,500.

Datacube Inc.

300 Rosewood Drive
Danvers, MA 01923
Circle 102



MathSoft/Maple Math

Two products that, when combined, offer a rival to the Mathematica symbolic math package have been introduced. MathSoft, which sells the MathCad scientific and technical calculation package, and Waterloo Maple software, maker of the Maple symbolic math product, have announced a relationship under which MathSoft will publish Maple V Release 2. MathSoft will sell Maple V by itself and in combination with its own product.

The new Maple will differ from its predecessors both in the front end provided by MathSoft's Mathcad, and in several additional new features. It will have, for instance, a much-improved graphics capability, an improved user interface based on Motif, and more than 700 new math functions, for a total of 2,500. The two companies are targeting Mathematica and say that the Maple V/Mathcad combination now offers everything that the Wolfram Research product does, except for Mathematica's audio and sound effects. Pricing begins at \$795.

MathSoft Inc.

201 Broadway
Cambridge, MA 02139-1901
Circle 100

Waterloo Maple Software

160 Columbia St. West
Waterloo, Ontario, Canada
N2L 3L3
Circle 101

SCSI Subsystem Adds 28.8 GB

Parity Systems has announced a desktide SCSI subsystem that allows users to add up to 28.8 GB of disk storage to a Sun or other workstation. The PS7900 Series desk-side subsystem is a bay that can contain from 1.6 to 28.8 GB of disk storage, and/or 1/4-inch tape, DAT or 8mm tape drives, or some combination of all of those

plus optical and CD-ROM devices.

The enclosure consists of the drives, power supplies, internal cabling, fans and SCSI connectors. It measures only 26 1/2 inches high by 12 1/2 inches wide by 26 inches deep. Pricing ranges from \$5,630 to \$42,980, depending on the number and type of devices installed.

Parity Systems Inc.

110 Knowles Drive
Los Gatos, CA 95030
Circle 103

3½-inch MO

MOST has announced a 3½-inch optical disk drive, RMD-5200-S, with a capacity of 256 MB. The company says that the product is backward-compatible with the 128-MB ISO DIS10090 standard. This is possible by means of an Automatic Media Sensing technology that allows the drive to recognize the capacity of disk within it and deal with it appropriately.

The product supports sustained data rates of up to 1 MB/s. It has a maximum data integrity of less than one hard read error in 10¹² bits of data. It has a mean time between failure rate of 30,000 hours. Pricing for the RMD-5200-S begins at \$1,695.

Mass Optical Storage Technology Inc.
11205 Knott Ave.
Cypress, CA 90630
Circle 104



minimal is like a dumb character terminal except that it is capable of windowing and can display icon-like figures. The new ADDS Alpha terminal is the 4000/AWT. It can show up to 16 windows at a time and has 80 to 132 columns. It can emulate the AT&T 705 and 605, the Digital Equipment Corp. VT-320, 200 and 100, as well as an ANSI PC terminal. It has two RS-232-C ports and one parallel port.

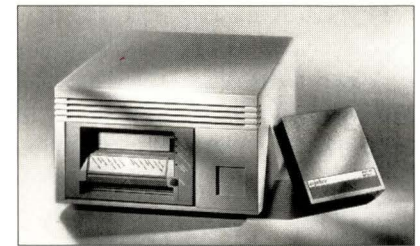
The product comes with an enhanced PC keyboard and a Microsoft

Corp.-compatible mouse. It will be shipped through ADDS distributors and VARs. Pricing begins at \$729. The one-year warranty can be extended to four years for \$50.

Applied Digital Data Systems Inc.
Display Products Division
100 Marcus Blvd.
Hauppauge, NY 11788
Circle 105

Digital Linear Tape Backup


A line of ½-inch digital linear tape (DLT) backup systems has been introduced for networks and large systems.



The Ciera series of devices, from Cipher Data Products, includes a 2.6-

ADDS Adds Alpha

A new AlphaWindow Terminal has been introduced by Applied Digital Data Systems (ADDS). An Alpha ter-




Modem Security Software with Dial-Back Capability

CoSECURE software protects your Sun or Solbourne system from electronic vandalism by adding powerful, but versatile, security protection to dial-up (modem) ports. Operating as a UNIX application, CoSECURE intercepts incoming telephone calls, qualifies those calls according to your specific security parameters, and then "goes away". CoSECURE adds no system overhead.

With CoSECURE, you can choose from a wide range of security options, including time and date controls, as well as full "dial-back" capability. Security parameters can be set either globally, or on an individual basis.

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GB system, a 6-GB system, and two autoloaders of 18- and 42-GB capacities. The Ciera drives provide a data transfer rate of 800 KB/s.

The subsystems come with a SCSI host adapter, a software application kit and user documentation. Pricing for the subsystems starts at \$4,595. The 18-GB autoloader is \$13,700. The 42-GB autoloader is \$14,300.

Cipher Data Products Inc.
10101 Old Grove Road
San Diego, CA 92131-1682
Circle 106

HA! Says Fusion

Fusion Systems has introduced software to provide High Availability (HA) for Sun. The HA software was developed for mission-critical applications being run on or in a network. In the event of a primary server failure, HA shifts the operation to a selected alternative system. HA supports Sun IPI and SCSI disk technologies as well as third-party disk and RAID solutions.

HA features a periodic "heartbeat" protocol that bounces back and forth

between servers to ensure that they are all operating normally. In the event of a failure, the HA software goes into operation automatically and can bring the original server back on-line once its problems have been dealt with.

Fusion Systems Group Ltd.
225 Broadway, 24th Floor
New York, NY 10007
Circle 107

High-Speed Optical Drives

Alphatronix has introduced a line of optical drives which it says are among the fastest in the world. The Inspire II drives have an average seek time of 23 msec, which rivals that of hard disks, and effective access time of 14 msec. The company says this makes the Inspire II an effective competitor to hard disks for most applications, particularly as the product has a capacity of 650 MB in its "F" or low-end version, and 1,021 MB in its "G" high-end version.

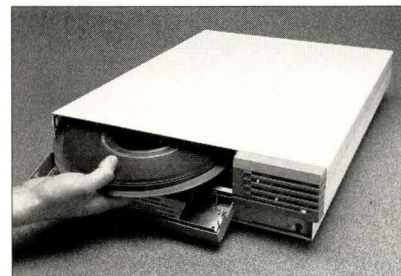
The drives are available in several configurations, including desktop,

stacker, rack-mount and tower versions. The drives are SCSI II-compatible and come with the company's Alpaguard data protection system. Pricing begins at \$4,495.

Alphatronix Inc.
Englert Drive, Suite C
P.O. Box 13687
Research Triangle Park, NC 27709
Circle 108

Nifty Nine-Track

Two nine-track tape drives have been introduced for Sun and other UNIX workstations. The 5612 and the 5212,



from Overland Data Inc., attach via the SCSI port to workstations and provide mainframe-style data storage. The company notes that applications for the products include backup and data exchange between mainframes and workstations.

The 5612 offers 1,600/6,250 bpi, while the 5212 offers 1,600/3,200 bpi. Each drive stands less than 4½ inches tall and weighs 34 pounds. They can fit under a workstation; a rack-mount version is available as well. The 5212 is \$3,495, while the 5612 is \$5,495.

Overland Data
5600 Kearny Mesa Road
San Diego, CA 92111
Circle 109

32-Bit X for Windows

For those who want both X and Windows on their PCs, AGE Logic has introduced a 32-bit X Window System implementation that runs on PCs under Microsoft Corp. Windows. XoftWare/32, which is based on MIT's X11R5 server code, allows users to run Windows-based applications on their PCs while dipping into a UNIX server as an X terminal. The company says that it may be the first PC X product

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to exploit the 32-bit nature of the Intel 386 and 486 processors. Formerly, most PC X products were 16-bit implementations.

That it is 32 bit means that the product has extended direct memory addressing, increased maximum request size up to 256 KB and so on. In addition, the XoftWare/32 automates host login and application start-up through an icon-based "click & start" feature. Pricing begins at \$495.

AGE Logic Inc.
 9985 Pacific Heights Blvd.
 San Diego, CA 92121
 Circle 110

Intelligent Power

An intelligent AC power line controller has been introduced by Pulizzi Engineering. The Z-Line IPC boasts its own microcontroller. The user can specify such functions as remote control of individual outlets or the whole system, sequential power up or down, system lockup and reboot and so on. Password security is also available.

The IPC has four output receptacles.

Its circuit protection is a Slo-Blow 20A Fuse. The data input connector is a RS-232-C. The device weighs four pounds and is 2½ inches high, 5½ inches wide and 9½ inches deep. Pricing is approximately \$225.

Pulizzi Engineering Inc.
 3260 S. Susan St.
 Santa Ana, CA 92704-6865
 Circle 111

Encryption for DAT and CD

Need to give your product or archives a touch of security? Digital Delivery has announced software that will encrypt your files on CD-ROMs, DATs or other distribution or archive technology. Called the Digital Delivery System, the product masters the data onto high-density storage, can manage the resulting encrypted data (even searching it), and then can later unlock it for use. The product can be extensively modified via a variety of optional modules to add such functionality as modem-to-modem connections for on-line processing and fuzzy logic searching.

The product is chiefly meant for vendors of applications or unique data who wish to distribute their products on disk or tape in some catalog form. Pricing is therefore geared toward that end, with either of two options available. Users can pay \$75,000 for a fully featured system, or they can pay a one-time \$10,000 price plus a 10% royalty on products sold with encryption features.

Digital Delivery Inc.
 38 Meriam St.
 Lexington, MA 02173-3618
 Circle 112

RAMs with Watches

For those working on the component level, Dallas Semiconductor has announced a new series of timekeepers that incorporate both a clock and nonvolatile RAM functions accessible in a bitwise format. The DS164X Timekeeping RAM series has memory densities ranging from 2 KB through 512 KB. The chips can be put in ROM, EPROM or EEPROM sockets. Currently there are two models, the

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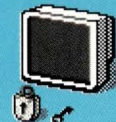
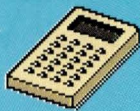
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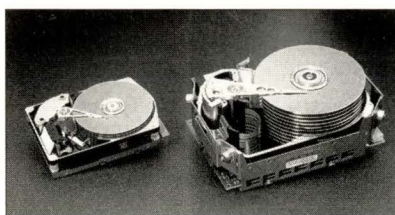
24-pin dual-in-line DS1642 and the 28-pin encapsulated DIP DS1243, though other models are planned for future introduction.

The DS164X pieces have real-time clock registers in the uppermost eight bytes of their memory map. These provide year, month, date, day, hours, minutes and seconds. They also automatically correct the date during leap year. The 1642 is \$13 and the 1643 is \$13.75, both in quantities of 5,000.

Dallas Semiconductor
4350 Beltwood Parkway South
Dallas, Texas 75244-3219
Circle 113

DEC Shows Two OEM Drives

Former mini maven and now micro marvel Digital Equipment Corp. has released two new SCSI-2 disk



drives. The DSP5350 is a 5¼-inch device with 3.5 GB of formatted capacity. The DSP3160, meanwhile, offers 1.6 GB. Both will marketed to OEMs and systems integrators.

The DSP5350 has a rotational speed of 5,400 rpm, an average latency of 5.6 msec, and average seek time of 11.5 msec. DEC says it is meant for high-capacity, high-performance systems and subsystems in a networked environment. The 3160, meanwhile, has the same rpm and latency and an

average seek time of "under 10 msec." DEC says it is meant for "space-limited" systems, such as workstations and PCs. Pricing on the 3160 is \$1,995, while the 5350 is \$3,495.

Digital Equipment Corp.
Maynard, MA 01754-2571
Circle 114

New Disk for VME

A disk module to provide mass storage in a VME card cage has been introduced by ACT/Technico. The module comes in two versions, compatible with the Sun 1E and 2E Force CPUs, respectively. It provides a mass storage choice of a SCSI floppy or tape drive along with a hard drive offering up to 1 GB.

The module uses three slots within a VME card cage. It provides an electrical bypass of the BUSGRANT and IACK signals through an integrated backplane. Pricing begins at \$2,250.

ACT/Technico
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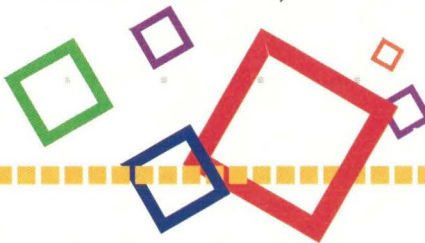
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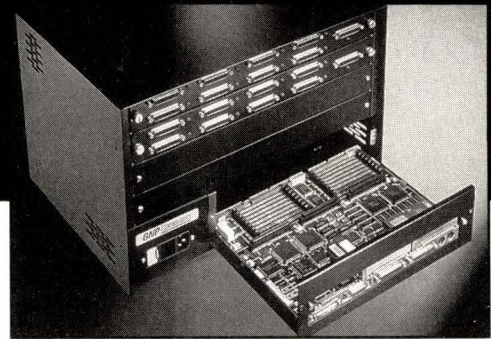
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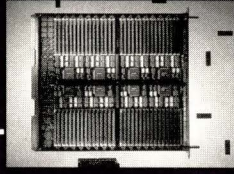
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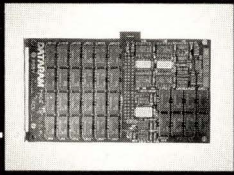
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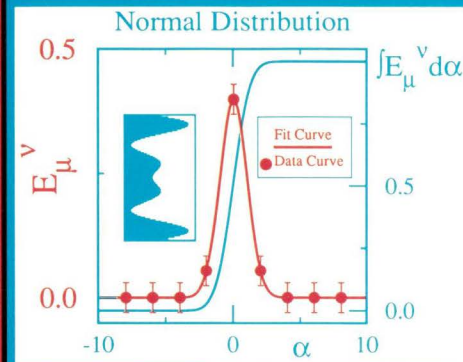
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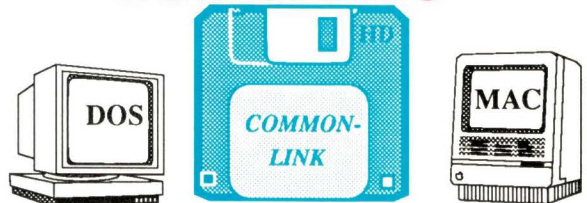
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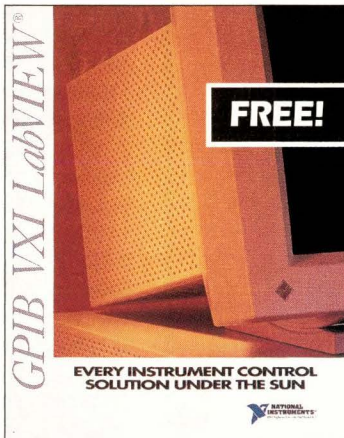
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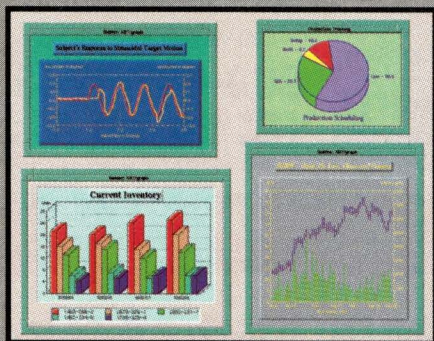
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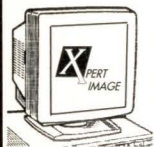
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READER INQUIRY NUMBER	PAGE	READER INQUIRY NUMBER	PAGE		
40	Alpha Technologies	42	20	Itac Systems	16
1	Apex Computer	12	21	IXI	80
2	Apunix Computer	11	39	Lago Systems	45
3	Artecon	7	22	Larabie Distributing	59
4	Aurora Technologies	57	23	Minicomputer Exchange	31
5	AT&T	77	24	Overland Data	79
6	AT&T	79	25	Quality Software	78
7	AT&T	81	26	Race GmbH	81
8	Comtec Automated Solutions	51	27	Rave Computer Association	56
9	Contemporary Cybernetics	41	28	RC Electronics	59
10	Cosystems	77	29	Scientific Computing Associates	21
11	Disk Emulation Systems	18	30	Sun Microsystems	inside front cover-1
12	Engineering Design Team	47	31	Sun Select	32-33
13	Falcon Systems	22-23	32	Sun Technology Enterprises	25
14	Green Hills Software	61	33	Super Workstations	46
15	Helios	9	34	Tech Source	5
.....	IBM RS/6000	35	35	Tektronix	back cover
16	IBM TPCIP	14-15	36	Transitional Technology	55
17	IGM	53	Uniform	82
18	Intersolv	19	37	UniSQL	13
19	Introl	inside back cover	38	ZZYZX	2

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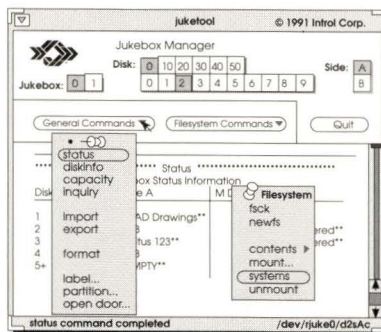
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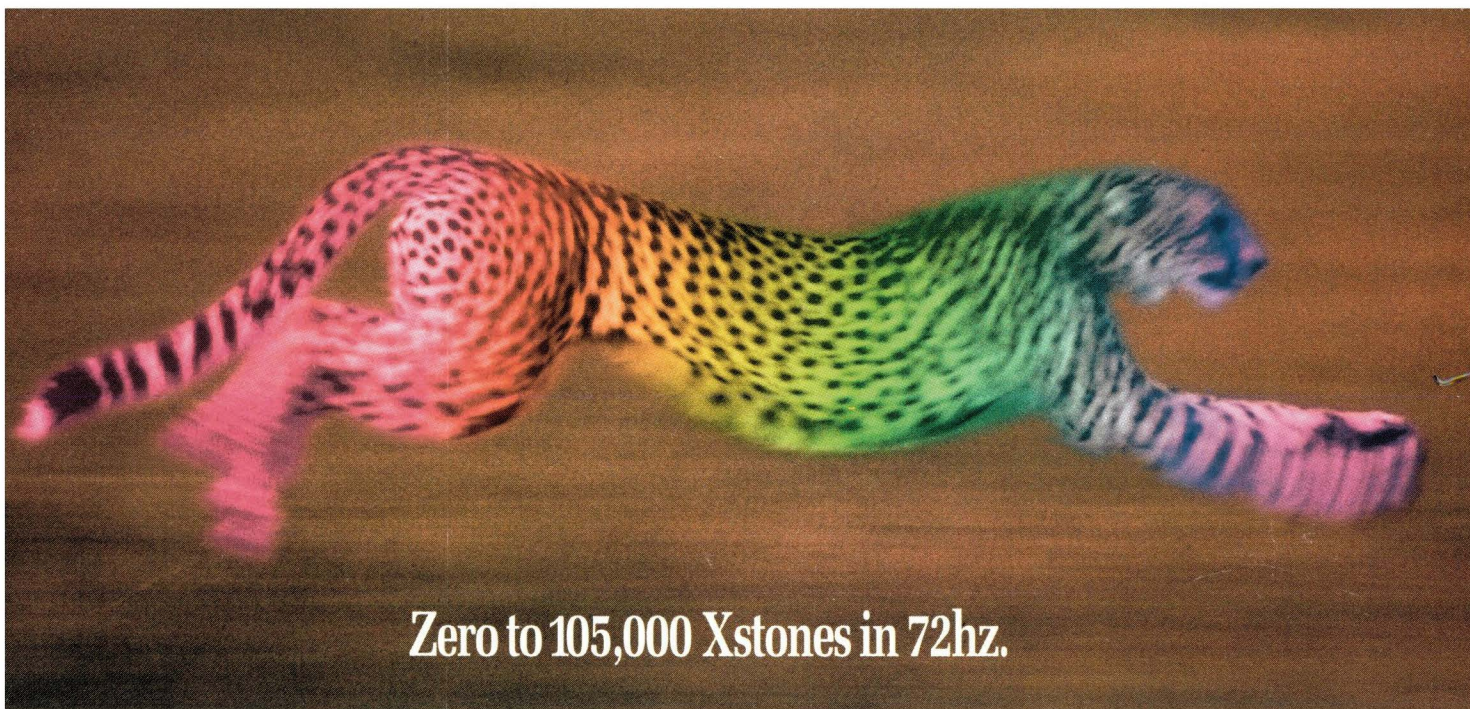
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