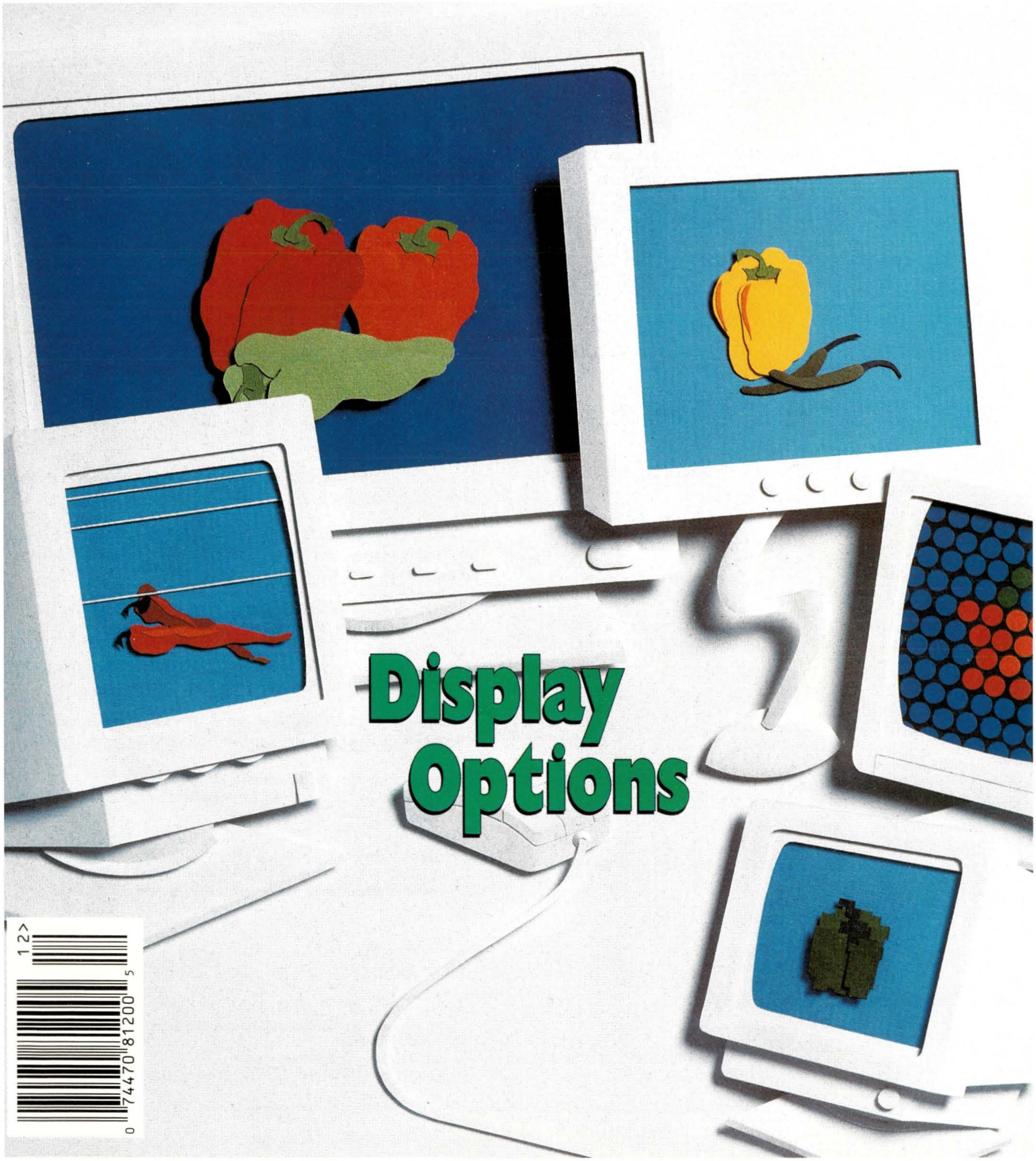
Incorporating RS/Magazine

DECEMBER 1997 Vol. 8 No. 12 $5.50

SUNEXPERT

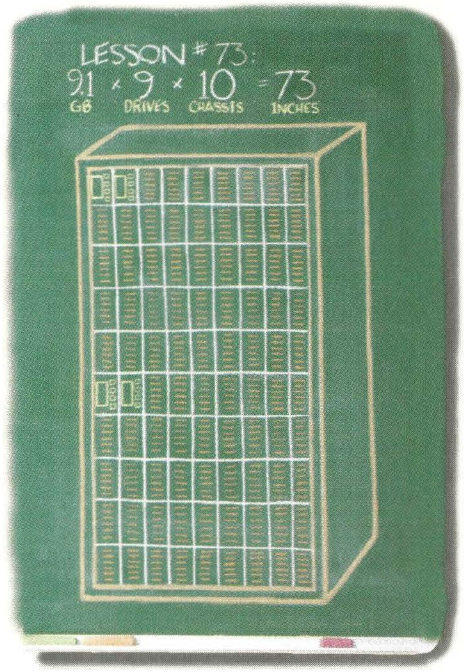
The Server/Workstation Magazine for UNIX/NT IS Managers



urvey: Monitors

UNIX Basics: A Shell Road Map

Artecon's New RAID Math

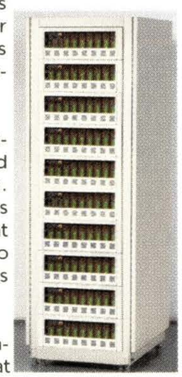


New RAIDvisor™ Software

Graduate to the Next Level.

9.1 X 9 X 10 = 73

Other entry-level RAID systems require you to anticipate your future storage needs due to confusing choices in controllers and enclosures. Graduating to the next level becomes difficult, if not impossible. LynxArray™ gives you true scalability by featuring the same controller and enclosure architecture whether you have 9 drives or 90 drives. You can start with a deskside tower using 9.1GB drives, increase your capacity ten times and move to a 73.5" rack with 100% investment protection.



From any entry point to a multi-terabyte RAID solution, each LynxArray component can be used toward your system's move to the next grade. Multiple hosts are supported, allowing for numerous configuration options. So you can really show that you've done your homework when you need to increase your storage capacity with Artecon's LynxArray.

No other RAID system on the market offers the scalability and investment protection of LynxArray - at any price.

For departmental to enterprise storage needs, LynxArray offers these top-of-the-class features:

- **Performance** - Our RAID controller surpasses the competition with I/Os of up to 4600 per second. Ultra-Wide, end-to-end SCSi achieves transfer rates of 40MB/s burst and 33MB/s sustained.

- **Hot-Swappable Controllers** - Hot-swap removable controllers allow for high availability and redundancy of your RAID system.

- **Package Density** - Configure up to 82GB of total capacity and still have room for hot-swappable failover controllers in only 7" (4u EIA).

- **JBOD/Tape Inline** - Backup your RAID system inline with DLT or hot-swap 8mm tape devices all within the same LynxArray chassis.

LynxArray subsystems are compatible with Sun, HP, SGI, IBM, Macintosh and PCs. Custom configurations and -48VDC telco models are also available.

So, if you are looking for a new and better way to solve your RAID storage problems, study up on Artecon's New RAID Math. **Check out our website or give us a call to see how it all adds up!**

1-800-USA-ARTE
www.artecon.com/raid

Artecon
Capturing The World In Storage™
A Member of the Nordic Group of Companies

RAB

6305 El Camino Real, Carlsbad, CA 92009
Phone 760-931-5500, FAX 760-931-5527 email: raidmath5@artecon.com
Nihon Artecon 81-03-5458-8260 ▲ Artecon B.V. 31-53-483-2208 ▲ Artecon France 33-1-6918-1850 ▲ Artecon U.K. 01344-636390

Circle No. 1

Incorporating RS/Magazine

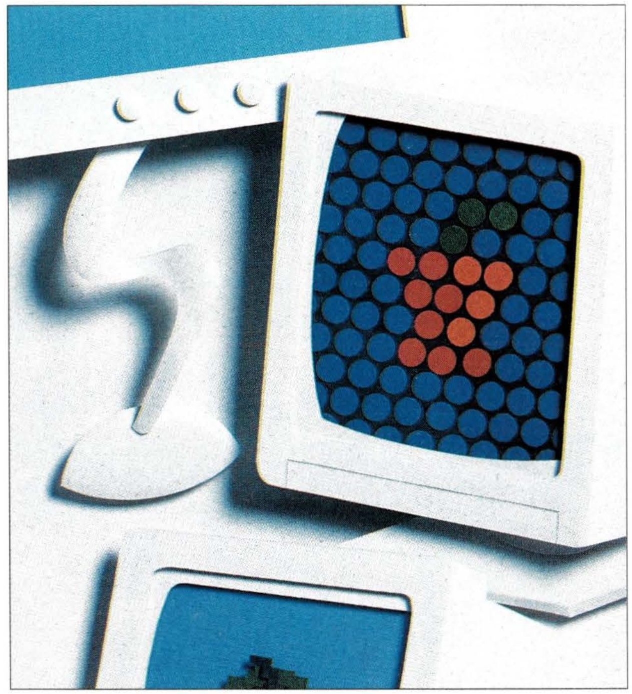
World Wide Web
http://www.cpg.com

SUNEXPERT

December 1997
Volume 8
Number 12

The Server/Workstation Magazine for UNIX/NT IS Managers

CONTENTS



PAPER SCULPTURE: DENISE ORTAKALES

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

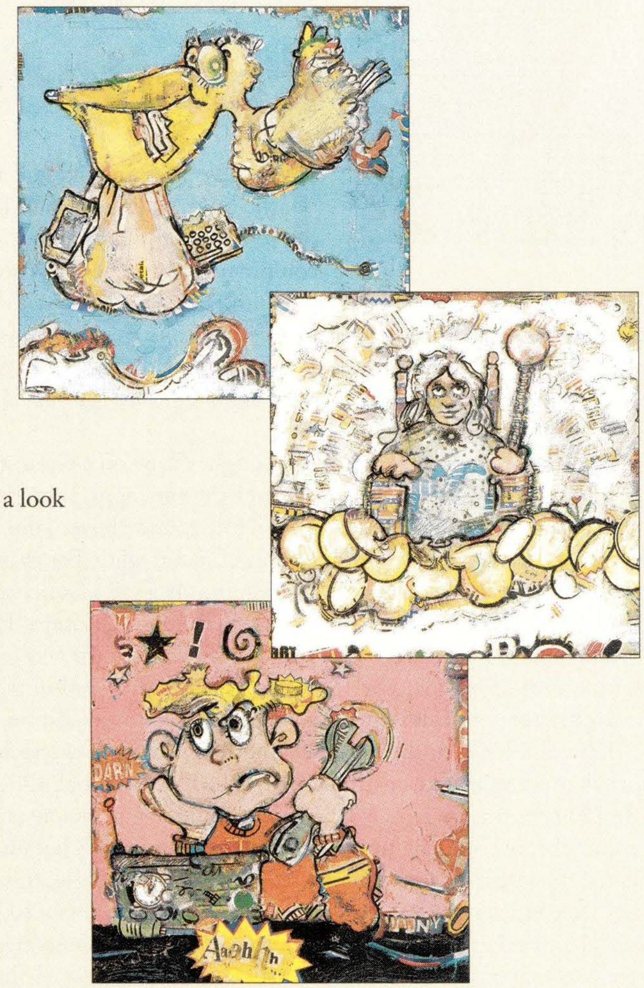
POSTMASTER, please send all address changes to *SUNEXPERT* Magazine, Circulation Department, 320 Washington St., Brookline, MA 02146. Please allow 6-8 weeks for change of address. Include your old address as well as new–enclosing, if possible, an address label from a recent issue.

Feature

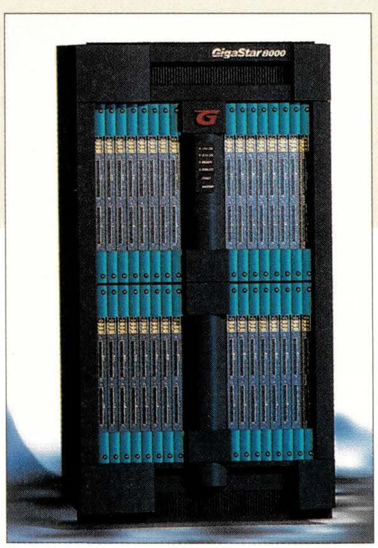
SUPPLEMENT begins Page 62

RS/Magazine

Columns



Columns illustrated by DANIEL C. O'CONNOR



Page 83

Departments

BONUS DISTRIBUTION OF THE FEBRUARY ISSUE:

Internet Expo, *San Jose, CA*

BONUS DISTRIBUTION OF THE MARCH ISSUE:

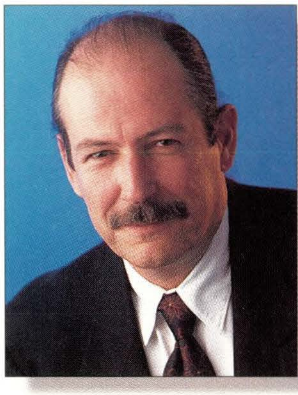
Spring Internet World, *Los Angeles, CA*
Internet Commerce Expo, *Boston, MA*
Comdex Enterprise West, *San Francisco, CA*

BONUS DISTRIBUTION OF THE APRIL ISSUE:

Comdex/Spring, *Chicago, IL*

EDITORIAL

dpryor@cpg.com



Monitor Monitoring

If you're anything like me and most of the buyers I know, when it comes time to replace old or buy new computer equipment, you fret over processor speed, system throughput, I/O speed, price and so on. We overlook what stares us in the face: the monitor, that is. It is easy to forget that Sun is not the only choice for us. In his last story as a staffer with *SunExpert*, Senior Editor John Webster discovers a world of "Display Options for Sun Users." (All of us wish John the best.)

Rather than look at monitors you might throw on a server to be a console or on a desktop to be used for run-of-the-mill apps, John decided to take a look at some large-format displays–19 inches and above. John also explores some of the trends in monitor design and functionality. For example, when Sun introduced the Ultra 30 workstation in July, it also launched a whole new class of monitors. The 24-inch high-definition television (HDTV) display offers 30% more screen area than a 20-inch monitor and features screen resolutions of up to 1,900 by 1,200 pixels at a 70-Hz vertical refresh rate, and an aperture grille dot pitch ranging from .26mm to .29mm.

John also looks at the flat-panel market. Although the technology is more than 25 years old, it still hasn't reached its potential. Of course, price is prohibitive, but there may be a chicken-and-egg principle at work here. (I mean chicken and egg in this sense: The price is high because it hasn't reached its potential, and it hasn't reached its potential because the price is high). Nonetheless, in user environments such as the financial market, medical and other imaging and even in some industrial settings, where space is at a premium and image clarity is a must, flat panels have found a niche. So despite the high retail price compared with CRTs, the technology is still finding growing, if slow, acceptance in the desktop monitor market.

Be sure to check out the survey of large-format monitors by Research Editor Maureen McKeon.

I would like to know whether or not you've experimented with monitors from vendors other than Sun. Drop me a line at `dpryor@cpg.com`.

Doug Pryor

Incorporating RS/Magazine

SUNEXPERT

The Server/Workstation Magazine for UNIX/NT IS Managers

December 1997 Vol. 8 No. 12

Publisher	S. Henry Sacks shs@cpg.com
Editor-in-Chief	Douglas Pryor dpryor@cpg.com
Managing Editor	Lisa Guisbond lisa@cpg.com
Senior Editor	John S. Webster johnw@cpg.com
Technical Editors	Ian Westmacott ianw@cpg.com Richard Morin rdm@cpg.com
Contributing Editors	Michael Jay Tucker Simson L. Garfinkel Mark Seiden
Research Editor	Maureen McKeon mm@cpg.com
Staff Editors	Alex Simeonides alex@cpg.com Patrick T. Coleman pat@cpg.com
Production Editor	Lisa Bucher lisab@cpg.com
Marketing Manager	Susan R. Sacks srs@cpg.com
Art/Production Director	John W. Kelley Jr. jwk@cpg.com
Senior Designer	Jerry Cogliano jerry@cpg.com
Designer	Brad Dillman bdillman@cpg.com
Production Assistant	Joseph MacDonough joem@cpg.com
Circulation Director	Deborah Moore dm@cpg.com
Circulation Coordinator	Gregory Hart ghart@cpg.com
Administrative Assistant	Tina Jackson jamal@cpg.com

World Wide Web
http://www.cpg.com

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

BPA INTERNATIONAL®
Printed in USA

Next-Generation UltraSPARC Announced

Beginning next summer, expect Sun Microsystems Inc. to roll out systems equipped with 64-bit 600-MHz UltraSPARC-III chips, the first members in the new generation of the UltraSPARC microprocessor family.

Sun announced the UltraSPARC-III in October to a receptive chorus of oohs and aahs over the chip's impressive clock speed. At 600 MHz, the UltraSPARC-III runs at twice the speed of the fastest UltraSPARC-II currently available (300 MHz), which Sun officials say translates into a two- to three-times performance boost. And while Sun has yet to publish any official benchmarks, the company expects initial versions of the Ultra-SPARC-III to deliver SPECint95 results of 35, and SPECfp95 of 60.

What's more, Sun has stated that it will build systems based on the Ultra-SPARC-III that contain 1,024 processors. Current Sun systems scale to 64 processors, as seen with the Ultra Enterprise 10000, or Starfire. However, Sun did not specify when exactly it might be able to demonstrate such a system.

Other features of the new Ultra-SPARC-III chip design include the VIS instruction set and a 2.4-GB/s memory bandwidth.

The kinds of applications for which the UltraSPARC-III is well suited won't come as any surprise. Candidates include computer-aided design (CAD), electronic design automation (EDA) and scientific modeling, as well as database applications such as data warehousing. In short, Sun says, applications that work with large data sets, or that must rapidly increase capacity, would do well with the UltraSPARC-III.

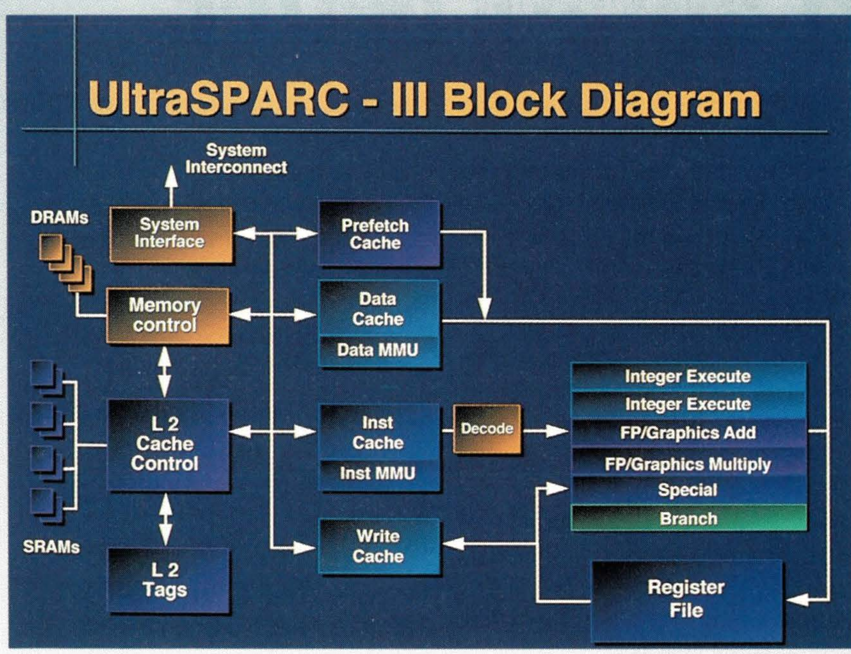
Chips with clock speeds of 600 MHz were until now the exclusive domain of Digital Equipment Corp., whose RISC-based Alpha chip runs at 625 MHz. And while the Alpha could very well hit clock speeds of 800 MHz by the time the UltraSPARC-III ships, according to Andrew Allison, industry analyst and publisher of the newsletter, *Inside the New Computer Industry*, "the SPARC architecture is more efficient than Alpha." Therefore, Allison says, expect comparable performance from the two chips, even if in terms of clock speed the Alpha continues to beat the Ultra-SPARC-III.

But while analysts bow down to the Alpha's technological superiority, most do not view it as UltraSPARC-III's principal competitor. "Digital has a phenomenal product," says Jennifer Cooke, analyst with International Data Corp. (IDC), Framingham, MA, "but for some reason it never really caught on."

The chip most observers expect will compete with the UltraSPARC-III is Intel Corp.'s IA-64 chip, or Merced. Expected to ship sometime in 1999, Merced represents Intel's first stab at a 64-bit processor. And while the company has divulged few specifics about the chip, rumors of phenomenal performance and a 1,000-MHz clock speed abound.

Sun has publicly pooh-poohed Merced on its Web site (see, `http://www.sun.com/sparc/hottopics/merced.html`), insinuating that Intel lacks experience in producing scalable, enterprise-quality microprocessors, and that customers running 32-bit applications will not enjoy the performance benefits of the 64-bit architecture.

Nevertheless, Merced is a force for the UltraSPARC-III to reckon with, as one by one, traditional UNIX vendors show signs of a weakened commitment to the UNIX/RISC platform. IBM Corp., Hewlett-Packard Co. and DEC all offer both UNIX and NT. What's



In October, Sun announced details of its new UltraSPARC-III chip, set to ship in 1998. With a clock speed of 600 MHz, Sun says it is twice the speed of the fastest UltraSPARC-II on the market.

Prism Library Architecture,™

Created for growth and capable of adapting to new technology. Prism's industry standard PCI slots allow for a future of high performance PCI adapters. Fibre-channel host adapters. Gigabit network adapters. Single-board computers with embedded backup software. Tape array adapters with mirroring, automatic drive fail-over and more!

Fibre Ready.
Network Ready.
Server Ready.
Array Ready.

The P1000 Series. A bundle of performance, capacity and fault-tolerance that's incredibly easy-to-use. Up to 30 cartridges and 4 DLT™7000 drives. Rackmount or deskside enclosures. Hot-swap DLT drives. Security, admin and service from a browser-like touch screen. WebAdmin™ software for library administration anywhere on the world wide web. Prism Inside.

One day all libraries will have Prism Library Architecture.

ATL PRODUCTS

Quantum
Capacity for the Extraordinary

www.atlp.com 714.774.6900

more, HP codeveloped Merced with Intel, and DEC has handed off the fabrication of its Alpha chips to an Intel facility, as well as having signed a cross-patenting agreement with Intel in the settlement to a patent-infringement lawsuit. Indeed, analysts wonder whether the terms of the Intel-DEC deal sound the death knell for the Alpha, essentially leaving the UltraSPARC alone in its class of high-performance RISC chips. IDC's Cooke, for one, thinks so: "My take is that Alpha is going to die at about the same time that Merced is announced."

For Allison, Merced's success hinges on whether or not Intel will be successful at scaling the processor–an area in which Intel has so far shown very little expertise. Allison quips that some Intel x86-based systems have actually gotten less performance from four processors than from one.

A lot hinges, therefore, on the terms of the Intel-DEC deal. "Digital's crown jewel is their high-speed logic design capability," says Allison. "Whether Intel got access to that technology under the NDA [nondisclosure agreement], nobody knows."*–as*

SunReady Simplifies Product Selection

Sun Microsystems Inc.'s new SunReady program informs customers that third-party products developed for Sun's network computing environment meet specific standards for ease of installation, ease of use and management, according to Sun. Products that meet these standards will carry the SunReady logo, a symbol to Sun customers that these products have been tested to operate and integrate in the SPARC Solaris environment.

For a product to carry the SunReady logo, it must first be tested by VeriTest & Trade Inc., a Santa Monica, CA-based independent computer products testing laboratory. During the process, which takes two weeks, products are evaluated for platform support, ease of use, ease of installation and interoperability. Special attention is given to areas such as platform support, Solaris compliance and product documentation clarity. Qualifications for testing are set by Sun, and only products that pass these tests will be allowed to market the SunReady brand.*–mm*

Next Phase for Sun Clusters

Not long ago, Sun Microsystems Inc.'s clusters were limited to two nodes, restricted to certain hardware configurations and focused primarily on application failover. This placed Sun clusters functionally ahead of Microsoft Corp.'s WolfPack offering, for sure, but a good bit behind its clustering brethren from IBM Corp., Hewlett-Packard Co. and Digital Equipment Corp. In October, however, Sun announced it had reached the second phase (of four) in its Full Moon clustering initiative, giving it a cluster story worth mentioning.

Today, Sun clusters can consist of up to four nodes made up of any combination of Ultra Enterprise servers, be it a modest Enterprise 1, or a top-of-the-line Enterprise 10000. Nodes can be linked via a high-speed, low-latency interconnect (latencies as low as 3.9 microseconds running at 200 MB/s), based on CluStar/4 cards and switches from Dolphin Interconnect Solutions Inc., Framingham, MA. And the list of supported storage subsystems has been expanded to include the Sun RSM Array 2000, as well as Fibre Channel offerings to be announced later.

Another difference in Full Moon manifests itself in the clustering software. Gone are the days of Solstice HA, which provided failover services, as distinct from parallel database (PDB), which offered functions for running a database in parallel. Instead, Sun now provides a single product, Sun Cluster 2.0, which merges both functional offerings in a unified package. This latest version of Sun Cluster also supports high availability for BEA Systems Inc.'s Tuxedo TP monitor, in addition to pre-existing HA support for Netscape Communications Corp.'s Internet services, Sun's NFS, as well as major relational databases.

Sun maintains that people cluster first for availability, and then for performance. To that end, Sanjay Sinha, marketing manager for Solaris servers, emphasizes the 99.997% availability of the Enterprise 10000, which translates to approximately 15 minutes of downtime a year. Other availability features of the E10000 include dynamic reconfiguration, which allows servers to attach and detach CPUs, memory and I/O devices without disrupting the production environment; and Dynamic System Domains, analogous to logical partitioning in the MVS world. Sun announced that it plans to bring these features to the Enterprise 3000 and 6000 as well, beginning in the spring of 1998.

Analysts agree that, with respect to UNIX cluster competitors, Sun has succeeded in playing catch-up. "This is a very solid offering," says Bob Sakakeeny, analyst with The Aberdeen Group, Boston, MA. And while the number of nodes supported in Full Moon clusters pales in comparison to, say, IBM's 128-node RS/6000 SP, analysts mirror Sun's sentiment that the number of nodes in the cluster is less important than the overall performance of the system. "Don't forget that if you cluster four 64-processor Enterprise 10000s, that gives you the processing power of 256 CPUs," says Joyce Bucknell, director of distributed computing research at the Business Research Group (BRG) in Newton, MA. "Sun has pushed the proverbial ceiling of scalability past what anyone would realistically need, at least for the time being," Bucknell says.

Still, analysts are not fully satisfied

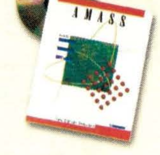
Enjoy

AMASS® software will give you more free time to enjoy life, with worry-free data storage. You won't be spending endless hours, or late nights, in the office gnawing on network storage problems.

AMASS gives you the freedom to choose the optical or tape library, and media, that best meets your specific storage requirements. And AMASS is so easy to use. Your applications simply read and write files to the library as if it were a single large magnetic disk. An on-line index tracks files, on media in and out of the library, for fast file system operations. Magnetic disk caching provides high performance. AMASS supports all of the most popular UNIX and Windows NT* platforms.

AMASS Supported Libraries			Media	
EMASS	IBM	Philips LMS	5.25" optical	SD-3
ATL Odetics	IDE	Plasmon	12" & 14" WORM	VHS
Breece Hill	Kodak	Sony	CD ROM	3490/90E
Cygnet	Maxoptix	StorageTek	Quantum DLT	Others
DISC	MountainGate	Others	Sony DTF	
Hewlett Packard	Panasonic		IBM 3590	

So, lick your data storage problems, call now for a free AMASS overview book or a 30 day free software trial.



EMASS

A Raytheon E-Systems Company

1-800-653-6277 • storage@emass.com • http://www.emass.com

Circle No. 5

with the Sun cluster offering. "I'd like to see Sun support non-Sun storage," suggests Aberdeen's Sakakeeny, "and show that they can work [in parallel] with databases other than Oracle."

For BRG's Bucknell, it's a matter of time. "The problem Sun has with clustering is the same that they have with servers: They're new at this. It's a maturity issue."*–as*

'When I'm 64'

The wraps have come off IBM Corp.'s new server called the RS/6000 S70. The machine is being positioned against Sun Microsystems Inc.'s Ultra Enterprise 5000 and Hewlett-Packard Co.'s K570, and is available as a four-, eight- or 12-way symmetric multiprocessor (SMP).

In addition to increased performance, the S70 also marks IBM's foray into the 64-bit market. The S70 uses four PowerPC RS64 microprocessors mounted on a single circuit board housed in a protective "book." The S70 can be installed with up to 16 GB of memory to support 64-bit applications. All processors and memory books slide into slots housed in a single tower for performance upgrades.

Coupled with the announcement of the S70, IBM has released AIX 4.3, which runs both 32- and 64-bit applications. "We really think we have it all coming together," says Don Johnson, IBM RS/6000 manager for enterprise systems. "The hardware, the software and the middleware, stacks up real well against the competition."

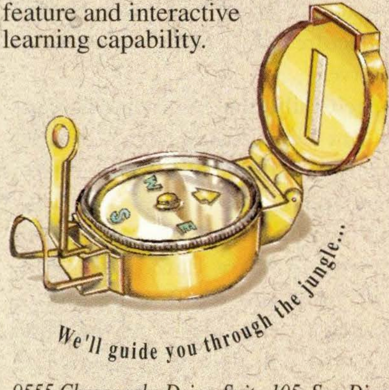
I/O features are housed in a separate rack from the processing tower. Each rack contains either one or two I/O drawers with PCI slots for attaching disk files, communications adapters or terminals. Each drawer contains 14 slots and can include five 64-bit and nine 32-bit slots and 12 hot-swappable disks for up to 54 GB of storage. Both SSA and SCSI disks are supported for additional capability.

IBM hopes the S70 will spruce up the RS/6000 line as it competes against other UNIX systems. Analysts agree that it's an improvement performance-wise over previous machines offered in the product family. In addition, the I/O capacity is comparable to what Sun is offering with its 5000 and 6000 lines and better than what HP can do with its K-Class. "It's a big improvement over the best that they were able to offer in the past. The S70 is twice as powerful as a R50, their fastest SMP machine so far, and the pricing is very aggressive," says Paul McGuckin, vice president of server research, Gartner Group Inc., a research firm based in Stamford, CT. "It still falls far short of where HP and Sun have been able to go in terms of scalability."

McGuckin feels that while the S70 is an improvement, it might not be enough to gain ground on its UNIX competitors. "Will it be enough to keep all of the RS/6000 customers from having to bring in an HP or a Sun? No, it won't help for all of them,"

Document Imaging

Whether you are scanning documents, letters, or photographs, we will fulfill your needs with Apunix's scanners. To convert your scanned documents to text on your SPARCstation™ system, Apunix offers the latest and most advanced document recognition software available today. ***CharacterPro***™ has both omnifont and trainable technologies in one easy to use package. It can handle character recognition on documents ranging from one page to hundreds of pages. Even correcting and training multipage documents is easy with CharacterPro's unique font review feature and interactive learning capability.



OpenScan™

Apunix's award winning software is ideal for both document and color scanning applications. It is both full-featured and easy to use for the novice user so that production scanning is a breeze. The OpenScan software kit consists of a loadable SCSI device driver for Solaris® 1.X and 2.X, the OpenScan GUI (Graphical User Interface) allowing access to all hardware features supported by each scanner, a UNIX-style command line scan program for prototyping or easy integration, the Remote ScanServer Daemon that turns the scanner into a true workgroup device by allowing scanning from remote Sun® Workstations™ and X-Terminals, GammaTool for creating and loading gamma tables into the scanner, and our device independent API (user callable library) for incorporating scanning into your own application. OpenScan supports an extensive list of scanners.

Call for more information on the fine products from Apunix

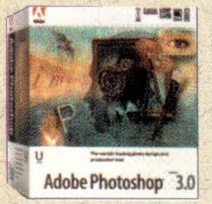
1-800-8APUNIX

Apunix

Color Imaging

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

**Adobe Photoshop™ plug-in included.*



Sun
Value Added Reseller

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

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

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

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

Circle No. 7

IBM has unveiled its latest SMP server, the 64-bit RS/6000 S70, which can be installed with up to 16 GB of memory to support 64-bit applications.

he says. "It won't meet all the performance requirements out there, but it will meet a portion."

One customer hoping the S70 will meet his requirements is Mark Davydov, director of new technologies at Edison Brothers Stores Inc., operator of 1,600 specialty apparel stores throughout North America and headquartered in St. Louis, MO. His company is developing and implementing a data warehouse, and after comparing systems from HP and Digital Equipment Corp., he decided to go with the S70. "We've done benchmarking of other 64-bit implementations and we've found the S70 will be able to achieve what we're planning," Davydov says.

Edison Brothers Stores has six divisions that will be connected to the data warehouse that will support up to 300 users. "This is what the machine is intended for," Davydov says. "We are planning to explore 64-bit extensively."

HP's new operating system, HP-UX 11, will offer 64-bit capabilities, and Sun plans to ship a 64-bit operating system with full 64-bit support next year.

In related news, IBM has announced the RS/6000 Model 397 workstation, based on the POWER2 SuperChip (P2SC), and processor enhancements to the 43P Model 140 workstation and workgroup server. While the S70 is targeted for business users, the 397 and 43P are geared to handle the demands of scientific researchers, engineers and product designers. The Model 397 registered a SPECfp95 benchmark of 25.8, and the 43P Model 140 now has 332-MHz processing power.*–ptc*

Java Report Card

A recent study conducted by Redwood City, CA-based Zona Research Inc., a subsidiary of IntelliQuest Information Group Inc., in an attempt to define and quantify the Java market, estimates that $58 million will be spent on Java programming tools by the end of this year. Further, the report, entitled "Java: Markets, Opportunities, and Trends," predicts that the market will triple by the year 2000, reaching nearly $180 million in revenues.

Zona defines Java as a language with a supporting environment that enables cross-platform application development. Thus, the research company differentiates between the Java language and Java-based products. Ron Rappaport, analyst with Zona, contends that products such as a Java-based server are bought not because of a need for Java but rather a need for a server. "That [server] vendor is capitalizing on a perception associated with Java as opposed to examining the value of the technology within," he says. "The Java market as it exists today is driven completely by sales of Java development tools, not by products that are simply written in Java."

Lew Tucker, director of developer relations with Sun Microsystems Inc. subsidiary JavaSoft, agrees that people are not buying products just because the word Java is associated with them. "People always buy things out of need. I don't think people buy things because it has some fancy title," Tucker says. "People that are buying Java products are buying them specifically because they need products that work in this multiplatform, cross-platform space."

The Java development tool market will grow based on the inherent merits of Java in terms of efficiency gains over other development languages, according to Zona. "Casual estimates are that it will save 70% to 80% of development time, translating into reduced costs of development," Rappaport says. "That is a compelling reason to use the language."

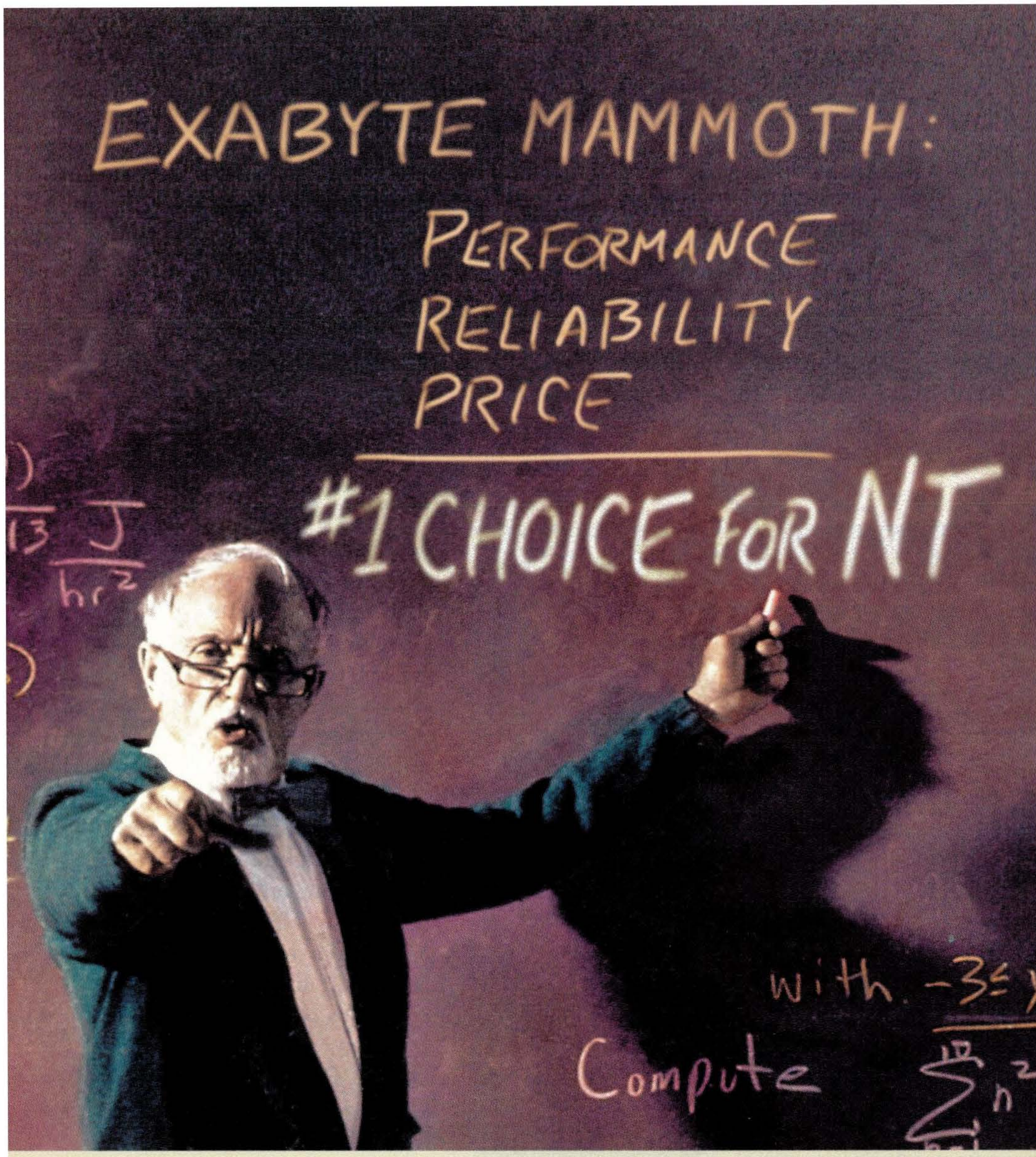
In addition to the savings in development time, JavaSoft's Tucker says other benefits of using Java as a development language include a reduction in bugs found during the testing phase of application development and the "write it once and run it everywhere" promise of Java. "The back end cost of porting that product to 10 or 11 platforms goes to zero," Tucker says.

The report notes several other findings as significant: Java is not an operating system and cannot convincingly challenge operating systems or platforms on the desktop such as UNIX, Windows or Mac OS. Zona claims there is no parity between Java OS and other operating systems, and comparisons such as Windows versus Java are invalid. In addition, Zona believes the opportunity for server-side Java exceeds the opportunity for Java on the client side and that vendors are turning to HTML to complement their Java cross-platform strategies. Also, the report states, "the Java Virtual Machine is a priceless technology that has infinite technological value but a discrete market value of zero."*–ptc*

IBM Adapters for Sun Servers

IBM Corp. continues to roll out new products and technologies for its Seascape Storage Enterprise Architecture system. The latest is a new adapter that connects Sun Microsystems Inc. servers to IBM serial disk technology. The IBM SSA-to-Sun SBus Interface Controller card provides native attachments for the IBM 7133 Serial Storage Architecture (SSA) Disk Subsystem to Sun servers.

Specifically, the SSA adapters support Sun Ultra Enterprise 2, SPARC 20, 1000, 1000e, 2000 and 2000e servers and the Solaris 2.4 and 2.5.1 operating systems. IBM also plans to support Sun Ultra Enterprise 3000, 4000, 5000 and 6000 sometime in 1998. Until the release of the IBM SSA-to-Sun SBus Interface Controller card, the 7133 SSA Disk Subsystem

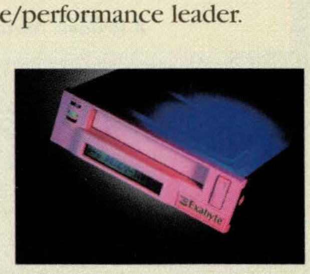


You Do The Math

Exabyte Mammoth technology adds up to better backup.

Far better, in fact, than anything offered by DLT™. If you've been thinking about DLT's "fast throughput" – think again. Independent testing demonstrates Mammoth's superiority in real-world backup applications. Certified by Microsoft® to be Windows NT® compatible, Mammoth is also certified in our laboratories for optimum performance in NT and UNIX® environments. This performance combined with competitive pricing make Mammoth the price/performance leader.

Mammoth wins on reliability, too. While a Mammoth drive writes to a tape in a single, gentle pass, a DLT drive demands 64 high-tension passes to do the same job. Small wonder that Mammoth 8mm tape drives are rated significantly more reliable than comparable DLT products. And with Mammoth's availability, it all adds up.

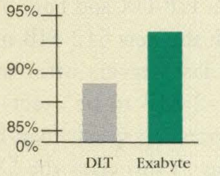


Want proof? The independent reviews are in and are yours for the asking. Just give us a call at 1-800-EXABYTE for your free #1 CHOICE packet or visit our web site at www.exabyte.com.

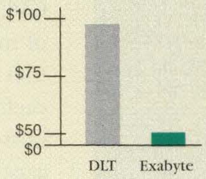
Exabyte. The recognized leader in UNIX, the #1 choice for NT.

MICROSOFT® WINDOWS NT™ COMPATIBLE

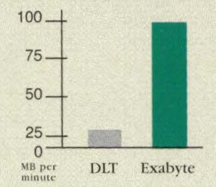
Independent tests are in: Exabyte Mammoth is the #1 choice for NT.



Annual Reliability Rate



Cost per Megabyte



Backup Performance

Exabyte®
www.exabyte.com

Circle No. 8

could be attached to a Sun server via the 7190 SCSI Host-to-SSA Loop Attachment. "While we've seen increased performance across the SCSI bus because of the 7190 interface to the SSA at the disk level, we think that we'll have significantly better performance in this native attach to Sun, via this SBus adapter," says John Bynum, program manager of open systems storage marketing at IBM's storage systems division. "We'll still offer the 7190 but, except for perhaps some unique situations, we think the [IBM SSA-to-Sun SBus Interface Controller card] would be the preferred method of attaching to Sun."

IBM announced it's long-awaited Seascape Storage Enterprise Architecture in June, and describes it as a building-block approach to creating and upgrading a storage system that is centrally managed on a UNIX platform. The various building blocks include storage components such as tape and optical drives; RISC processors; network platform attachments (these include adapters that connect to Fibre Channel, SCSI, Ethernet and token-ring networks); software; and intelligent adapters for connecting to the storage server.

The new SBus Interface Controller card has the SSA chip set on it and creates a node in the Sun server that directly attaches into the SSA loop. IBM says one card can offer support for clustering up to four Sun servers with a single 7133 SSA Disk Storage Subsystem, while two cards can be attached per server. The SBus Interface Controller card is available for $2,500. "Each card can handle 3,000 I/Os per second, and you can attach up to 48 disks for something like 436 GB on a single loop," Bynum says. "Since you can attach two cards, you actually address up to 873 GB per server."

IBM also offers SSA disk storage solutions for Hewlett-Packard Co., Digital Equipment Corp., Compaq Computer Corp., Microsoft Corp. Windows NT and IBM servers.–*ptc*

HP Targets High-, Low-End Users

Hewlett-Packard Co. has rolled out two entry-level servers geared for small to medium-size environments and one targeted at the high-end, technical computing market.

The HP 9000 D-Class Enterprise RISC-based servers, geared for customers interested in entry-level commercial applications, have been named the Model D280 and the Model D380. The servers are powered by HP's 180-MHz 64-bit PA-8000 RISC processors and are offered with either one or two CPUs. They run HP-UX and have 3 GB of memory with the new 512 MB modules. The D-Class servers offer more cache memory–2 MB to be exact–and boast higher processing speeds than HP's existing offerings in this class–the D270 and D370.

Differences between the two new D-Class models include disk drive bay and I/O slot offerings. The Model D280 has five I/O slots and two drive bays, and the Model D380 offers eight I/O slots and five drive bays. Pricing also differs slightly, with the D280 starting at $25,450 and the D380 starting at $30,490.

The new models are the fifth performance improvement to the D-Class family since it was introduced less than two years ago. HP says that it is enabling customers to protect their initial server investments with easy "in-cabinet" upgrade paths through many performance, I/O and storage points. Additional D-Class models are planned for release in 1998 and will continue to expand the performance and range with future in-cabinet upgrade paths, according to HP.

At the higher end, HP announced the HP 9000 Exemplar K370, K570 midrange servers and the V2200 high-end server. The K370 and K570 scalable servers support one to six processors and clients running either UNIX or Windows NT. Both models take advantage of a 200-MHz RISC processor. Pricing for the K370 with 4 GB of memory starts at $66,500, and pricing for the K5780 with 8 GB of memory starts at $86,500.

The V2200 can be configured with 16 GB of memory and is scalable up to 16 processors. Pricing starts at $157,000.

HP also recently announced the HP-UX 11, its 64-bit operating system for UNIX servers and workstations. "Right now, Hewlett-Packard and Digital are the only ones that offer a true 64-bit operating system," says Dan Beringer, marketing manager for HP-UX software. "IBM was fairly recent with their 64-bit announcement, but they lack a 64-bit kernel." IBM's core kernel is a 32-bit architecture that supports 64-bit applications.

HP, according to Beringer, feels that Sun is far behind with its operating system. "We feel that Sun's investment in Solaris is behind as compared to what HP's investments are in our operating system," says Beringer.

Richard Fichera, vice president of research at Giga Information in Cambridge, MA, doesn't think that this release is all that significant. "The release of HP-UX 11 brings Hewlett-Packard up to parity or maybe a tiny leapfrog ahead of Sun and others as far as reliability goes," says Fichera. "Hewlett-Packard may be ahead as far as the 64-bit aspect goes, but as far as customers are concerned, 64-bit isn't that important since most operating systems now support very large file systems."

Fichera says 64-bit is important from a database perspective where very large joins and other large database operations are performed, but for fundamental needs, 64-bit is not that big a deal for most users. Fichera concludes, "both HP-UX and Solaris are extremely reliable, competent operating systems."*–mm*

At $10,000 per hour, how much downtime can YOU afford?

When acceptable uptime is measured in the tenths of a decimal point, can you risk your datacenter (or your career) to the inevitable hazards of bad power? That's why 8 out of 10 leading corporations trust APC solutions, such as the innovative Matrix-UPS™, for maximum uptime of their business-critical systems.

With bad power causing nearly half of all data loss, and downtime costs for medium sized companies exceeding $10,000 per hour, it's no wonder that experts agree - you need reliable power protection from a leader like APC.

Now, more than ever, disaster prevention and recovery plans are critical, and with the growing dependence of businesses on their computers and networks, power protection and management must be part of that plan. Make APC's modular Matrix-UPS part of yours.

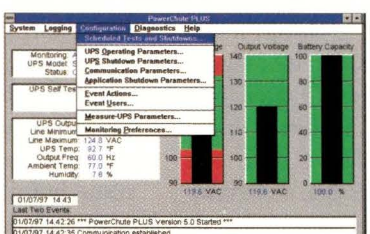
Award-winning modular reliability

According to Contingency Planning Research, poor power quality can quickly cost you thousands or millions of dollars per hour whether your business is finance, media, retail or transportation. APC's Matrix-UPS™ was built for the 3 to 5 kVA range (between 2250 and 3750 watts), and provides modular, manageable, APC-reliable, high power availability. You get all this plus low operating costs and APC's commitment to your satisfaction.

Matrix-UPS eliminates tough installation, burdensome service contracts, high lifecycle costs and the threat of a single point failure that plague existing midrange UPSs. Matrix-UPS has an innovative modular design which isolates any problems to its self-diagnosing, hot swappable 'module'. No downtime. No service delays. No unnecessary risk. Matrix-UPS modularity also doubles expected battery life and has half the typical 5-year lifecycle cost.

Unlimited runtime suits any application

A Matrix-UPS 5000 with two SmartCells™ can support eight Compaq SystemPro (4000 VA) servers for nearly 15 minutes. Eight SmartCells provide two hours of instantaneous backup power. You can even quickly and easily add hours of runtime with SmartCell™ XR's, which pack four times the runtime of a typical SmartCell™, and allow you to easily extend system uptime. You'll also find that Matrix-UPS reliability costs less than you would ever imagine, and has never been more affordable.



Matrix-UPS offers FREE APC PowerChute® plus and PowerNet™ SNMP power and environmental management and monitoring software. Safe auto-shutdown protects data and lowers support costs. (For All LANs and WANs, including NetWare and Windows NT.)

Take the expert advice of editors and datacenter managers around the globe and avoid downtime altogether with modular Matrix-UPS power protection.

FREE! Matrix Video

For your FREE video, simply mail or fax this completed coupon to APC, or visit us at www.apcc.com

☐ **YES!** I'm interested in learning more about Matrix-UPS. Please send my FREE video!

☐ **NO,** I'm not interested at this time, but please send a FREE Power Protection Handbook.

Name: ____________________

Title: ____________ Company: ____________

Address: ____________________

City/Town: ____________________

State: ______ Zip: ______ Country ______

Phone: ____________________

Brand of UPS used? ____________ # ______

Brand of PCs used? ____________ # ______

Brand of Servers used? ____________ # ______

Dept. A31-MX

APC®

(888) 289-APCC x7174

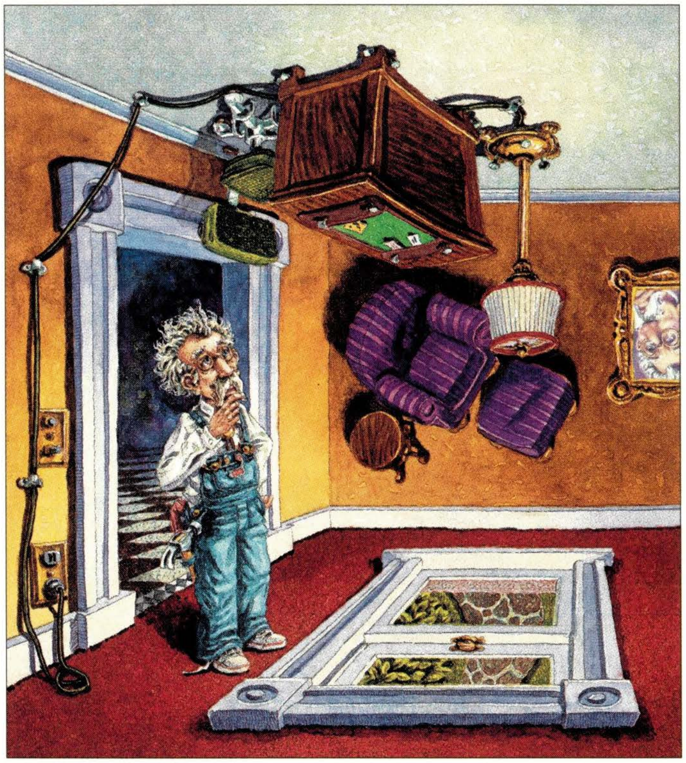
Fax: (401) 788-2797 • www.apcc.com

 • (800)347-FAXX PowerFax • E-mail: apcinfo@apcc.com • 132 Fairgrounds Road, West Kingston, RI 02892 USA

Circle No. 12

Ask Mr. Protocol

by Michael O'Brien



TOM BARRETT

"The Office." – A very cleverly named bar

"They rang the Lutine Bell at Lloyd's." – The Space Child's Mother Goose

"Now get back to work!" – Barry Shein, `alt.my.crummy.boss`

Mr. Protocol Explores Space

Q: *OK, I'm used to it by now. I've even seen the Mugwump Mystery Spot, where they nailed all the furniture to the ceiling. But why has Mr. Protocol nailed all his furniture to the south wall?*

A: Mostly, I think, because he likes the north light. Also, because the ceiling's already been done. As you say, by the Mugwump Mystery Spot, a fine roadside attraction just outside Ashtabula. Sometimes, I think Mr. Protocol is the only person in the world who thinks the comic book characters Sam and Max are the world's finest interior decorators. Then I remember Sam's immortal words ("Don't forget the orange marshmallow peanuts. I think they're a vegetable."), and I thank my lucky stars he doesn't follow the *Sam 'n' Max Diet Book* too.

Mr. Protocol's odd taste in decor started when he saw me reading a book. The sight of actual paper sewn into signatures and held together with glue exerts a powerful effect on him, and it's never certain just what that's going to be. This time, the book happened to be *How Buildings Learn*, by Stewart Brand, and the result was that he started to wonder why an office with a Net connection looks exactly like an office without a Net connection, except for a few more wires. This got him started. I just hope he doesn't decide to change walls. I hate driving a skip-loader. It's tough holding that furniture exactly straight while he nails it down. Besides, I think we're running out of nails.

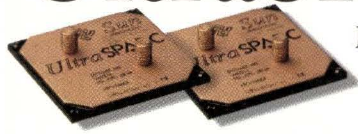
About 10 or 15 years ago, a Harvard professor of archaeology was heard to say, "We've only been building cities for 5,000 years. We're not very good at it yet."

One of the points to draw from this is that before we began to build cities, we were limited in what we could do with the space around us. Rocks and trees were the decor, pretty much, except for whatever nomadic shelters we could carry with us or build on the spot. Anyone who's seen a Bedouin encampment will know that this still leaves room for a remarkable amount of originality. Hard to believe you can create such opulence out of a drop spindle and some fibers. But the drop spindle lets you spin while you're walking, and if you're nomadic, you walk a lot. That's a lot of spinning.

Almost all cultures on Earth build permanent structures with rectangular floor plans and flat walls. Partly, this is a compromise to allow us to cram as many rooms into buildings as possible. We could cram even more rooms in if we built them with regular hexagonal floor plans, but that would mean six walls per room instead of four, which is harder to build. Even today, we pack things in as rectangular bricks rather than hexagons. Cargo container ships are full of bricks. Hexagonal closest packing is used only when we have to. It seems that on some deep level, we believe that hexagons are for bees, and rectangles are for people.

There are exceptions. The Oval Office of the president of the United States is a work of deliberate genius. Only a person seated at one side of the office, able to see both foci of the ellipse

UltraSPARC® 2...More Power



Highest speed, dual processor performance in an easy plug in module

More power for faster processing, 3-D imaging, high-bandwidth networking and your choice of one or two of the industry's fastest UltraSPARC processors. The COMPstation™ U-series of Sun® Ultra™ 2 compatible workstations from Tatung, lead the workstation market in affordable performance.

UltraSPARC Port Architecture (UPA) has forever changed the definition of high performance workstations. The incredible power of high clock speeds and floating point performance brings even the most demanding application to its knees.

ULTRASPARC™ DRIVEN

When you combine this great architecture with up to 100mbits per second network throughput, and the well respected Solaris™ OS, you have the best in all around computing. Solaris now offers more than 10,000 applications that run—and run best—on SPARC™/Solaris. Use this powerful system with on-chip Visual Instruction Set (VIS) for your demanding Engineering, Multimedia, or Internet/Intranet computing.

SPARC Compliant SCD 2.1

As with all Tatung Workstations, the U-series is manufactured in the U.S.A. Call us today to power up a U-Series workstation for you, **1-800-659-5902.**

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

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

The Intelligent Choice in SPARC Computing Solutions

TATUNG®

SCIENCE & TECHNOLOGY, INC.

Phone 1-800-659-5902 • Fax (408) 383-0886
1-408-383-0988
email — mkt@tsti.com or website — www.tsti.com

27GDA

Circle No. 13

at a glance, can feel comfortable in such a place. That means the president. Everyone else feels subtly (or not so subtly) uneasy. One supposes that this is deliberate, giving the president an unconscious advantage...always the best kind of advantage to have.

So we build boxes. How we build those boxes, and what we do with them after they're built, is the study of the architect and the decorator. What is certain is that we have deep wiring in our brains that regards the place that gives us shelter as an extension of our personal space, and that we therefore regard this space as an extension of ourselves, of our own minds. In order to feel comfortable, we must reflect our inward selves in our outward surroundings. Old haunted houses make us feel uncomfortable. Frank Lloyd Wright dwellings make us feel at first delighted but eventually overwhelmed, not to mention the slew of little problems that go with a Wright house, such as the full impact of a brook trickling through the living room in Wright's Falling Water house in Pennsylvania. Wright's Hollyhock House in Los Angeles would remind a body of a power station, except for the upstairs passage, which is definitely early Krell. The body of knowledge required to make a home out of a house, or even a house out of a building, is only partly learned academically or by experience. Partly it is artistic, and partly it is (for lack of a better word) "spiritual," or perhaps psychological. It comes from within.

Over time, homes change. Old homes must eventually be remodeled, not only to keep them in repair, but to keep them in step with the society in which their inhabitants dwell. An extreme example is the English manor house, which typically has a kitchen suitable for feeding not only the owner and his family, but an entire army of servants. It is cavernous. Remodeling a manor house, in those few cases where a new owner is actually able to afford it, invariably involves not only a drastic revamping of the kitchen's appointments, but also a considerable reduction in its size, with the space reclaimed going to some other–any other–purpose.

For a less drastic example, the reader is referred to the folk village at Glencolombkille, County Donegal, Ireland. Even a population whose national hobby appears to be periodic starvation, where a house with four walls and a sound roof is the primary consideration, underwent a vivid evolution in interior structure and architecture as society and technology evolved. The several houses at Glencolombkille, reconstructed with great exactness according to the lights of different eras in Irish history, will be a revelation to the keen observer. (So will the surrounding countryside. There is none more beautiful in the world. Unfortunately, all of the road signs are in Gaelic.)

In this country, a division appeared quite early in the houses of families that were able to afford it. One room, the living room, or family room, was used for everyday activities. Another, the front room, or parlor, was used only for entertaining important guests. Usually, this meant the local parson. This room had

the best furniture, as well as the family treasures. Often, this entire room went unoccupied for a week at a time. This dichotomy remains in suburbia to this day, in the rumpus room or playroom, which is distinct from the living room.

But what does all this have to do with networks? Mr. Protocol is glad you asked.

From Living Room to TV Room

In the past, technology has affected our living spaces largely in terms of the mechanics of what are, after all, day-to-day survival tasks: eating, sleeping and relaxing. Most of the radical change has taken place in the kitchen. Similarly, radical changes should, perhaps, have taken place in the bedroom, but for some reason Western culture is profoundly conservative in its sleeping habits. We spend much more time sleeping than eating, but have paid that activity far less attention.

Be that as it may, the rest of the house has started undergoing changes as a result of the advent of mass communication. Take a look at old photographs, or, if you are old enough, remember the living rooms of your grandparents. The furniture along the walls of the room was dedicated mainly to storage, while the furniture used in activities, such as tables and chairs, was grouped around the room in such a way as to provide light for those tasks that most needed it (generally, sewing and reading), with the remainder of the furniture being grouped for conversation. With the advent of radio, this changed. The early home radios were floor-mounted pieces of cabinetry, and some of the furniture was grouped around it. Some or all members of the family were no longer concerned merely with family matters. The world had, for the first time, entered the home in real time.

With the advent of radio.... the world had, for the first time, entered the home in real time. The effect on culture was profound. Suddenly, everyone could talk with their neighbors about what they'd heard on the radio last night.

The effect on culture was profound. Suddenly, everyone could talk with their neighbors about what they'd heard on the radio last night. It joined with the mass print media in binding the culture together. It bound the family together physically, too, because listening to the radio was a group experience.

Culturally and architecturally, television was merely a minor modification of this. Lighting levels had to be controlled and the furniture had to be more explicitly placed to allow viewing as opposed to listening, but the household niche filled by a television set is the same as that filled by a radio of the '30s and '40s. As time has passed, a few more changes have taken place. The family room may now be the TV room. Furniture, rather than storage units, now lines the walls, to allow unobstructed sight paths to the television. The logical extension of this is the home theater, where the entire space is subsumed in enhancing the experience. Mr. Protocol, by the way, thinks that a home theater system that projects U.S. NTSC television is a hysterically funny notion, something like solid gold bottles filled with mud. High-definition television, maybe, but NTSC just doesn't bear being blown up past about two feet or so. (NTSC, by the way, stands for National Television Standards Committee–or maybe Never Twice Same Color–the U.S. color TV standard.)

Cable television brought about a few changes, because suddenly you can't just plunk a television set down wherever you want it (as if, realistically, you ever could). You have to carefully plan the introduction of a cable feed into the house at whatever point the television is going to be placed, and there it remains forevermore, or until you pay the cable guy to string more coax. This tends to anchor the television even more firmly, and make it more of a monumental structure in the interior architecture of the home.

Enter the Internet.

The Internet, at least so far, is an intensely solipsistic medium, even more so than reading, because a book can be read aloud. Reading Internet content aloud sounds silly in all but a few possible scenarios. Current Internet setups revolve around a personal computer, which is the centerpiece of a one-person workspace. A person occupying that workspace and engaged in using the Internet might as well not even be present in the room, from a social standpoint. In fact, it would generally be an improvement if they were gone, because the occasional sound bites coming out of the speakers are annoying and distracting. This certainly doesn't sound like a wonderful change for the home, but it sure does sound like another sort of common human activity: office work.

Let's look at that. Why are offices like that? Where did they come from? Mr. Protocol doesn't actually give a hoot about this one because offices predate the Internet. But, strangely, not by as much as you'd think.

The Homegrown Office

An office used to be a piece of furniture in the home. Ditto a secretary. An office was a specialized desk or writing table that held the account books of a household or an estate. The term probably comes from the much earlier meaning of a daily regimen of prayer or duty, just as a political office is a regimen of duty (supposedly). A secretary was a similar piece of furniture for organizing letters and other correspondence: a repository of secrets or private information. Gradually, an office grew to become a room, and a secretary grew to become a person.

All of today's business offices grew out of a fairly late development: the giant trading and mercantile companies that arose in Europe during the late Middle Ages. Originally, a trading house really was a person's house. Dutch merchants lived in big houses on the canals because their homes and their warehouses were one and the same. Gradually, as the merchants found nicer places to live, their businesses came to occupy buildings that were not fit to live in, and that's been the way ever since–most offices are not fit to live in.

Offices were not designed. They "just growed." This fundamental fact is responsible for more human misery than

any war ever fought.

White-collar office workers band together to create something intangible, for which they are rewarded with something equally intangible: a bank balance. The connection between the work they do and the food on their tables is terribly tenuous. It goes against fundamental human psychology. In the hunter-gatherer days, the guys went out and killed something, and dragged it back, and everybody ate it. On-the-job motivational seminars were hardly necessary. What was necessary was the motivation to go out there and risk getting killed and eaten in turn, and a whole lot of religion was devoted to this.

Agriculture still had tangible benefits. Temple scribes in ancient Egypt creating tallies and contracts on parchment became somewhat removed from the basic necessities, but everyone could see the Nile flooding and the grain coming up, or not.

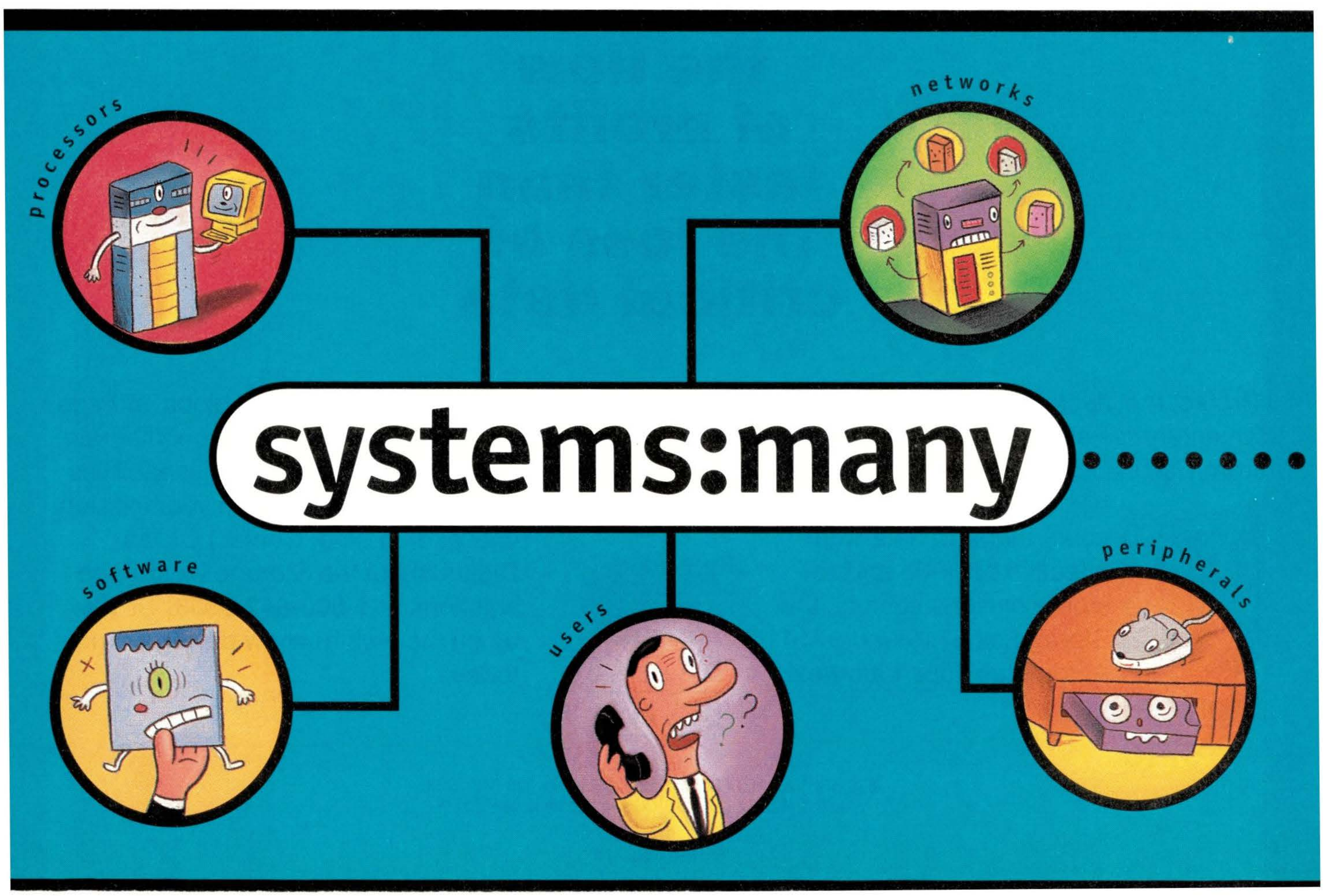
Lloyd's of London was a coffeehouse, originally. Underwriters would meet there and execute joint contracts to cover the risks of transoceanic voyages of trade and discovery. It only gradually became its own establishment, a great enterprise devoted to money and trade in the abstract. As this proceeded, as the First World's gross national product rose, more and more paper-pushers came together in more and more offices to drive it and distribute it.

The key observation is that these giant, centralized office blocks were made necessary by the sheer bulk of the information they handled. Information has, until recently, been physical: great mounds of paper. That's no longer true, or needn't be. Now that large amounts of information can be crammed over wires at high speeds, the office can move out of the centralized block and back into the home where it originated–this time, the home of the office worker, not the merchant.

This is the fundamental premise behind telecommuting, which almost no one has realized. It is not that telecommuting represents anything fundamentally new. It is that having thousands of people coming together into a gigantic block of offices is a fundamentally aberrant thing for people to do. It isn't natural or convenient, and it is only marginally productive. When it was made necessary by the sheer weight of the paper information involved, it was necessary to make concessions that created commuting, giant parking lots and the office cold bug. Now it is possible for white-collar corporations to be much more distributed.

There has been a movement in the past to make offices more fluid, providing more common space for people to meet and mingle. This tendency will increase, because the nerve center of a business will still be a place for people to meet. There is also such a thing as a physical white-collar job, as in a laboratory. But even here, people will be able to carry the raw information of their office around with them. The "office" associated with a job will take on more of the meaning of a political office than a physical residence: a regimen of duty rather than a physical place.

Current offices are not interesting. They are deliberately



made uninteresting so that people will concentrate on their jobs rather than on their surroundings. This deliberate movement reaches its epitome in the "open office," consisting of a warehouse-size room filled with a maze of cubicles. The architecture is not that of a business enterprise, but that of a monastery. The difference is that in a monastery, people choose to follow the Rule of St. Augustine as a matter of vocation, not as an incidental plague associated with a job whose aims are quite different.

The rise of the Internet will not eliminate the office as we know it today, but it will transform it in fundamental ways, ways that not many companies are going to be comfortable with, at least initially. It will force offices to become more interesting places, geared to a mentality other than the monastic. A great fraction of daily work will be accomplished at home, just as it had been throughout most of human history up until the 16th century. And if we're new at creating today's offices, we are absolutely clueless as to how to create this new kind of office. This is not going to be a painless transition into some kind of white-collar utopia. It is going to be wrenching, unpleasant, exciting, distressing, and it's going to hurt a lot of people and help a lot of others, often in very unfair ways.

The rise of the Internet will not eliminate the office as we know it today, but it will transform it in fundamental ways, ways that not many companies are going to be comfortable with, at least initially.

The home is going to change, all right. It's going to revert to type. The office will become a room in the home, and as the technology of network communication becomes more and more ubiquitous and more and more flexible, it will shrink back to a piece of furniture. Eventually, it will be a regimen of duty rather than a single, physical location or thing.

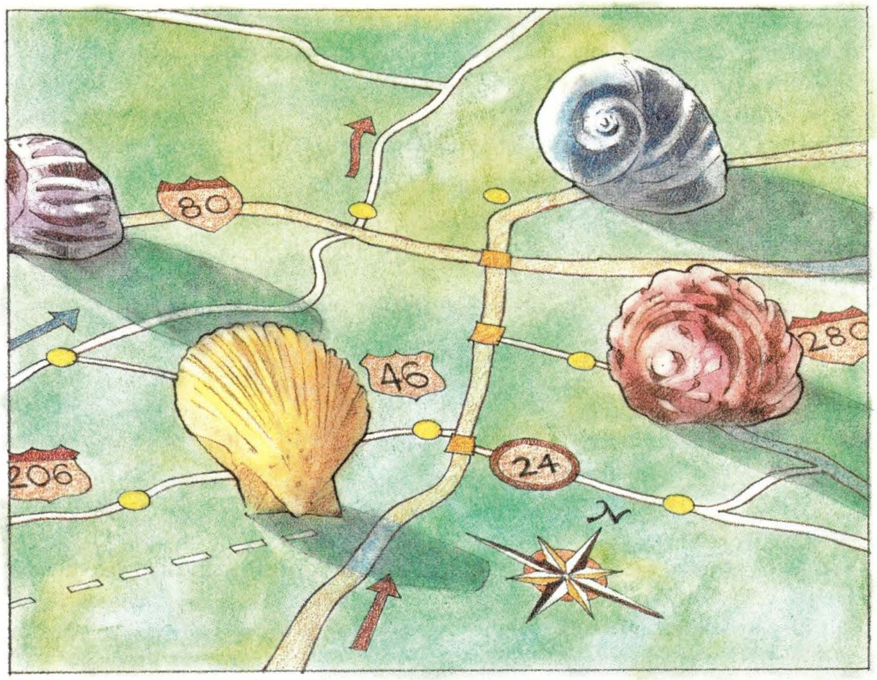
The corporate campus? It will be different. Eventually, it will be very different. Mr. Protocol doesn't think anybody has much of a clue as to what it will look like.

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

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

__Mr. Protocol__ refuses to divulge his qualifications and may, in fact, have none whatsoever. His email address is `amp@cpg.com`.

by Peter Collinson, **Hillside Systems**



GARY DAVIS

A Shell Road Map

One of the early design requirements for UNIX was the need to generate a small kernel, the memory-resident part of the operating system that interfaces the user's applications to the hardware. There were pragmatic reasons for smallness. The kernel had to fit completely into the 32-KB 16-bit words of kernel memory address space afforded by the PDP-11. It had to fit and also leave enough memory space available so that the user could run programs. Small was beautiful.

To reduce the amount of code in the kernel, many aspects of the "operating system" were moved into user processes. When I first encountered UNIX, some 20 years ago, it was novel to see that the contents of `/bin` were a set of commands whose names you typed to get your work done. Likewise, it was novel to see that `/bin/sh`, your command interpreter, was not a protected part of the operating system. It was just another user-level program whose job was to take typed information and launch processes.

Small was beautiful in the shell too. The part of the command interpreter that performed filename expansion–changing `*` to a list of filenames–was actually a separate program called `/etc/glob`. The shell scanned the input line, and if filename expansion was needed, `/etc/glob` was executed to do the job.

A consequence of the use of programs sitting in separate files for what are considered to be parts of the operating system is the ability to replace those standard utilities with alternatives. Of course, you didn't want to physically replace, say, the standard `rm` command, but you may want some users to use one version while others see the standard one.

Providing personalized utilities was made easier when UNIX Version 7 appeared. Its kernel introduced the per-process environment strings whose contents are retained when a process uses the `fork()` system call to create a new process. One of the standard environment strings is the `PATH` variable. It provides an ordered list of places to search for the file containing the binary program that matches the command name typed by the user on the input line. The use of the `PATH` variable means that by controlling the search path, it's possible to place alternative utilities *in front of* existing ones for some users. Also, it is now simple for users to include a private directory in their search path (often called `bin`) that contains private copies of standard commands.

It didn't take much time before alternatives to the standard `sh` program were created, providing different user interfaces to the system. We now have a plethora of different shells to choose from; most derive from either the Bourne shell (`/bin/sh`) or the C shell (`/bin/csh`).

The Bourne Shell

UNIX Version 7 was released in 1978 sporting a brand-new shell that was significantly different from the Version 6 shell. It has since become known as the Bourne shell, after its author. Steve Bourne had arrived at Bell Labs directly from Cambridge University in the United Kingdom and was an Algol 68 aficionado. The syntax of this language found its way into the control structures of his shell. The shell itself was coded using an Algol 68-like language that used the C preprocessor to convert its source into C.

As I said, the shell made use of various new features of the system and also made its own impact on the kernel design. The shell treated commands as subroutines and could test their success or failure, meaning that each command had to be recoded to return a result when it exited. There's a story that when Bourne first developed his shell, he made it print a rude message when a command did not return a valid return value. Soon people were embarrassed into converting their programs. I think the ability to detect the success or failure of commands has made UNIX scripts significantly more useful, so those peoples' red faces were worth it.

The Bourne shell was (and is) a fully functional programming language using text replacement ideas that were prevalent in macro processors. The language comes with a full set of program control structures, allowing tests and loops. In the early '80s, when UNIX System V was released, the shell was extended to include *shell functions*, allowing the user to collect commonly used command sequences into private shell built-in commands. Shell functions also made it easier to write complex scripts, allowing the programmer to split the task into small chunks.

The C Shell

The names for UNIX commands are littered with puns (usually bad) and jokes (usually obscure), and the C shell, csh, is no exception. I expect you to sea that. Csh was created by Bill Joy when he was at the University of California at Berkeley. I think he started at about the same time that Bourne was making his shell. Joy took the shell's programming syntax from the C language.

The shell was groundbreaking because it contained many features that were executed in the shell itself. For example, csh has the ability to perform arithmetic in the shell. It has aliases for command names, allowing the user to create command names without recourse to a specific command file. Many people use aliases to add preferred switches into commands. For example,

```
alias rm 'rm -i'
```

adds the interactive switch to every invocation of the rm command made from the shell.

Csh also contains many built-in commands. For example, echo is the shell's print statement and is used considerably. The code for the command is resident csh, making it much faster to print messages.

Testing the values of variables is another very common operation, and csh evaluates the values internally. So a csh statement like this:

```
if ($var == "hello") echo yes
```

would execute quickly because the whole line is interpreted in the shell.

The original Bourne shell relied on executing commands in /bin to perform the equivalent task:

```
if test $var = "hello"
then
        echo yes
fi
```

The test and echo commands lived in /bin, so by the time you had executed the test, you had also created two new processes. Incidentally, in Bourne shell, you can write the test using square bracket syntax:

```
if [ $var = "hello" ]
then
        echo yes
fi
```

The opening square bracket was originally a command in /bin (a link to the test command). The shell checks for a closing square bracket and removes it from the invocation of the command. You won't find a command called [on your system today. The command echo and variable test have become built-ins in the System V version of the Bourne shell, following csh's lead.

I first started to use csh when we switched to 4.1BSD in around 1981. There were two reasons: First, csh had implemented command history; for example, typing

```
% !!
```

would execute the last command, and

```
% !m
```

would execute the last command starting with the character m. As a perpetually dreadful typist, history substitution makes my work go faster.

To stop people from doing dumb things and changing their shell to something that was not a legal program, the passwd program used the /etc/shells file as a reference source to determine if the shell that the user selected was sensible.

Second, 4.1BSD came with job control that gave us the ability to manipulate background and foreground processes. Typing Control-Z puts the current foreground job into the background. The shell notices this and presents you with a prompt so you can start a new command. There are various commands built into the shell that allow you to control the background processes. Actually, job control was my sole reason for switching to 4.1BSD, and because it was not supported by the extant Bourne shell, you had to use csh as your primary interface to the system.

I still find myself using job control even though I obviously run an X Window system. It's still quicker to type Control-Z, suspending the current job on the desktop, than it is to locate the mouse and click here and there on the screen.

Changing Shells

When csh appeared on the BSD system, UNIX suddenly had a choice of two real shells providing different interfaces for the user. Ideally, you want to run one shell or the other when you log in. The UNIX password file format has always contained a field that tells the login program which shell is to be started for that user when they first connect to the system. So using an alternative shell is not a problem.

The Berkeley system handed this choice directly to the user by supplying a utility that could be used to change the shell field in your password file entry. The commands were actually links to the passwd program, and options to the passwd command could be used to perform the edit too.

To stop people from doing dumb things and changing their shell to something that was not a legal program, the passwd program used the /etc/shells file as a reference source to determine if the shell that the user selected was sensible. This file has subsequently taken on other uses, mostly in checking that a user coming in with FTP has a legal shell.

The chsh command can be still be found in SunOS, and you can easily select your own shell. Things have changed a bit on Solaris. The explicit commands have disappeared, and you can change your shell using options to the passwd command, but only if your site uses NIS or NIS+. You need to discuss the situation with your systems administrator if the password file exists on your machine. This may not be a bad thing. Changing shells can be complicated because they use start-up files that will need tailoring for your environment.

Once a system had more than one viable shell, then users were able to write scripts in either. They wanted to put the script in a file, turn on the execute bit and use that file as a standard command. However, in the early systems, a problem arose of exactly what syntax the file contained. The file needed to be passed to an appropriate interpreter to execute its commands. Early systems used a bit of hackery. If the first character of a file was #, introducing a comment in csh, then the script was passed to csh; otherwise the script was executed by the Bourne shell.

Later, a more general-purpose approach was adopted. If the file starts with the sequence #!, then the remainder of the line is taken to be the full pathname of an interpreter to which the script is passed. This solution permits users to write scripts for an arbitrary interpreter, which may or may not be a shell. So, for example, you'll see that Perl scripts will start with something like this:

```
#!/usr/local/bin/perl -w
```

The Korn Shell

The Korn Shell, ksh, is a development of the Bourne shell, adding many features that people liked from csh and introducing some new ones too. You do need to have Solaris to have access to the shell; it's not supplied on SunOS.

The main change in ksh as far as the terminal user is concerned is the provision of command-line editing using either `emacs` or `vi` keystroke patterns. You can edit the line that you are typing, using full visual editor capability. Also, ksh stores all the commands, so you can treat the command sequence as a file, stepping back to a command, pulling it into the current line and editing it to suit. As I found when csh was introduced, the ability to deal with your command history is a huge win. However, it was hard, and somewhat nonintuitive, to reuse bits of lines in csh. With ksh, you use a set of familiar editing keys to create just that tiny change to the line that you need. Incidentally, line editing is turned off by default. You need to say

```
set -o emacs
```

or

```
set -o vi
```

in your start-up file to ensure that it's enabled.

Ksh has several other additions, many picked up from aspects of csh. It supports integer arithmetic in the shell itself and has new syntax to aid expression evaluation. It has arrays of variables, a long-missed feature of the Bourne shell. It allows the use of tilde before a login name to mean "the home directory" of the user. It also implements aliasing, allowing the shell to store replacements for commands. A new idea uses aliasing to automatically

track commands. Once a command is found by searching the PATH list, an alias to the full pathname of that command is established, meaning that subsequent use of the command will not require directory searching. Finally, ksh supports job control.

David Korn, the author of ksh, spent many hours sitting in the POSIX committees that were working on the shell and its utilities and, as a result, some of the new features that were present in ksh became enshrined in the standard POSIX shell. Lacking some of these new features, the Bourne shell cannot fulfill the requirements of the POSIX standard. So we've seen ksh appear as an alternative shell on various systems that need to be POSIX compatible.

The POSIX committee liked ksh's alternative method of expressing the Bourne shell's backquote operator for command substitution. Let's say we want to look in a set of files for some string or other, and then put those files into an editor. Well, we know that we can use the `grep` command to search for a string. Also, we can make `grep` output a list of filenames by giving it the `-l` option. The output would look something like this:

```
$ grep -l lookfor *
file1
file10
file9
```

so we can see that the string `lookfor` was found in `file1`, `file10` and `file9`. If we want to use command substitution to load the output of `grep` into the editing command in Bourne shell, we'd say

```
$ vi `grep -l lookfor *`
```

The backquote syntax makes the shell run the command and capture the standard output. The output of the quoted command replaces the backquoted section of the line, so the command that we would execute is this:

```
$ vi file1 file10 file9
```

The problem with the backquote syntax is that it doesn't nest. In ksh, the example above would be written as:

```
$ vi $(grep -l lookfor *)
```

Because there are start and finish markers, we can embed other commands inside the command substitution. Actually, there are still some problems, and these are highlighted on the ksh manual page.

David Korn, the author of ksh, spent many hours sitting in the POSIX committees that were working on the shell and its utilities and, as a result, some of the new features that were present in ksh became enshrined in the standard POSIX shell.

If you are using Bourne shell to talk to the machine, then switching to ksh makes sense. You might want to think a little if you use csh; the cultural shock may be too great. However, it depends on how complex your use of the shell actually is. If you just type commands and use the occasional loop, then switching will not be too difficult.

The Bourne-Again Shell

The shell that I actually use is bash from the Free Software Foundation. Of course, bash is another quirky acronym, standing for the Bourne-Again Shell. Bash is intended to be a complete implementation of a shell that complies with the POSIX standard. It basically has the feel of the Bourne and Korn shells, but with several extra features that make it considerably more usable.

Bash has command-line editing, providing `emacs` and `vi` keystrokes to edit the current line or the command history, but added to that is the ability to automatically complete commands and filenames, a feature aimed at lazy or inept typists.

When you are typing a filename, you can hit the tab key to force the shell to look in the directory for a file that starts with just the characters you have typed so far. So if your directory contains `jim.txt` and `fred.txt`, you can type

```
$ vi j<TAB>
```

and you will see the filename be completed,

```
$ vi jim.txt
```

now you can hit the return key to start the editing command. The completion will not occur unless the string you have typed is unique. If you had another file in the directory, say `jane.txt`, then when you hit the tab key in the example above, the shell would make the system beep at you, demanding that you create a unique string. Typing another tab will give you a list of alternatives. You then need to enter enough characters to select the appropriate file. This feature also works for command-name completion, although I rarely use that. Most UNIX commands are short anyway.

Bash also implements csh-style history invocation, which is not supported in ksh. So you can use the old `!!` to execute the last command that you typed. Sometimes my fingers do this; mostly they type the Control-P character that is the `emacs` "previous line" command, pulling the last command from the history list. However, if you are seeking the last command starting with say "m," then `!m` is easier and faster to type than the equivalent `emacs` search command.

Bash has all the advantages of the Bourne shell, with powerful redirection features and sympathetic treatment of multiline quoted strings and few real annoyances.

Finally

If you are going to use bash, then probably the easiest way to obtain it is to get hold of a binary distribution for your machine. If you are running Solaris 2.5 on a SPARC, then take a look at `http://smc.vnet.net/` (also named `http://sunfreeware.com`). These good folks have done the compilation work for you and created Sun packages that can be loaded using the standard installation facilities. The Web site says that 2.6 packages will be along soon, and

Now, there's a reliable way to automatically back up, archive and retrieve all their critical business information.

Presenting Network Storage Manager

A lost file here. No backup there. Nobody in your enterprise is perfect. Luckily, IBM has an integrated storage solution for these sorts of problems.

IBM Network Storage Manager gives you reliable backup, recovery and archiving of stored data anywhere on your network. Automatically. This solution of powerful software and lightning-fast hardware easily attaches to your network like any other server. So it's nondisruptive.

It also works across all major computing platforms, including NT, Sun, HP and IBM. There's a broad family of flexible and reliable storage solutions for just about any size company or department. And they can be easily upgraded as your business needs change.

Call us at 1 800 IBM-CALL, ext. RA062, or visit www.ibm.com/storage/backup to learn how IBM storage solutions can give everyone access to the information they need. Sometimes, in spite of themselves.

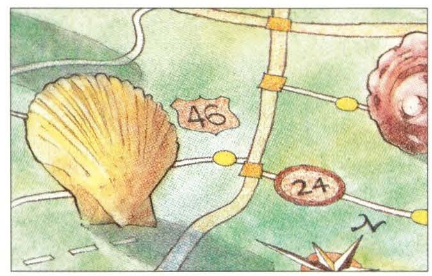
www.ibm.com/storage/backup

IBM

Solutions for a small planet™

undoubtedly things will change by the time you read this.

If you have a C compiler, then it is actually very easy to install bash from the sources. Check out your nearest Free Software Foundation mirror site, or failing that use anonymous FTP to `prep.ai.mit.edu`. If you are unsure about FTP, then locate `ftp://prep.ai.mit.edu/pub/gnu` using your Web browser. This will give you a list of files, and you need to find the most recent version of bash. As I write, that file is `bash-2.01.tar.gz`. There are lots of earlier bash versions, and some files containing differences between versions, so ignore these. If you just want to look at the documentation, then `bash-doc-2.01.tar.gz` contains it in various formats.



Tcsh is a variant of the csh that supports line editing and also command completion. It's become the shell of choice for people who like csh. I've not mentioned it in full, because I've never used it. My loss, I suspect. Confirmed csh users may want to check out this shell; it seems well liked by its users. You can obtain tcsh from `ftp://ftp.gw.com/pub/unix/tcsh`.

I got the idea of writing this article from reading the excellent *UNIX Power Tools*, edited by Jerry Peek, Tim O'Reilly and Mike Loukides, published by O'Reilly and Associates Inc. The second edition of this tome has just arrived, complete with a supporting CD-ROM (ISBN 1-56592-260-3).

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

I/Opener

by Richard Morin, **Technical Editor**

ERIC YANG

On the Making of Lists

You better watch out
You better not cry
You better not pout
I'm telling you why
...

He's making a list
He's checking it twice
He's gonna find out
Who's naughty or nice
...

He sees you when you're sleeping
He knows when you're awake
He knows if you've been bad or good
So be good for goodness sake
...

"Santa Claus Is Coming To Town"
J. F. Coots, H. Gillespie

Unfortunately, Santa Claus isn't the only one making lists. These days, any number of commercial, governmental and other organizations are making lists. Are you on these lists? You bet you are, in more detail than you ever might have guessed. At the risk of fomenting paranoia during this holiest of commercial holidays, here are some lists–and other data collections–you may want to consider avoiding (or even complaining about).

Bank Surveillance

Despite their folksy commercials, banks tend to be pretty paranoid places. When this is used to keep my money safe, I think it's a good idea. When it impinges on my privacy, however, I start to get a bit twitchy. Some banks require fingerprints from noncustomers in order to cash checks. A lawyer in San Jose, CA, recently filed a lawsuit against one such bank; he thinks he shouldn't have to give a fingerprint to get paid on a recognized debt.

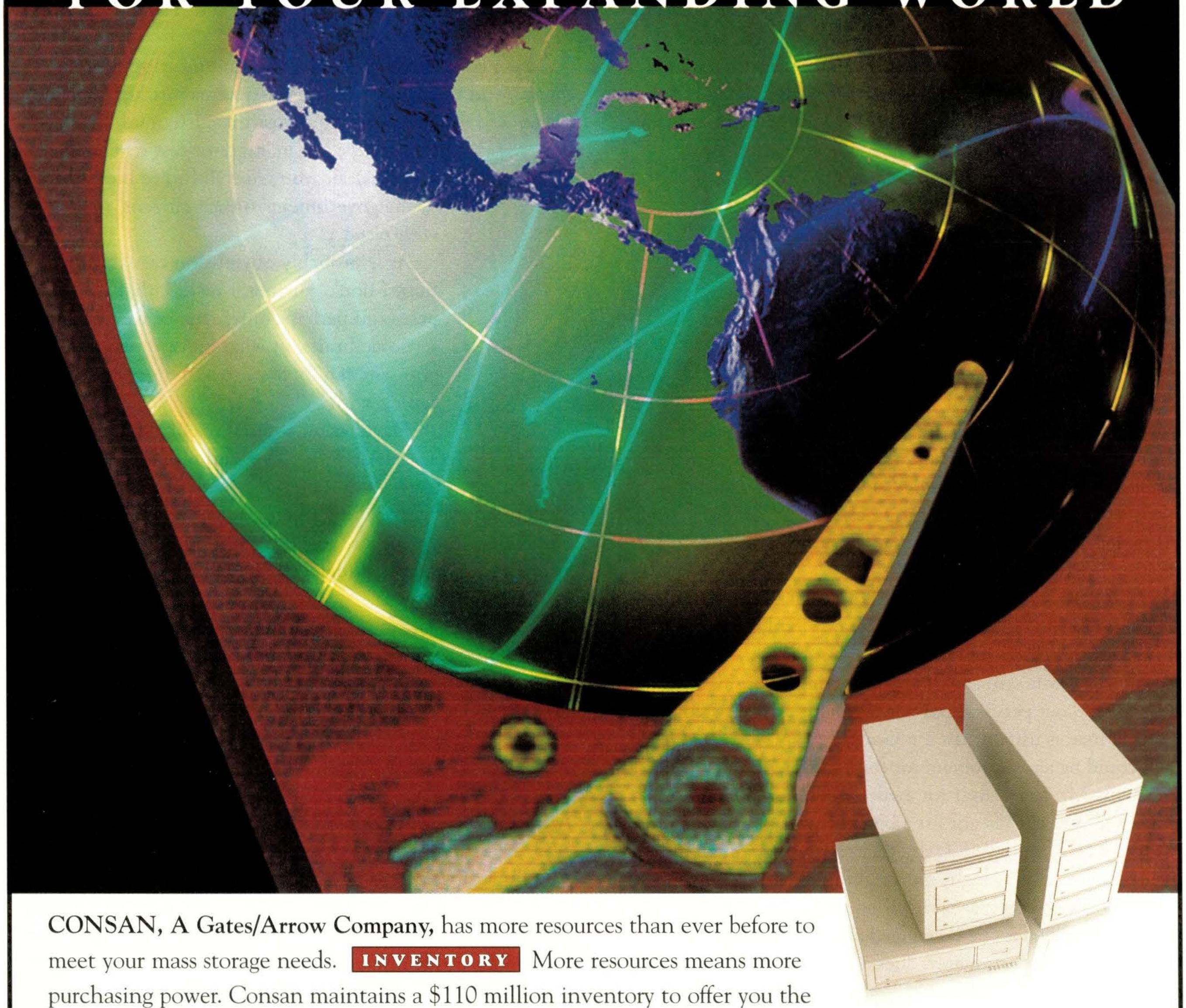
Banks commonly use video cameras to record the images of customers. Most of us don't see this as a problem. This summer, however, some recordings of a law-abiding bank customer were given to the police and posted to a "fugitive" Web site. The customer was thus defamed publicly–and hauled down to the police station in the middle of the night–purely on the basis of a bank employee's speculations. As you might guess, another lawsuit has been filed.

Digitized Signatures

More and more companies, these days, are collecting digitized signatures. PETCO Animal Supplies Inc. and Sears, Roebuck and Co. do, in my area, and I'm sure they're not the only ones. The sensor collects not only the final signature, but also the real-time "signature" of pen motions. This might be a good way to detect incipient coronary difficulties, but I think I'd rather leave that to my doctor. Meanwhile, I find it intrusive.

In a [probably] futile effort to push back against this sort of thing, I refuse to have my signature digitized. It sometimes takes a few minutes for the manager to come over and explain things to the clerk, but I tend to count the time as well spent.

MASS STORAGE
FOR YOUR EXPANDING WORLD



CONSAN, A Gates/Arrow Company, has more resources than ever before to meet your mass storage needs. **INVENTORY** More resources means more purchasing power. Consan maintains a $110 million inventory to offer you the widest selection at the best price. **SALES+SUPPORT** Our sales staff and engineers receive constant training in mass storage on all platforms—they recommend configurations that work. **INTEGRATION** Our 10 year focus on mass storage has given us the expertise in building integrated storage products such as jukeboxes, RAID, libraries and towers. Understanding how a storage configuration will meet your current and future needs allows us to guarantee performance and compatibility on all systems. **VALUE ADDED** Consan understands that you need a distributor that allows you to profit. From our purchasing power to our highly trained engineers and sales staff, look to Consan for value added services that mean success.

CALL CONSAN TODAY, the best high-end storage integrator for disc, tape, RAID, and optical storage solutions. **1-800-229-3475.**

CONSAN
A GATES/ARROW™ Company

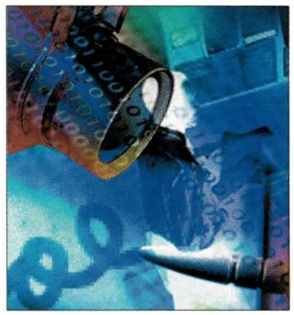
18750 Lake Drive East	1166 Springlake Drive	3220 Commander Drive
Chanhassen, MN 55317	Itasca, IL 60143	Carrollton, Tx 75006
TEL: 612-949-0053	TEL: 847-519-1060	TEL: 972-422-3392
FAX: 612-949-0453	FAX: 847-519-1248	FAX: 972-422-3397

Seagate

Internal Passports

Back in elementary school, I learned about how citizens of the Soviet Union were required to furnish "Internal Passports" to move around the country. Worse, the USSR had "secret laws" that were not available for inspection by the citizens.

Today, when I go to the airport, I find that I am required to prove my identity before I can get on a plane. This is done under the guise of "protecting the safety of the flying community" or some such nonsense. I go along with this, even though I think it's a crock: How hard do you suppose it is for terrorists to get false papers?



A friend of mine tested the law a while back, in any case, and discovered that there are no publicly readable regulations involved, just unpublished Federal Aviation Administration directives, giving airport security forces the power to arrest and detain citizens.

Call me oversensitive if you like, but tracking every movement of the flying public seems a bit wrong to me! And, if you find out that checkpoints are being set up for buses or trains (aside from the Immigration and Naturalization Service's current practice of harassing random Hispanic citizens), remember that you heard it here first.

Purchase Records

Point of sale (POS) equipment at your local supermarket tallies your purchases and prints them out for you, along with (perhaps) a credit card slip. Is anyone saving all of this data, possibly to send out personalized notices about unadvertised sales?

Junk mail is usually just a nuisance, but personalized junk mail could be a real problem for some people. If Mrs. Jones intercepts Mr. Jones' flyer for a sale on fine jewelry and perfume, she may cut his gift list a bit short this year: "Gosh, Milton, I can't understand why they're sending you all these flyers. You've never bought me anything like this!"

Many countries place controls on the amount of personal information that can be exchanged among third parties. The United States, unfortunately, does not. So, if the credit card companies and merchants start finding useful ways to pool their records about you, there is really very little to stop them.

Social (In)security

The Social Security Administration, or SSA (`http://www.ssa.com`), has already embarrassed itself in its efforts to make all of our employment histories and much of our financial data available over the Internet. In a recent episode, detractors showed just how easy it was to gain access to random individuals' records.

The SSA backed off, but the word is out that it hasn't given up. Watch for its next attempt. It should be interesting, if less than totally amusing to those of us who like to keep our finances relatively private.

And Worse...

As annoying as the SSA's efforts can be, however, they are totally benign when compared with the goals of the Federal Bureau of Investigation, National Security Agency and other government surveillance organizations. President Clinton, while publicly backing away from any domestic controls on encryption technology, has sent his messengers to Congress to promote "backdoor requirements" and related limitations on our privacy.

Make no mistake: Electronic communication is going digital, and the spooks' computer systems just keep getting bigger and faster. Even if you trust the current administration (and all of its more-or-less regulated agencies), do you trust all future incarnations of the government to treat citizens' rights with respect?

As is probably obvious on casual inspection, I don't. Further, I believe that this is the best (and perhaps only) chance we will get to set some limits on what kinds of data the government can force us to surrender and what it can do with it.

David Brin, a noted science fiction author and futurist, offers us an interesting and rather disturbing vision of the future. Assuming the growth of nanotechnology and ubiquitous networking, there could be "bugs" literally everywhere. Every office, home, park and school could be infested by zillions of undetectable and ineradicable cameras and microphones.

Given this scenario, who should have access to the resulting data? In one scenario, the information is funneled into the government. In another, it goes out onto the Internet. I don't know about you, but I don't relish either of these possibilities. If we are to prevent Brin's vision from becoming reality, however, some rules will have to be set. Now.

The First Circle

The First Circle is Aleksandr I. Solzhenitsyn's excellent, if chilling, novel about the USSR's scientific Gulags (prison camps). Taking his title from Dante's *Inferno*, Solzhenitsyn compared the scientific prisoners to the pagan philosophers, both being condemned to reside in the "First Circle" of Hell.

Solzhenitsyn's premise, as I understood it, is that no single individual in the Gulag system was particularly evil. Nonetheless, the system forced the scientists, guards and administrators to contribute to their own enslavement, along with that of the rest of the country.

If you feel like making a New Year's resolution, therefore, you might consider one that would force you to think carefully about each action you take that contributes to your own enslavement. In particular, if you are asked to help collect or disseminate information on your neighbors, think carefully before you acquiesce.

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

We'll pay you $1000 to outgrow your tape drive system.

Trade in your old autochanger for an ADIC VLS DLT400 and get a $1000 rebate. If your back-up's running out of space and out of time, we'll make it easy to switch to high-capacity, high-throughput DLT™ technology. We'll send you a factory-direct $1000 rebate for trading in virtually any 4mm or 8mm autoloader when you buy an ADIC VLS™ DLT400 tape library before October 31, 1997.

You can trade in your old autoloader whether it's working on not. Under warranty or not. No matter whose name is on it.

280GB of high-speed, automated back-up. The ADIC VLS DLT400 with its high-reliability Quantum DLT4000 drive provides 280GB* capacity. And its 180MB per minute transfer rate* is 3 to 4 times faster than traditional 4mm and 8mm systems. Backed by a 2-year warranty, this award-winning library is already a bargain. The $1000 rebate makes the VLS DLT400 an unbeatable value.

Call us today for program details.

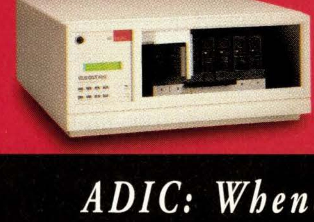
1-800-336-1233

www.adic.com

Trade in your 4mm or 8mm tape library for a $1000 rebate.

4mm	8mm
HP SureStore 12000E Autoloader	Exabyte 10e, 10h, or 10i Autoloaders
Conner Diamondback Autoloader	Exabyte 210 Library
Exabyte 218 Library	ADIC VLS 8mm Library
Intel Storage Express DAT Autochanger	Lago LS/380L DataWheel
ADIC VLS 4mm Library	
ADIC 1200 DAT Autochanger	

Systems listed are examples, many others qualify. Call for program details and to see if your library qualifies.



Quantum® CAPACITY FOR THE EXTRAORDINARY™

adic

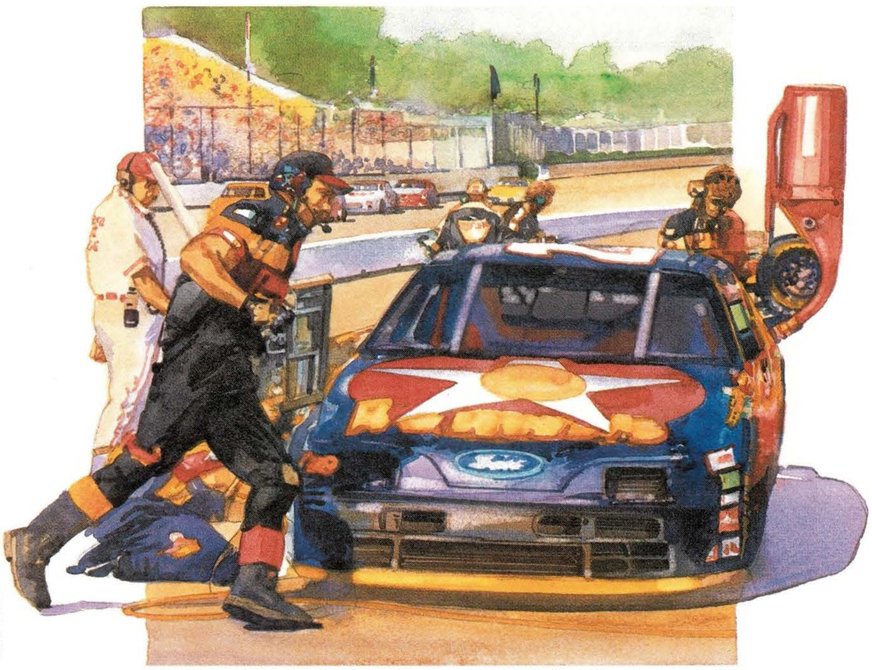
ADIC: Whenever You're Backing Up.

**Assumes 2:1 average compression. ™VLS is a trademark of Advanced Digital Information Corporation. DLT is a trademark of Quantum Corporation.*

Circle No. 22

Systems Administration

by S. Lee Henry



KEN CALL

Dealing with Limits

Solaris systems administration is a nonexacting science. There are always many ways to solve a problem. You can spend a lot of time looking for the perfect one-liner that is maximally clever but, generally, it's not worth the effort. A solution that does the job is OK, even if it isn't optimized and isn't particularly clever.

This becomes less true, however, when we start working with more complex problems and larger data sets. Once we start to bump into memory limits, space limits and the limits of our patience, it's time to start looking at our tools with an eye to efficiency. Sometimes, coming up with a better approach calls for a fresh look at the problem. Maybe it can be broken down a different way or tackled with a different tool.

The basic problem is that not everything we do is scalable. As soon as a problem reaches a certain complexity or our data set reaches a certain size, it becomes a different problem.

Let's take an all too familiar analogy–traffic. The beltway around Washington, D.C. (Rte. 495) as well as Rte. 405 out here in Los Angeles are roads I have come to know very well, having perused great lengths of shoulder at slow speed. Both carry lots of traffic and, at some point, probably served the needs of local commuters quite well regardless of the time of day or day of the week. But once commuter traffic reached a certain size, the traffic problems on these roads could no longer be solved by adding lanes–because there were other limits.

Similarly, sorting some data and taking the `tail` of the result might be a perfectly good way to find the largest quantities while analyzing a problem. Once that sort takes hours or days, however, it might not be a solution you can cope with.

Solaris has a number of limits that we bump into when we try to solve too big a problem–edit too large a file or put too many items in a `foreach` statement, open too many files at once, log in too many times, become a member of too many groups, have too many letters in a file name and so on. These are not limits we encounter very often. Solaris is, after all, quite generous in almost all of the limits it imposes. But they are limits we will sometimes have to work our way around.

Sources of Limits

Where do limits come from? Some are tied to the Solaris kernel. Some relate to memory and available `swap`. Some are determined by the particular tool or command we are using. Others are actually matters of contention for scarce resources.

Generally, we become aware of limits when they rear up and bite us–when we get a "line too long" message in `vi`, or "too many words from ``" in a `foreach` statement in `/bin/csh`, or "out of memory" when a system is just too busy with memory-hungry processes.

I ran into some limit problems while trying to help my stepdaughter, Mallory, "unjumble" some words for her fifth-grade computer class. Only one word on


Advanced RAID Systems
Enterprise RAID Solutions
nStor Parity+ Products
UNIX Memory Products
nStor Corporation, Inc.
Who is nStor?

Listing 1. "fac" awk Script

```
{
TOT = 1

for ( n = 1; n <= length($1); n++ ) {
    TOT = TOT + n
    }

}
END {print TOT}
```

the list had me stumped. That was "doyarcph." The handout said that it meant "what you get from a printer." Printouts? No. Documents? No. Pages? Letters? Sheets? No. No. No. I decided that "docraphy" sounded like a fine word for printer output, but "Daddy" thought there was a typo on the handout, and all the parents of the fifth-graders were scratching their heads that evening in the same hopeless pursuit. Handout? No.

Solaris to the Rescue

My next step, after the disappointment of not finding "docraphy" in the dictionary, was to use Solaris to solve the problem. Rearranging the eight letters into every possible combination and then eyeballing the list for a word was clearly *not* a good approach. Echoing the string "doyarcph" to the `fac` script in Listing 1 showed there were more than 40,000 such "words"–far too many to scan. Another approach was to take every eight-letter word in `/usr/dict/words`, alphabetize the letters (for example, "hello" becomes "ehllo") and then compare these to "acdhopry" (alphabetized "doyarcph"). Even with the streamlining of only looking at eight-letter words, we overpowered the limits of our `foreach` loop:

```
% foreach word (`cat /usr/dict/words | awk -f 8chars`)
Too many words from ``
```

What is happening here, I explained to Mallory, is that the expansion that the shell performs, turning `` `cat /usr/dict/words | awk -f 8chars` `` into a very long list of words, is too long for the buffer trying to hold it–hence, no output at all. There were, as we soon found out, 3,621 eight-letter words in `/usr/dict/words`:

```
% cat /usr/dict/words | awk -f 8chars | wc -l
  3621
```

The next step was to optimize the problem. We had to do some of the work in our heads and give the system a problem that was laid out in such a way that we didn't encounter any of the system limits we know exist.

We did a few tests to determine where we were running into problems. The limit of our `foreach` loop seemed to be 1,704 words. So we simply broke our list of 3,621 into three same-size chunks and processed each one separately as shown in Listing 2.

As I said in the beginning, there are many ways to solve the same problem in UNIX. Had we decided to use a different technique for internally alphabetizing our words, we might not have had to split the file. However, using the technique that we used (where `sort` is used to arrange the letters in reverse alphabetical order), this was a good "quick and dirty" solution.

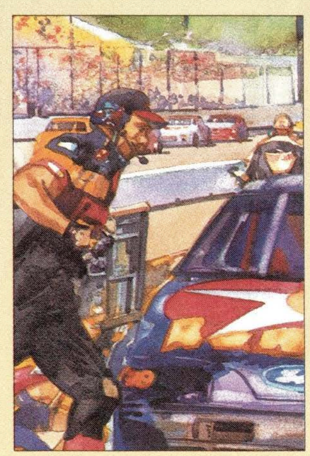
We also needed to be able to "recall" the original word for each alphabetized word; otherwise, we'd wind up only knowing that the unjumbled counterpart for "acdhopry" was indeed in `/usr/dict/words`, but *still* not know what the real word was. The script that we wound up using is shown in Listing 2 and the word (why didn't I see this right away?) is "hardcopy."

__S. Lee Henry__ works as a security services engineer at Infonet in El Segundo, CA, where no one else necessarily shares any of her opinions. Mallory is a fifth-grade student at Brentwood Science Magnet and has some unique opinions as well. Neither of them accepts limits very gracefully. You can send email to them by addressing it to `slee@cpg.com`.

Listing 2. grep 'acdhopry' alphwords

```
#!/bin/csh

cat /usr/dict/words | awk '{if (length($1)==8) print $1}'>words.$$
split words.$$
foreach file ( xaa xab xac )
   foreach word (`cat $file | awk '{print $1 ":"}'`)
      set ALPHWORD = `echo $word \
      | awk '{for (d = 1;d <= length(&0);d++) print substr($0,d,1)}' \
      | sort -r | tr -d "\012" | tr ":" "\012"`
      echo $word $ALPHWORD >> alphwords.$$
   end
end
```



Starting over from scratch? Again?

Wouldn't it be nice to have a fallout shelter that could protect the entire company's system?

No matter what the cause, no matter what the reason.
Complete system restoration at your fingertips! SolidStor is your answer.

SolidStor was specifically designed for enterprise-wide, storage management for heterogeneous computing environments requiring back-up/recovery, archiving, HSM and disaster recovery of mission-critical data. It contains some of the best-of-breed technologies from Sun Microsystems, IBM and ATL Products. This self-contained, high-performance solution supports a wide variety of different operating systems and does on-line back-ups for numerous databases. Benefits of SolidStor include the ability to protect your corporate data, more efficient network utilization, improved productivity, reduced storage costs, reduced training costs and reduced labor costs - all in one package.

Let us show you how SolidStor can be *your* Fallout Shelter.

solidstor
SOLID SYSTEMS, INC. storage solutions

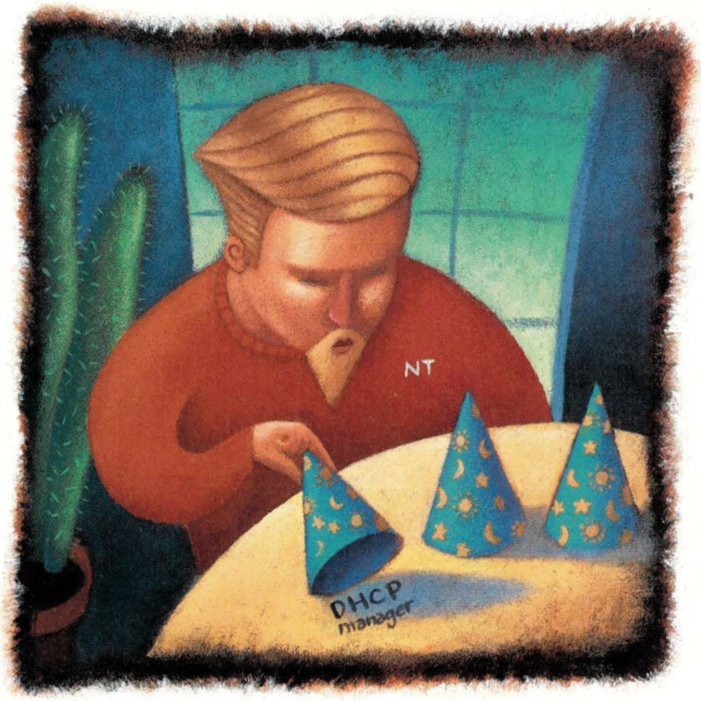
(800) 324-0500
http://solidstor.com
solidstor@solidsys.com

solid
SOLID SYSTEMS, INC.

Sun microsystems
VALUE ADDED RESELLER
Enterprise Computing Certified

Circle No. 24

by Æleen Frisch



WILL TERRY

The NT Administrative Toolkit

This month, we'll take a look at the tools that are available for administering Windows NT systems, including both those provided as part of the operating system and those that have been developed to fill in for some of the missing pieces in the standard set.

Windows NT provides several kinds of programs and utilities designed for systems administration:

• Control panel applets: These utilities are located in the **Control Panel** folder under **My Computer** (they may also be reached via the **Start=>Settings=> Control Panel** menu path). Each control panel applet is used to display and/or modify the configuration settings for a specific subsystem or function within the local system. The more complicated control panel applets may subdivide the groups of settings for which they are responsible among several tabs within their dialog box.

• Administrative wizards – These utilities are found on server systems and are designed to perform a single administrative task in an automated, step-by-step manner–for example, adding new users or printers. You run these wizards via the menu provided by the **Start=>Programs =>Administrative Tools (Common)=> Administrative Wizards** menu path or the `wizmgr` command.

• Windows-based administrative tools – Microsoft intends that most administrative tasks on Windows NT systems be performed via the series of Windows-based administrative tools it provides with the operating system. Most of these utilities can be run via the **Start=>Programs=>Administrative Tools (Common)** slide-off menu (although a few are accessed in other ways). Each tool manages a specific system/domain component or subsystem, and they are all capable of performing far more complex administrative tasks than the control panel applets or administrative wizards.

• Command-line administrative utilities – These programs duplicate a subset of the functionality found in the graphical administrative tools. They are generally run from a command window (remember, you can open one by entering `cmd` into the **Start=>Run...** dialog box).

We'll consider each of these utilities in more detail.

Control Panel Applets

Control panel applets control configuration settings that apply only to the local system. Many of them are primarily designed to allow users to customize their working environments, but some of them have systems administration uses as well. The exact number of them varies somewhat, depending on the system's hardware and software configuration. Figure 1 illustrates a common set of control panel applets.

The following are the most important control panel applets for systems administrative purposes:

• **Date/Time**: This extremely simple program allows you to set the system's date, time and time zone.

• **Licensing**: This applet is used to manage licenses belonging to the local system. On a Windows NT server system, it may also be used to change the licensing mode from per-server (where system usage is measured as the number of client connections to the server) to per-seat (where licenses reside with the client computers, which can use their licenses to access multiple server systems as needed) on a onetime basis.

• **Network**: You'll encounter this utility often as you install and configure networking on new computer systems. The purpose of this applet is to configure network adapters, protocols and services and to specify the relationships among them. This tool may also be accessed via **Properties** of the **Network Neighborhood** (using its right-click menu).

• **Printers**: This is a shortcut to the **Printers** folder under **My Computer**. You can use it to add, remove and manage printers and print queues, manipulate print jobs and configure the spooling subsystem.

• **Regional Settings**: Another simple utility that allows you to specify how dates, times, numbers and currency are displayed and sorted on the system.

• **SCSI Adapters**: If your system uses SCSI disk, this tool is needed to add and remove SCSI adapters and to display the properties of the devices under their control.

• **Server**: This utility is used to monitor client usage of the system's shared resources.

• **Services**: This is another frequently encountered control panel applet. It is used to configure and manipulate the server processes that run on the local system.

• **System**: This utility is used to display and modify the values of a variety of system parameters, including ones related to system booting, system shutdown, the user environment and system performance characteristics.

• **Tape Devices**: This applet is used to manage tape drives on the system.

Administrative Wizards

The administrative wizards are included only on Windows NT server systems. As we noted, they consist of automated procedures for common administrative tasks. Each task can be performed either on the local computer or on a remote computer. As with the Windows 95 procedures of the same name, administrative wizards proceed as a series of dialog boxes requesting the information required to complete the desired action.

There are eight administrative wizards, most of whose functioning is described in its name: **Add User Accounts**, **Group Management**, **Managing File and Folder Access**, **Add Printer**, **Add/Remove Programs**, **Install New Modem**, **Network Client Administration** (allows you to set up the system as a server for subsequent network installations of Windows NT) and **License Compliance** (checks a domain for unlicensed products).

GUI-Based Administrative Utilities

As with control panel applets, the exact number of administrative tools located in the **Administrative Tools (Common)** subgroup varies according to the hardware and software installed on the system. Figure 2 illustrates a common set of these utilities.

Table 1 describes all of the GUI-based systems administration tools provided by Windows NT. For each program, it provides the name of the utility as it appears on the **Start=>Programs=> Administrative Tools (Common)** menu (if applicable), the corresponding command executable name (by which it may be accessed from the **Run** menu), the type of system where the tool is provided (server only or servers and workstations) and a brief description of its purpose. All of these tools may be used to affect either the local system from which they are executed or to perform remote administration of other systems within the network. They also generally require administrative privileges.

Installing Server Tools on Workstations

The Windows NT Server distribution CD contains versions of many of the server-specific administrative tools that may be executed on a Windows NT Workstation system. You can install them by running the `Setup.Bat` command in the CD's `\Clients\Srvtools\WinNT` directory at the target workstation, which will copy them

Figure 1. Control Panel Applets

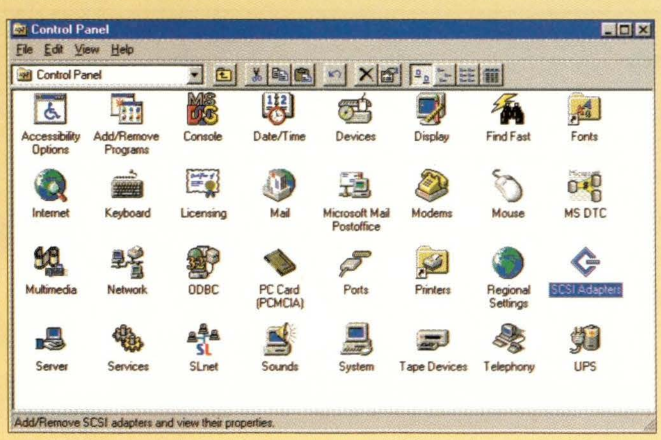
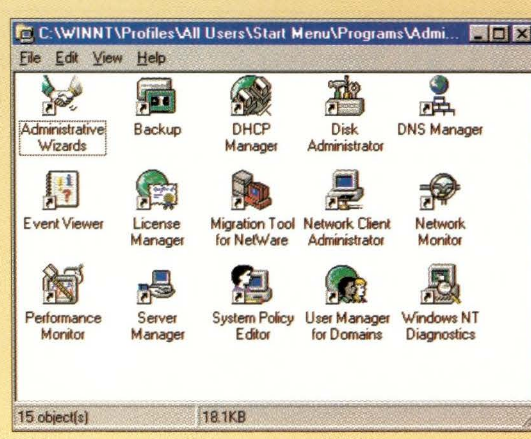


Figure 2. Windows NT GUI-Based Administrative Tools



into the local `C:\WinNT\ System32` directory. If you want the program to appear in the **Administrative Tools (Common)** menu, create shortcuts for each of the executables by dragging their icons into the `C:\WinNT\System32\ Profiles\AllUsers\StartMenu\ Programs\AdministrativeTools (Common)` directory.

Command-Line Utilities

The standard Windows NT operating system includes a number of command-line utilities that are useful for systems administration, and the Resource Kit includes many more. These are the most important standard commands (with which every Windows NT systems administrator will need to become familiar), grouped by function:

- `net share` – Make local file system resources available to the network.
- `net use` – Map remote file system resources to a local drive letter.
- `cacls` – Display and/or modify file permissions (access control lists).
- `compact` – Specify or remove transparent file compression for files

Table 1. Windows NT Administrative Tools

Tool	Command	Type	Purpose
Backup	`ntbackup`	Both	Back up and restore files to/from tape.
DHCP Manager	`dhcpadmn`	Server	Manage the TCP/IP Dynamic Host Configuration Protocol service.
Disk Administrator	`windisk`	Both	Create, configure and remove disk partitions and file systems.
DNS Manager	`dnsadmin`	Server	Manage the TCP/IP Domain Name Service.
Event Viewer	`eventvwr`	Both	Monitor hardware, security and application-related system status messages and errors.
License Manager	`llsmgr`	Server	Manage software licensing for one or more domains.
Network Client Administrator	`ncadmin`	Server	Prepare the system to provide network-based installation services.
Network Monitor	`netmon`	Server	Monitor and record current network activity.
Performance Monitor	`perfmon`	Both	Monitor, analyze and record system usage data for performance tuning.
Registry Editor	`regedt32`	Both	View and modify settings in the system registry.
Remote Access Administrator	`rasadmin`	Both	Manage Remote Access Services (the dial-up networking facility that runs on top of PPP or SLIP).
Remote Boot Manager	`rplmgr`	Server	Configure remote booting services (via the TCP/IP Bootp protocol).
Server Manager	`srvmgr`	Server	Manage shared resources and services for computer in the domain; also promote/demote primary and backup domain controllers.
System Policy Editor	`poledit`	Server	Create and modify system policies (these specify allowed user actions and general areas access within the operating system).
Task Manager	`taskmgr`	Both	View and manipulate running applications and processes.
User Manager for Domains	`usrmgr`	Server	Create and modify user accounts for use within the local domain. On workstations, a similar tool is provided for managing local accounts (`musrmgr`).
Windows NT Diagnostics	`winmsd`	Both	View system characteristics and current hardware settings.
WINS Manager	`winsadmn`	Server	Manage the Windows Internet Naming Service facility.

Table 2. Web Resources for Windows NT Software

Aaron's Alpha NT Applications Archive
http://dutlbcz.lr.tudelft.nl/alphant/archive.html

Beverly Hills Software
http://www.bhs.com/download/default.asp

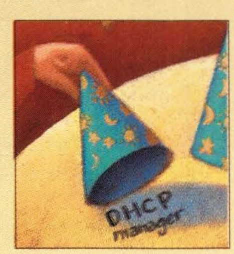
Jim Buyens' Windows NT Web Server Tools
http://www.primenet.com/~buyensj/ntwebsrv.html and *sysadmin.html*

The Coast to Coast Software Repository
http://www.coast.net/SimTel/nt.html

Windows NT Internals Utilities
http://www.ntinternals.com/ntutil.htm
(created by Mark Russinovich and Bryce Cogswell)

Windows NT-Plus
http://www.windowsnt-plus.com/shareware

WinSite Windows NT Archive
http://www.winsite.com/winnt



and/or directories.

- `chkdsk` – Check a file system for integrity errors.
- `net send` – Send a message to a user or group of users (locally or on the network).
- `at` – Schedule a job to run at a specific time or periodically according to a specified schedule (a combination of UNIX-style `at` and `cron` facilities).
- `start` – Initiate a process.
- `net start`, `stop`, `pause`, `continue` – Initiate, terminate, pause and resume system services and the processes associated with them.
- `net user` – Create or modify user accounts.
- `net group` and `net localgroup` – Create or modify groups and their memberships.

Here are some of the most important administrative commands included in the Windows NT Resource Kit:

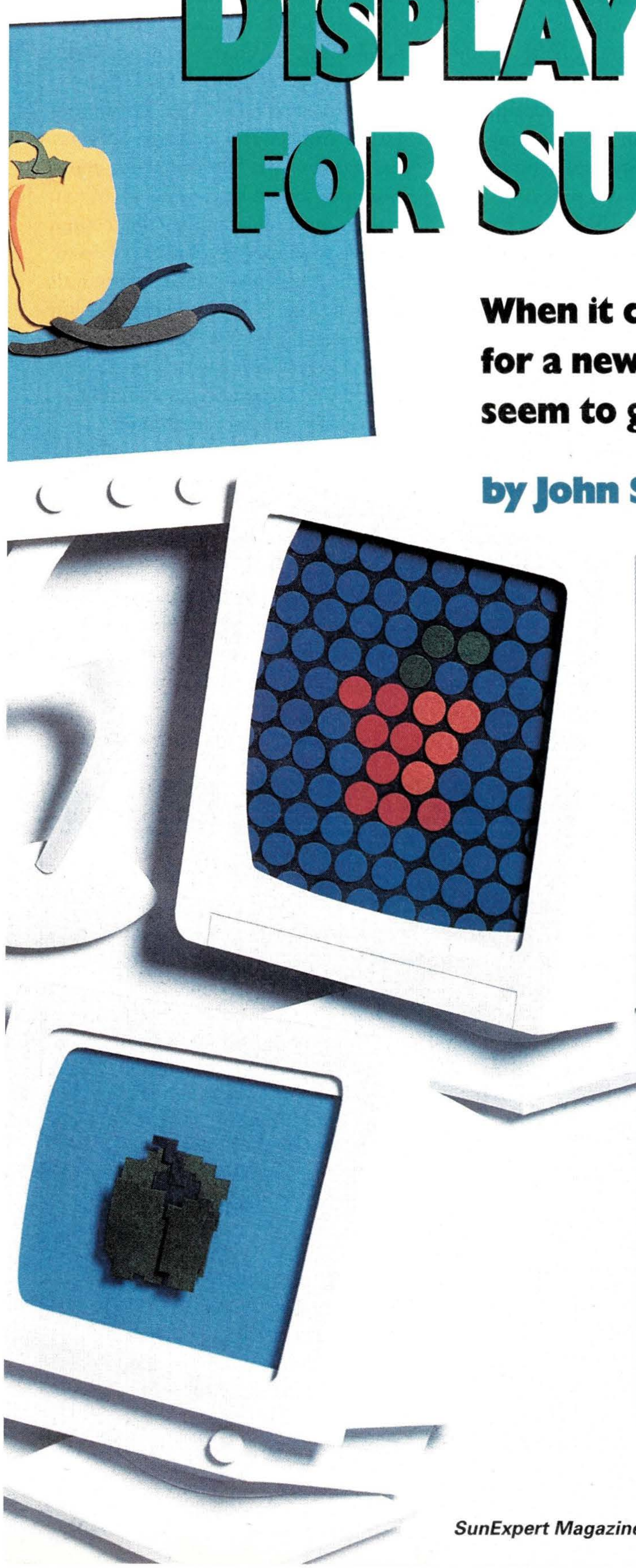
- `regback` and `regrest` – Back up and restore registry hives to a file.
- `scanreg` – Search the registry for a character string.
- `shutdown` – Initiate a system shutdown.
- `srvcheck` – List shared resources for a local or remote system and their access permissions.
- `pmon`, `pulist` and `tlist` – List processes currently running on the system in various formats.
- `pview` and `pviewer` – Display detailed statistics for a single process.
- `sclist` and `netsvc` – Display services for a remote host and manipulate services on a remote host.
- `usrstat` – List domain users and their most recent login times.
- `srvinstw` – Service installation administrative wizard.

As I've hinted, there are many tools that are missing from Windows NT even as supplemented by the Resource Kit. We will be considering some of them in the coming months. For now, Table 2 displays the Web addresses of several excellent software repositories focused on Windows NT. All of the sites include many administrative tools among their offerings. The programs that you can download from these sites are of three general types: freely available utilities, shareware (much of which is fully functional only for a limited period of time) and time- and/or feature-limited demonstration versions of commercial software.

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

DENISE ORTAKALES

Display Options for Sun Users



When it comes time to weigh options for a new desktop system, monitors seem to get short shrift.

by John S. Webster

Considering that most of us spend virtually all of our computing time staring at the monitor screen, it's surprising how little attention this peripheral garners in the press. It's hard to miss the plentiful (and often colorful and snazzy) monitor advertisements as we flip through computer publications, but aside from the occasional feature or review, monitors get very little in the way of editorial coverage.

For users who need to display multiple windows from several applications and a variety of data-intensive imagery, such as 3D CAD models, animations, page proofs and CAT scans, monitor size and quality become crucial factors in a new system purchase. These users want crisp images and not a wisp of noticeable screen flicker. Detail is paramount, and screen sizes ranging from 19 to 21 inches are fast becoming the standard for users working with these kinds of images. But far more emphasis seems to be placed on CPU horsepower, storage capacity and software features than on the peripheral that conveys all the information we use in a form that makes sense to us–that is, the monitor.

Large-screen displays are most commonly found in vertical markets where the screen real estate depicts complex data and minute detail. These markets include manufacturing and automotive, including petroleum exploration; EDA/CAD/CAM; medical imaging; finance; entertainment; graphic arts and publishing; and application development.

Sun the Only Option?

A number of manufacturers offer large-screen displays that work with the Sun Microsystems Inc. platform, but many Sun users don't bother to look beyond Sun's own products, according to Lori Salcido, product line manager for display devices at Sun Microsystems Computer Corp. (SMCC).

"When our customers in these markets [CAD/CAM, finance, graphic arts and so on] look at the screen, they want to see a clear, crisp, clean image, and they won't buy a monitor that is less than satisfactory. And customers know when they get a Sun monitor that clarity will be there," Salcido says.

The truth is, monitors from a number of other manufacturers might also be worth a look. Even Sun's UNIX system competitors, including IBM Corp., offer monitors that work with the Sun platform. Alan Petersburg, IBM's worldwide brand manager for visual products, says that users in vertical markets have higher standards than users running Windows productivity applications such as spreadsheets and word processors on the desktop, and that IBM has a few units aimed at presenting this data-intensive material in a clear manner.

"These users need to have more information in front of them. They're looking at CAD imagery with 3D rotating models to see what the wind-resistance demand is on an airplane wing, for example, and this requires a 1,600-by-1,200-pixel screen resolution on a 21-inch display. And the financial market tends to require quite a lot of screen real estate. When you get into graphical representation of stock prices, as well as the fine print they frequently have to read, they need a multitude of monitors. A lot of times, they'll have a Reuters screen with a second screen pulling up the latest financial information, and different flows of information," Petersburg explains. Much of this could be combined on a couple of 21-inch monitors, he adds.

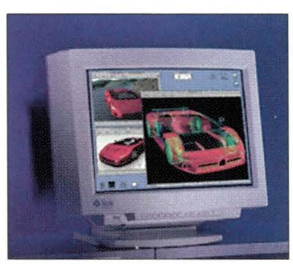
Other monitor vendors offering large-screen displays that work with the Sun platform include Panasonic Computer Peripherals Co., ViewSonic Corp., NEC Technologies Inc., Eizo Nanao Technology Inc. and KDS USA. Before you start to shop around, however, a few factors regarding the Sun platform's graphics output should be considered. Most vendors, including Sun, say that besides needing to support resolutions of up to 1,200 by 1,000 pixels or so, a minimum refresh rate of 75 Hz is required to eliminate screen flicker. And that's the minimum. Users working with virtual reality images, stereoscopic scenes and 3D models want even higher refresh rates.

"You need to support the resolution and output of the graphics card, but for stereo images, 3D and virtual reality, the minimum resolution requirement would be 1,280 by 1,024. You have to look at what's generated by the Sun graphics cards shipped with the workstations," says Bjorn Anderson, product line manager for graphics and multimedia at SMCC.

Sun's TurboGX and TurboGXplus

Sun Rolls Out HDTV Display

When Sun Microsystems introduced the Ultra 30 workstation in July, it also rolled out a whole new class of monitors, including a 24-inch high-definition television (HDTV) display that adds a different look to the company's monitor line. The display offers 30% more screen area than a 20-inch monitor and features Sony Electronics Inc.'s Trinitron tube with screen resolutions of up to 1,900 by 1,200 pixels at a 70-Hz vertical refresh rate, and an aperture grille dot pitch ranging from .26mm to .29mm. The new display unit is targeted at users in publishing and multiwindowing environments, such as gas exploration.



Sun's new 24-inch display provides 30% more screen area than a 20-inch monitor.

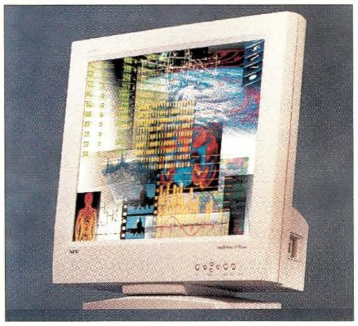
Sun developed the monitor based more upon user requests than of its own accord, says Lori Salcido, product line manager for display products at Sun Microsystems Computer Co. (SMCC), Menlo Park, CA.

"We didn't really plan to come out with an HDTV monitor, but users wanted a large enough screen to view two full pages side-by-side, for example, or in the financial market users wanted to see more information on one monitor."

The monitor has a 16:10 aspect ratio (horizontal by vertical units that make up the screen image), which, although differing from the standard monitor's 4:3 aspect ratio, can still be used by existing imaging software due to the flexibility inherent in the windowing system, says Bjorn Anderson, graphics and multimedia product line manager at SMCC.

"The aspect ratio is driven by the graphics card," Anderson adds. "The software only needs to know the screen resolution. The windowing system, whether it is OpenWindows or the Common Desktop Environment [CDE], is flexible enough to handle the different aspect ratio."

The 24-inch HDTV monitor costs $4,000.–*jsw*



NEC's MultiSync LCD400 has a 14.1-inch monitor.

graphics cards produce the following output frequencies: 1,024-by-768-pixel resolutions at 60 Hz or 77 Hz; 1,152-by-900-pixel resolution at 66 Hz or 76 Hz; and 1,280-by-1,024-pixel resolution at 67 Hz or 76 Hz. The Ultra 1 and Ultra 2 Creator and Creator3D Series 1 cards produce the same resolutions and frequencies. The Ultra 30 Creator and Creator3D Series 2 cards also produce the same, as well as 1,280-by-800-pixel resolution at 76 Hz; 1,440-by-900-pixel resolution at 76 Hz; 1,600-by-1,000-pixel resolution at 66 Hz; and 1,920-by-1,200-pixel resolution at 70 Hz.

Users looking beyond Sun for new monitors should also keep in mind that a special adapter will be necessary to hook the monitor up to the Sun workstation. While most monitors ship with a 15-pin adapter, Sun requires a 13W3 13-pin adapter. Sun's Salcido says the 13-pin adapter produces a better picture quality at higher resolutions.

Most dealers should offer a 15-pin-to-13-pin adapter, says Gary Newkirk, senior engineer at IBM's visual products division. "The IBM G series uses the standard 15-pin adapter so you'll need the 13W3 adapter for the Sun Ultra platform. It's just a different detachable cable that you can buy to attach to the machine. You can also get a 15-pin-to-13-pin adapter, called a dongle, which is a wire-to-wire connector."

Resolution vs. Brightness

For Sun's part, the company offers several monitors with screen sizes measuring 19 inches or more. These include a 20-inch model using aperture grille display technology, a 24-inch HDTV-specification monitor (see "Sun Rolls Out HDTV Display"), and a new 19-inch shadow mask display, which replaces a 17-inch aperture grille unit. Sun's 17-, 20- and 24-inch displays use Sony Electronics Inc.'s Trinitron tube, regarded throughout the monitor industry as the leader in image clarity.

Briefly overviewing the differences between aperture grille and shadow mask technology, Dave DeVries, monitors product manager at Panasonic Computer's display monitor division, Secaucus, NJ, says that with the latter, the monitor's cathode ray tube (CRT) uses three electron guns arranged so the beams will pass through apertures in the mask and strike the phosphor screen in specific locations. The phosphor itself is composed of "triads of dots," called pixels, each containing one red dot, one green dot and one blue dot for displaying the primary colors and shades in between. The electron beam corresponding to the desired color strikes only the phosphor dots that produce that color at that point on the screen.

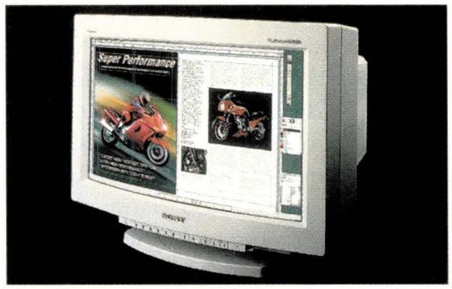
In contrast, DeVries says, the aperture grille tube uses vertical stripes of color phosphors in alternating red, green and blue triplets instead of dots, with a grid structure in front to focus and deflect the beam to the appropriate color stripe. A single large electron beam lens is used in conjunction with a three-aperture plate or three inline guns to produce the three inline beams. The apertures are one-third better in terms of resolution than the conventional shadow mask in transmission.

Shadow mask has higher horizontal resolution for a given pitch than an aperture grille monitor, but aperture grille has a higher brightness in general, he adds.

In other words, says Sun's Salcido, "the aperture grille provides a better picture quality for markets like CAD, due to the way the color landing beam is used. The shadow mask uses dots, whereas aperture grille uses vertical slots."

Another specification users should look for when shopping for a new large-screen monitor is dot pitch, which is the distance between two dots on the screen. As a rule of thumb, the smaller the dot pitch, the crisper the image. However, there are other variables to consider, cautions Panasonic's DeVries, including whether the tube is shadow mask or aperture grille, electron beam size and shape, video board signal quality, and video cable quality and length.

For example, "an aperture grille has about 12% less resolution for a given grille pitch compared to a given shadow mask dot pitch. An aperture grille tube would have to have a grille pitch of .22mm to equal the horizontal resolution of a dot-trio conventional CRT with a dot-pitch of .25mm," DeVries says.



Sony's GDM-W900's wide-screen monitor permits full-size viewing of two letter-size pages.

Panasonic's large-screen display line includes the PanaSync P21, which offers up to 1,800-by-1,440-pixel resolution at a 71-Hz vertical refresh rate and .25mm dot pitch on a 21.5-inch viewable screen. It is priced at $1,599.

Image quality controls are another feature users expect to find on a

Flat Panels

The first liquid crystal display (LCD) came into being a quarter century ago at RCA's Sarnoff Research Center, but the technology is still finding growing, if slow, acceptance in the desktop monitor market. In user environments such as the financial market, medical imaging and some industrial settings, where space is at a premium and image clarity is at the top of users' "want" lists, flat panels have found a niche, but a high retail price compared with their traditional cathode ray tube (CRT) counterparts is keeping them from reaching larger numbers of user desktops.

Still, image quality, aesthetics and space efficiency keep the products alive, especially on laptops. Their use on the desktop hasn't become as pervasive, however. According to a study conducted by Stanford Resources Inc., San Jose, CA, an electronic display market resource firm, which published its results in early 1997, flat panel's time is yet to come on the corporate desktop. The study, entitled "Liquid Crystal Display (LCD) Monitor Segmentation Study: A Market Opportunity Analysis," focuses on the North American LCD monitor industry, with an emphasis on unit and sales demand based on price, screen size and attributes end users consider important.

"Although LCDs have become the leading volume display technology in the market for portable computers, their application for the desktop has yet to fully emerge. As the LCD technology attempts to invade the desktop monitor market, many of the CRT-based PC and workstation monitors are improving and becoming less expensive," says Sweta Dash, senior market analyst at Stanford Resources and primary author of the report.

Even though the study was conducted almost a year ago, it provides a broad shipment forecast from 1997 to 2002 based on pricing models for LCD monitors with screen sizes corresponding to the most popular CRT monitors–those in the 14-, 15-, 17- and 20-inch size categories.

And as volume shipments rise, prices will slowly drop, say flat-panel vendors. "Three years ago flat panels in the 15-inch size range sold for $35,000, and now they're more like $4,000," says Ed Sasena, product marketing manager at PixelVision Technology Inc., Acton, MA, which manufactures flat-panel displays. "But there really isn't a market for it yet as a desktop product. Even engineering departments aren't buying them. It's very niche still, like in the New York Stock Exchange. In CAD/CAM, the business benefit is not really there yet." Sasena adds that more recent technologies are still years away from reaching production levels, and we won't see flat panels using those technologies for a few years.

Aside from revealing a widening price difference between CRT monitors and LCD monitors, the Stanford Research study found the following:

- Unit price is the most important attribute to consumers.
- Current price differentials will keep LCD penetration into the desktop market at a minimum, and even at a 25% premium over CRT prices, substitution will be significantly less than 50% in 2002 in all but the least expensive units with the smallest screen sizes.
- The North American market for thin-film transistor (TFT) LCDs (the most commonly used technology) is expected to grow from 24,245 units in 1996 to almost 3 million units in 2002, equaling a compound annual growth rate of 122%.

It appears on the basis of this report that LCDs will continue to be used only in their specific niche markets, because the bottom line still outweighs the convenience of space efficiency and their improved image clarity in all but a few industries.

Current LCD technology involves the use of a sheet of liquid crystal material, which is placed between a pair of transparent electrodes. The liquid crystal changes the phase of the light passing through it, controlled by voltage applied between electrodes.

According to Dave DeVries, monitors product manager at the display monitor division of Panasonic Computer Peripherals Co., Secaucus, NJ, "LCD display technology monitor, whether it's a knob located on the monitor bezel, or software controls accessed and manipulated by mouse clicks or keyboard strokes. Controls may include image size and positioning, image geometry, image rotation, color temperature and degaussing, which lets users adjust for different magnetic fields depending on where they are geographically situated.

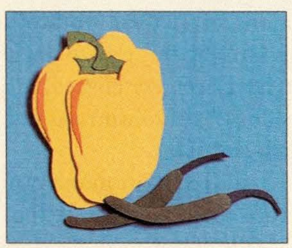
One recent entrant into the large-screen computer market, ADI Systems Inc., San Jose, CA, offers many of these controls on a software-generated panel that can appear on screen. "Part of what the high end of the market wants is digital controls," says Dan Dunn, director of distribution sales and marketing at the company. "We have increased the number of onscreen controls we offer. A microprocessor inside the monitor controls a digital panel that lets users adjust RGB color, temperature control and other parameters."

ADI's large-screen offerings include the $1,899 MicroScan 6G, a 21-inch (20-inch viewable) monitor supporting up to 1,600-by-1,200-pixel resolution, .28mm dot pitch and 75-Hz vertical refresh rate. The company also recently introduced a low-cost 19-inch display (18-inch viewable image), the MicroScan 6P, which offers screen resolutions of up to 1,600 by 1,200 pixels at a 75-Hz vertical refresh rate and .22mm dot pitch. This shadow mask monitor is built around Hitachi Ltd.'s CRT technology and sells for $975.

Image size and geometry controls become especially important on large screens to minimize distortion at the edges of the viewable portion of the

uses rod-shaped molecules (liquid crystals) that flow like liquid and bend light. Unenergized, the crystals direct light through two polarizing filters, allowing a natural background color to show. When they are energized, they redirect the light to be absorbed in one of the polarizers, causing the dark appearance of crossed polarizers to show. The more the molecules are twisted, the better the contrast and viewing angle."

LCD flat panels can be divided into two main categories: those that use passive-matrix technology and those that use TFT, synonymous with active matrix technology. Passive matrix, the less expensive of the two, consists of a grid of horizontal and vertical wires. An LCD element at the intersection of each set of wires makes up a single pixel, either letting light through or blocking it. Active matrix LCD flat panels contain pixels that are each controlled by one to four transistors, providing better resolution than CRT monitors, but they also cost more to manufacture.



Lower production costs, coupled with more recent advances in passive matrix technology, have helped this type of flat panel maintain a place in the industry, especially for monochrome displays. These recent advancements include supertwist nematic (STN) technology, in which light rays are twisted to increase image contrast; double-layer supertwist nematic, in which two display layers counteract the color shifting that can occur in STN displays; and color supertwist nematic, which now rivals TFT displays in terms of color quality, according to vendors.

IBM Corp.'s Gary Newkirk, senior engineer at the company's visual products division, says, "an image on a TFT monitor appears to be crisper and sharper than that on a comparably sized CRT. TFT is composed of fixed dots that are lit up and give you high resolution in a smaller screen area. And in medical and financial markets, clarity is crucial. The other thing is the ergonomics. CEOs like them sitting on their desks, not so much because they need the space, but they look good."

The IBM 16-inch 9516 flat-panel monitor retails for $4,695. It offers a 16.1-inch viewable image size, .25mm dot pitch and 16 million display colors in a 17- by 16.1- by 9.8-inch package.

Another advantage LCD flat panels currently have over CRTs is life expectancy. This is primarily due to the use of a replaceable backlight, according to manufacturers. "The limiting factor on life expectancy of an LCD panel is the backlight. This is currently about the same as that of CRTs, but the backlights are replaceable [on an LCD] as a service item for a small percentage of the original cost," Panasonic's DeVries says.

Adds PixelVision's Sasena, "After about 20,000 hours, a CRT tube will lose about 50% of its brightness, and that figure is about the same with LCD panels. The difference is that it [the backlight] can be replaced in a flat-panel monitor and it's like new again."

Imaging technology found in LCD panels also limits their emissions, which become a factor in hospitals, because even small amounts of electromagnetic radiation can affect sensitive X-ray devices and other instruments, says IBM's Alan Petersburg, worldwide brand manager for visual products.

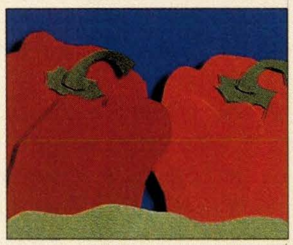
"Emissions in CRTs are fundamental in how they're manufactured. Around the yoke there are coils of wire reflecting the beam, so it will give off some electromagnetic waves. There are ways to limit that, but inside there are always these high voltage coils. As for most commonly used technologies, with TFT you have a sheet; there's no coil and no CRT, so there's no emissions. Even aside from the health concerns, with medical applications, flat panels are gaining acceptance because of their size and emissions," Petersburg says.

The consensus among vendors is that aside from narrow vertical markets, the desktop flat-panel market is destined for slow growth until prices come down considerably.–*jsw*

SmartGlas Adds Flexibility in Flat-Panel Environments

Flat-panel manufacturer PixelVision Technology Inc., Acton, MA, has teamed up with VisiCom Inc., San Diego, CA, to introduce a flat-panel display network. Called SmartGlas, the display network condenses the electronics of four LCD displays into a single hub to solve space-management, utility costs and ergonomic problems facing users in work environments such as stocks trading.

Introduced in May, the SmartGlas system can drive four "information tiles" from one SBus slot, which contains VisiCom's TiGriX card, an 8-bit SBus graphics controller. SmartGlas hubs handle image tile setup, single-point system control and fault-tolerant power distribution. Other features include a central power system and Ethernet connections.



"Users can move their mouse from a 2,048-by-1,536-pixel display to a 1,024-by-768-pixel display, or move windows between the two displays," says Ed Sasena, product manager at PixelVision.

Sasena says the hubs can also be linked together, so network administrators can manage many displays from a central location, and set each display to dim itself at the end of the workday, or to view voltage levels and flat-panel display temperatures in order to proactively deal with potential equipment failures.

In addition, because the SmartGlas system is designed "to handle central and local power supplies, network administrators can introduce fault tolerance and redundancy," Sasena says.

SmartGlas configuration prices start at $3,000.–*jsw*

monitor, which can be more pronounced in a larger-screen image, according to Sun's Salcido.

"Large-screen users want the image to be as close to the edge as possible. The lack of distortion is important, so you want to get rid of the black border and have as much usable space as possible," Salcido says.

However, these controls, while useful, are often more of a comfort feature than one that users want to fiddle with on a frequent basis, she adds. "I don't think controls are used very often. For the most part, from a Sun perspective, they [the users] basically can turn it [the monitor] on, but whether or not they're using them [the controls], they want them to be there."

While large screens carry the benefit of displaying vast amounts of data all at once, they also emit more radiation than their smaller counterparts. This was more of an issue five years ago, when a number of lawsuits were filed by plaintiffs claiming increased incidences of miscarriages and cancer due to monitor emissions. Since then, worldwide standards limiting this electromagnetic radiation have been established, meaning users don't have to worry as much about such emissions.

IBM's P200 is a 20-inch CRT monitor with 1,600-by-1,200-pixel resolution at 75 Hz noninterlaced.

Today, most monitor manufacturers conform to the MPR-II standard, developed in Sweden in the early '90s. The Swedes were the ones that raised the issue initially and drove the standards all the way up to the present MPR-II. And that's good news for consumers, according to IBM's Newkirk.

Prices Continue to Drop

While prices for their 15- and 17-inch counterparts are dropping fast, with most now available for well under $1,000, 19- and 20-inch monitor prices are for the most part still in the $1,500 to $2,000 range.

"Twenty-inch to 25-inch [monitor prices] are also coming down somewhat, but not like the 15-inch displays, which are pretty much at commodity pricing now, and the 17-inch are now approaching that. For the 19- and 20-inch, there's still some pressure to come down, but not as much," IBM's Petersberg says.

IBM's P200, a 20-inch CRT monitor with a 19-inch viewable image size and a 1,600-by-1,200-pixel resolution at 75 Hz noninterlaced, retails for $1,629; while the P209, also a 20-inch CRT with a 19-inch viewable image, has a 1,600-by-1,200-pixel resolution at 85 Hz noninterlaced and costs $1,949; and the P70, a 17-inch CRT with a 15.9-inch viewable image size and a 1,280-by-1,024-pixel resolution at 75 Hz noninterlaced, costs $849.

For Sun's part, the company's monitors are bundled with its workstations.

In the end, all vendors agree that the best way to choose a monitor is to look at the unit. Two monitors from different manufacturers that sport the same check-off features can present very different screen images. There are other large screen options available for Sun users, and despite the company's stated commitment to quality, it's worth noting that Sun Ultra users aren't required to limit their choices to Sun's own offerings. As with anything else, it pays to shop around.

A Sampling of Large-Format Monitors (19-inch and above)

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

KEY: ARAGAS = Antireflection, antiglare, antistatic V/H = Vertical/Horizontal — = Information not available

	ADI Systems Microscan 6G	CTX International* EX805	CTX International* EX910	EIZO Nanao* FlexScan TX-D7S	EIZO Nanao* FlexScan FX-E8	HP M900
Screen size (inches)	20	19	21	20	21	19
Viewable image size (inches)	20	18	20	18.8	19.7	18
Case footprint (HxWxD in inches)	19x19.6x22.1	18.2x18.1x18.7	20x20.2x20.3	19.1x19.4x22.5	19.1x19.4x22.5	17.9x17.6x18.1
Original manufacturer	ADI	CTX	CTX	EIZO Nanao	EIZO Nanao	HP
Tube technology	Invar shadow mask/ flat square	Hitachi high-contrast, flat square	Hitachi high-contrast, flat square	Sony Trinitron/ aperture grille	Invar shadow mask/ flat square	Flat square
Maximum pixel resolution	1,600x1,200	1,600x1,200	1,600x1,200	1,600x1,200	1,600x1,200	1,600x1,200
Maximum refresh rate	150 Hz @ 800x600	85 Hz @ 1,280x1,024	75 Hz @ 1,600x1,200	160 Hz @ 640x480	160 Hz @ 640x480	150 Hz @ 640x480
Maximum refresh rate at maximum resolution	75 Hz @ 1,600x1,200	75 Hz @ 1,600x1,200	75 Hz @ 1,600x1,200	87 Hz @ 1,600x1,200	87 Hz @ 1,600x1,200	75 Hz @ 1,600x1,200
Scanning frequencies (kHz horizontal, Hz vertical)	30-95 kHz, 50-160 Hz	30-95 kHz, 50-160 Hz	30-95 kHz, 50-160 Hz	30-95 kHz, 50-160 Hz	30-110 kHz, 50-160 Hz	30-95 kHz, 75-150 Hz
Dot pitch (mm)	.28	.26	.26	.25	.26	.26
Brightness control	Yes	Yes	Yes	Yes	Yes	Yes
Contrast control	Yes	Yes	Yes	Yes	Yes	Yes
Degauss control	Yes	Yes	Yes	Yes	Yes	Yes
Front-mounted controls	Yes	Yes	Yes	Yes	Yes	Yes
On-screen controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls description	Digital	Digital	Digital	4-way navigation	4-way navigation	Push-button, rotating thumbwheel
Basic geometric controls	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, image size, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation
Advanced geometric controls	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain, Degauss	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	User-defined settings with recall, color temperature
Tilt stand	Yes	Yes	Yes	Yes	Yes	Yes
Swivel stand	Yes	Yes	Yes	Yes	Yes	Yes
Screen glare reduction	Nonglare, dark tinted	ARAGAS multilayer coating	ARAGAS multilayer coating	ErgoPanel, antiglare, antistatic	SuperErgoCoat protection	Multilayer, antiglare and antistatic coating
Magnetic field correction	Yes	No	No	Yes	Yes	Yes
Microphone/speakers module	Yes	No	No	Yes	Yes	No
Standards compliance	TCO '95, MPR-II	TCO '95, MPR-II	TCO '95, MPR-II	TCO '95, MPR-II, CSA & FCC-B, ISO9241-3, Energy Star, more	TCO '95, MPR-II, CSA & FCC-B, ISO9241-3, Energy Star, more	TCO '92, MPR-II, Energy Star, Nutek, CSA, more
Warranty	42-month limited on parts, labor and CRT	3 years on parts and labor, 2 years on CRT	3 years on parts and labor, 2 years on CRT	3 years on parts, labor and CRT	3 years on parts, labor and CRT	3 years on parts and labor (first year on-site, second and third year carry in)
List price ($)	1,299	999	1,499	1,999	2,667	1,074

*Company offers additional large-format monitors

Large-Format Monitors

	HP Ergo Ultra VGA 1600	IBM P200	IBM P201	Iiyama Vision-Master 450	Intergraph* 19sd95	Intergraph* 28hd96
Screen size (inches)	21	20	20	19	19	28
Viewable image size (inches)	20	19.1	19.1	18	18	25.9
Case footprint (HxWxD in inches)	19.2x19.9x22.4	19.4x18.6x19.7	18.7x18.7x19.9	—	17.9x17.6x18.1	19.5x27.5x24.4
Original manufacturer	HP	Sony	Sony	Iiyama	Hitachi	Panasonic
Tube technology	Flat square	Sony Trinitron/ aperture grille	Sony Trinitron/ aperture grille	Invar shadow mask/ flat square	Invar shadow mask/ flat square	Invar shadow mask/ flat square
Maximum pixel resolution	1,600x1,200	1,600x1,200	1,800x1,440	1,600x1,200	1,600x1,200	2,048x1,152
Maximum refresh rate	150 Hz @ 640x480	85 Hz @ 1,280x1,024	85 Hz @ 1,600x1,200	94 Hz @ 1,280x1,024	88 Hz @ 1,280x1,024	85 Hz @ 1,920x1,080
Maximum refresh rate at maximum resolution	75 Hz @ 1,600x1,200	75 Hz @ 1,600x1,200	70 Hz @ 1,800x1,440	81 Hz @ 1,600x1,200	76 Hz @ 1,600x1,200	80 Hz @ 2,048x1,152
Scanning frequencies (kHz horizontal, Hz vertical)	30-95 kHz, 75-150 Hz	30-96 kHz, 48-160 Hz	30-107 kHz, 50-160 Hz	27-102 kHz, 50-160 Hz	30-95 kHz, 50-160 Hz	30-96 kHz, 50-160 Hz
Dot pitch (mm)	.25	.31	.25	.28	.28	.32
Brightness control	Yes	Yes	Yes	Yes	Yes	Yes
Contrast control	Yes	Yes	Yes	Yes	Yes	Yes
Degauss control	Yes	Yes	Yes	Yes	Yes	Yes
Front-mounted controls	Yes	Yes	Yes	Yes	Yes	Yes
On-screen controls	Yes	Yes	No	Yes	Yes	Yes
Controls description	Push-button, rotating thumbwheel	Push-button	Push-button	Push-button	Digital, push-button	Digital, push-button
Basic geometric controls	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation
Advanced geometric controls	User-defined settings with recall, color temperature	Moire, convergence	Moire, convergence, purity adjust	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain
Tilt stand	Yes	Yes	Yes	Yes	Yes	No
Swivel stand	Yes	Yes	Yes	Yes	Yes	No
Screen glare reduction	Multilayer, antiglare and antistatic coating	7-layer, 1/4-wave, antiglare coating	7-layer, 1/4-wave, antiglare coating	Antiglare coating, etching	Optical coating	Super ARAGAS optical coating
Magnetic field correction	Yes	No	No	Yes	No	No
Microphone/speakers module	No	No	No	No	No	No
Standards compliance	TCO '92, MPR-II, Energy Star, Nutek, CSA, more	TCO '92, MPR-II, ISO9341-3, Energy Star, VESA DPMS, Nutek	TCO '92, MPR-II, ISO9341-3, Energy Star, VESA DPMS, Nutek	TCO '95, MPR-II, VESA DPMS	TCO '95, MPR-II, ISO9241-3, Energy Star, VESA DPMS	TCO '95, MPR-II, ISO9241-3, Energy Star, VESA DPMS
Warranty	3 years on parts and labor (first year on-site, second and third year carry in)	3 years on all components, Advance Exchange Program	3 years on all components, Advance Exchange Program	3 years on parts, labor and CRT	Contact vendor	Contact vendor
List price ($)	1,929	1,499	1,799	849	1,125	9,995

*Company offers additional large-format monitors

Large-Format Monitors

	KDS USA VS-19	KDS USA VS-21	Mitsubishi* Diamond Pro 91TXM	Mitsubishi* Diamond Pro 1010	MultiVideo Labs MV2975XLV	NEC MultiSync E1100
Screen size (inches)	19	21	21	21	29	21
Viewable image size (inches)	18.8	19.9	19.7	19.7	27	19.8
Case footprint (HxWxD in inches)	19.1x19.9x20.7	19.1x19.9x20.7	19.3x19.7x19.2	19.3x19.7x19.2	23x26x19	20.4x20.0x22.1
Original manufacturer	KDS	KDS	Mitsubishi	Mitsubishi	—	NEC
Tube technology	Invar shadow mask/flat square	Invar shadow mask/flat square	Mitsubishi DiamondTron/ aperture grille	Mitsubishi DiamondTron/ aperture grille	Flat square, dual focus	Dot-trio CRT
Maximum pixel resolution	1,600x1,200	1,800x1,440	1,600x1,200	1,800x1,440	1,024x768	1,600x1,200
Maximum refresh rate	93 Hz @ 1,600x1,200	93 Hz @ 1,600x1,200	75 Hz @ 1,600x1,200	85 Hz @ 1,600x1,200	60 Hz @ 800x600	120 Hz @ 832x624
Maximum refresh rate at maximum resolution	78 Hz @ 1,600x1,200	78 Hz @ 1,800x1,440	75 Hz @ 1,600x1,200	75 Hz @ 1,800x1,440	—	65 Hz @ 1,600x1,200
Scanning frequencies (kHz horizontal, Hz vertical)	28-95 kHz, 50-120 Hz	30-117 kHz, 50-160 Hz	30-95 kHz, 50-152 Hz	30-115 kHz, 50-152 Hz	31-38 kHz, 55-100 Hz	31-82 kHz, 55-120 Hz
Dot pitch (mm)	.28	.28	.28	.26	.75	.28
Brightness control	Yes	Yes	Yes	Yes	Yes	Yes
Contrast control	Yes	Yes	Yes	Yes	Yes	Yes
Degauss control	Yes	Yes	Yes	Yes	Yes	Yes
Front-mounted controls	Yes	Yes	Yes	Yes	Yes	Yes
On-screen controls	Yes	Yes	Yes	Yes	No	Yes
Controls description	Push-button	Push-button	Digital	Digital	Rotating thumbwheel	Front-bezel, digital
Basic geometric controls	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Rotation	Tilt, align, rotation sides in/out, sides left/right
Advanced geometric controls	Moire, color temperature, RGB gain	Moire, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	Moire, digital dynamic convergence, color temperature, RGB gain, corner purity	None	Moire, Accucolor control system, linearity, language select, OSM position, OSM turnoff
Tilt stand	Yes	Yes	Yes	Yes	No	Yes
Swivel stand	Yes	Yes	Yes	Yes	No	Yes
Screen glare reduction	ARAGAS optical coating	ARAGAS optical coating	Optical quality, high-contrast, antistatic, antiglare	Optical quality, high-contrast, antistatic, antiglare	Etching	OptiClear screen surface
Magnetic field correction	Yes	Yes	Yes	Yes	—	Yes
Microphone/speakers module	No	No	No	No	Yes	No
Standards compliance	TCO '92, MPR-II, VESA DPMS, Energy Star, Nemko, more	TCO '92, MPR-II, VESA DPMS, Energy Star, Nemko, more	TCO '95, MPR-II, Energy Star, DPMS, Nutek	TCO '95, MPR-II, Energy Star, DPMS, Nutek	MPR-II, Energy Star	TCO '92, MPR-II, Energy Star, IS09241-3, more
Warranty	3 years full warranty	3 years full warranty	3 years on parts, labor and CRT	3 years on parts, labor and CRT	2 years on parts and labor	3 years limited on parts, labor and CRT
List price ($)	899	1,395	1,649	1,995	1,599	1,349

*Company offers additional large-format monitors

Large-Format Monitors

	NEC MultiSync P1150	NDP 445Xpro	NDP 446Xpro	Optiquest V95	Optiquest V115	Panasonic* PanaSync E21
Screen size (inches)	21	21	19	19	21	21
Viewable image size (inches)	19.6	20	17.7	18	20	20
Case footprint (HxWxD in inches)	20.4x20.0x22.1	19.29x20.28x21.41	17.8x18.3x18.6	18.1x17.7x17.7	19.2x19.8x20	19x19.9x20.4
Original manufacturer	Mitsubishi	NDP	NDP	Optiquest	Optiquest	Panasonic
Tube technology	Mitsubishi DiamondTron	Invar shadow mask/flat square	Invar shadow mask/flat square	Invar shadow mask/flat square	Invar shadow mask/flat square	Invar shadow mask/flat square
Maximum pixel resolution	1,600x1,200	1,800x1,440	1,600x1,280	1,600x1,200	1,600x1,200	1,600x1,280
Maximum refresh rate	160 Hz @ 640x480	150 Hz @ 1,024x768	130 Hz @ 1,024x768	88 Hz @ 1,280x1,024	88 Hz @ 1,280x1,024	138 Hz @ 800x600
Maximum refresh rate at maximum resolution	75 Hz @ 1,600x1,200	80 Hz @ 1,800x1,440	80 Hz @ 1,600x1,280	76 Hz @ 1,600x1,200	76 Hz @ 1,600x1,200	67 Hz @ 1,600x1,280
Scanning frequencies (kHz horizontal, Hz vertical)	31-94 kHz, 55-160 Hz	121 kHz, 50-150 Hz	107 kHz, 50-150 Hz	30-95 kHz, 50-160 Hz	30-95 kHz, 50-160 Hz	30-89 kHz, 50-160 Hz
Dot pitch (mm)	.28	.21	.21	.26	.26	.25
Brightness control	Yes	Yes				
Contrast control	Yes	Yes	Yes	Yes	Yes	Yes
Degauss control	Yes	Yes	Yes	Yes	Yes	Yes
Front-mounted controls	Yes	Yes	Yes	Yes	Yes	Yes
On-screen controls	Yes	Yes	Yes	Yes	Yes	Yes
			Yes	Yes	Yes	Yes
Controls description	Front-bezel, digital	Push-button, rotating thumbwheel	Push-button, rotating thumbwheel	Push-button	Push-button	Push-button
Basic geometric controls	Tilt, align, rotation sides in/out, sides left/right	Pin cushion, trapezoid, tilt, orthogonality	Pin cushion, trapezoid, tilt, orthogonality	Pin cushion, trapezoid, parallelogram, rotation, pin balance	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram
Advanced geometric controls	Moire, Accucolor control system, linearity, language select, OSM position, OSM turnoff	—	Moire, clarity preset	Moire, color temperature, RGB gain	Moire, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain
Tilt stand	Yes	Yes	Yes	Yes	Yes	Yes
Swivel stand	Yes	Yes	Yes	Yes	Yes	Yes
Screen glare reduction	OptiClear screen surface	Antiglare, multilayer, high-conductive Nokia coating	Antiglare, multilayer, high-conductive Nokia coating	ARAGAS coating	ARAGAS coating	ARAGAS (add-on filter)
Magnetic field correction	Yes	Yes	Yes	No	No	Yes
Microphone/speakers module	No	No	No	No	No	No
Standards compliance	TCO '92, MPR-II, Energy Star, IS09241-3, more	TCO '95, MPR-II, VESA DPMS, Energy Star, IS09241-3, Nutek	TCO '95, MPR-II, VESA DPMS, Energy Star, IS09241-3, Nutek	TCO '92, VESA DPMS, Energy Star	TCO '92, VESA DPMS, Energy Star	MPR-II, VESA DPMS, Energy Star, CSA, more
Warranty	3 years limited on parts, labor and CRT	3 years on parts and labor, 2 years on CRT	3 years on parts and labor, 2 years on CRT	3 years on parts and CRT, 1 year labor	3 years on parts and CRT, 1 year on labor	3 years on parts and labor, 1 year on-site replacement
List price ($)	1,349	1,599	1,099	945	1,349	1,299

*Company offers additional large-format monitors

Large-Format Monitors

	Panasonic* PanaSync P21	Philips Brilliance 109	Philips Brilliance 201	Pixie 995	Princeton* EO90	Princeton* C2001
Screen size (inches)	21	19	21	19	19	21
Viewable image size (inches)	20	17.9	19.9	18	18	20
Case footprint (HxWxD in inches)	19x19.9x20.4	19.1x20.3x19.3	21.1x20.7x21.7	—	18.8x18.8x18.9	15.8x16.1x18
Original manufacturer	Panasonic	Philips	Philips	Rovel Information Electronics	Princeton	Princeton
Tube technology	Invar shadow mask/flat square	Invar shadow mask/flat square	Invar shadow mask/flat square	Aperture grille/dark tint Hitachi	Invar shadow mask	Mitsubishi Diamontron/ aperture grille
Maximum pixel resolution	1,800x1,440	1,600x1,280	1,600x1,280	1,600x1,200	1,600x1,200	1,600x1,200
Maximum refresh rate	160 Hz @ 800x600	75 Hz @ 1,600x1,200	80 Hz @ 1,600x1,280	85 Hz @ 1,280x1,024	85 Hz @ 1,280x1,024	85 Hz @ 1,600x1,200
Maximum refresh rate at maximum resolution	71 Hz @ 1,800x1,440	71 Hz @ 1,600x1,280	80 Hz @ 1,600x1,280	75 HZ @ 1,600x1,200	75 Hz @ 1,600x1.200	70 Hz @ 1,600x1,200
Scanning frequencies (kHz horizontal, Hz vertical)	30-115 kHz, 50-160 Hz	30-95 kHz, 50-160 Hz	30-107 kHz, 50-170 Hz	30-95 kHz, 47-120 Hz	95 kHz, 50-200 Hz	30-107 kHz, 50-160 Hz
Dot pitch (mm)	.25	.26	.26	.22	.26	.28
Brightness control	Yes	Yes	Yes	Yes	Yes	Yes
Contrast control	Yes	Yes	Yes	Yes	Yes	Yes
Degauss control	Yes	Yes	Yes	Yes	Yes	Yes
Front-mounted controls	Yes	Yes	Yes	Yes	Yes	Yes
On-screen controls	Yes	Yes	Yes	Yes	Yes	Yes
Controls description	Push-button	Digital, push-button, rotating thumbwheel, software controls	Digital, push-button, rotating thumbwheel, software controls	Push-button	Digital, push-button	Digital, push-button
Basic geometric controls	Pin cushion, trapezoid, parallelogram	Pin cushion, trapezoid, parallelogram, tilt, V-shift, H-shift, corner correction, Moire	Pin cushion, trapezoid, parallelogram, rotation, tilt, V-shift, H-shift, unbalanced pin cushion	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation, H/V-size, position	Pin cushion, pin cushion balance, trapezoid, parallelogram, tilt, rotation
Advanced geometric controls	Moire, convergence, color temperature, RGB gain	Moire, color temperature	Moire, color temperature, geometry, RGB gain	Moire, convergence, color temperature, RGB gain	V/H Moire, coloright controls, RGB gain	H/V convergence, color temperature, H/V focus, adjust, purity
Tilt stand	Yes	Yes	Yes	Yes	Yes	Yes
Swivel stand	Yes	Yes	Yes	Yes	Yes	Yes
Screen glare reduction	ARAGAS (add-on filter)	ARAGAS coating	ARAGAS coating	Nonglare, antistatic coating	High-contrast, dark tinted, Advanced AntiReflection (AART) coating	Advanced AntiReflection (AART) coating
Magnetic field correction	Yes	Yes	Yes	Yes	Yes	Yes
Microphone/speakers module	No	Yes	Yes	Yes	No	No
Standards compliance	TCO '92, MPR-II, VESA DPMS, Energy Star, CSA, more	TCO '95, MPR-II, Energy Star, Nutek	TCO '95, MPR-II, Energy Star, Nutek	TCO '95, MPR-II, Energy Star, DPMS, CSA, more	TCO '95, Energy Star, VESA DPMS, FCC -B	TCO '95, MPR-II, IS09241-3, FCC-B
Warranty	3 years parts and labor, 1 year on-site replacement	3 years on parts and labor	3 years on parts and labor	3 years full warranty	3 years on parts, labor and CRT	3 years on parts, labor and CRT
List price ($)	1,599	1,049	1,799	799	999	1,999

*Company offers additional large-format monitors

Large-Format Monitors

	Samsung SyncMaster 20 GLsi	Samsung SyncMaster 1000p	Smile CA2111	Sony* GDM-400PS	Sony* GDM-W900	Sun* CMU51U
Screen size (inches)	20	21	21	19	24	19
Viewable image size (inches)	18.75	19.7	20	18	22.5	18
Case footprint (HxWxD in inches)	19.9x19.3x20.2	20x19.9x21.6	22.8x26x22.6	—	19.8x22.9x21.6	17.6x17.9x18.1
Original manufacturer	Samsung	Samsung	Smile	Sony	Sony	—
Tube technology	Invar shadow mask	Invar shadow mask	Invar shadow mask/ CromaClear-EX (NEC)	Sony Trinitron/ aperture grille	Sony Trinitron/ aperture grille	Invar shadow mask/ flat square
Maximum pixel resolution	1,600x1,200	1,600x1,200	1,600x1,280	1,600x1,200	1,920x1,200	1,600x1,200
Maximum refresh rate	76 Hz @ 1,280x1,024	85 Hz @ 1,280x1,024	75 Hz @ 1,024x768	75 Hz @ 1,600x1,200	76 Hz @ 1,920x1,200	85 Hz @ 1,600x1,200
Maximum refresh rate at maximum resolution	66 Hz @ 1,600x1,200	85 Hz @ 1,600x1,200	66 Hz @ 1,600x1,280	75 Hz @ 1,600x1,200	76 Hz @ 1,920x1,200	85 Hz @ 1,600x1,200
Scanning frequencies (kHz horizontal, Hz vertical)	30-82 kHz, 50-120 Hz	30-107 kHz, 50-160 Hz	30-82 kHz, 50-100 Hz	—	—	30-96 kHz, 10-160 Hz
Dot pitch (mm)	.28	.25	.28	.25-.27 variable	.25-.28 variable	.26
Brightness control	Yes	Yes	Yes	Yes	Yes	Yes
Contrast control	Yes	Yes	Yes	Yes	Yes	Yes
Degauss control	Yes	Yes	Yes	Yes	Yes	Yes
Front-mounted controls	Yes	Yes	Yes	Yes	Yes	Yes
On-screen controls	Yes	Yes	No	Yes	Yes	Yes
Controls description	Digital	Digital	Digital	Push-button	Push-button	Digital
Basic geometric Controls	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation, H/V position	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation
Advanced geometric controls	Color control, hue, saturation, signal select	Real color control, convergence, moire	Convergence, color matching	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain
Tilt stand	Yes	Yes	Yes	Yes	Yes	Yes
Swivel stand	Yes	Yes	Yes	Yes	Yes	Yes
Screen glare reduction	AR (Antireflective) Ultra Clear coating with antistatic	AR (Antireflective) Ultra Clear coating with antistatic	ARAGAS, tint-treated screen	Antireflective panel	Anitreflective panel	Antiglare coating
Magnetic field correction	No	Yes	Yes	No	Yes	Yes
Microphone/speakers module	No	No	No	No	No	No
Standards compliance	MPR-II, DPMS, Energy Star, Nutek, IS09241-3	TCO '95, MPR-II, DPMS, Nutek, Energy Star	MPR-II, VESA DPMS, Energy Star, CSA, IS09241-3, more	TCO '95, more	TCO '95, MPR-II, FCC-B, more	TCO '95, MPR-II, VESA DPMS, Energy Star
Warranty	3 years on parts, labor and CRT	3 years on parts, labor and CRT	3 years on parts, labor and CRT	1 year backlight warranty, 2 years on parts, labor and CRT	3 years on parts, labor and CRT	13 months full warranty
List price ($)	1,088	1,697	1,459	1,199	3,999	1,400

*Company offers additional large-format monitors

Large-Format Monitors

	Sun* GDM-20E20	Sun* GDM-90W10	Tatung* CM-20MVR	Taxan Ergo-Vision 2040	Taxan Ergo-Vision 2150	Techmedia Ventana 8221E
Screen size (inches)	20	24	20	20	21	21
Viewable image size (inches)	18.3	22.5	18.6	18.4	19.7	19.5
Case footprint (HxWxD in inches)	18.5x19.2x20	22.9x19.7x21.4	—	—	—	19.3x19.4x19.3
Original manufacturer	Sony	Sony	Tatung	Taxan	Mitsubishi	Iiyama
Tube technology	Sony Trinitron/ aperture grille	Sony Trinitron/ aperture grille	Invar shadow mask	Conventional	Mitsubishi DiamondTron	Invar shadow mask/flat square
Maximum pixel resolution	1,280x1,024	1,920x1,200	1,280x1,024	1,600x1,200	1,600x1,200	1,600x1,200
Maximum refresh rate	76 Hz @ 1,280x1,024	76 Hz @ 1,280x800	—	80 Hz @ 1,280x1,024	75 Hz @ 1,600x1,200	87 Hz @ 1,280x1,024
Maximum refresh rate at maximum resolution	76 Hz @ 1,280x1,024	70 Hz @ 1,920x1,200	75 Hz @ 1,280x1,024	107 Hz @ 1,600x1,200	75 Hz @ 1,600x1,200	75 Hz @ 1,600x1,200
Scanning frequencies (kHz horizontal, Hz vertical)	30-82 kHz, 48-160 Hz	30-96 kHz, 50-160 Hz	28-85 kHz, 50-160 Hz	30-86 kHz, 50-120 Hz	30-95 kHz, 50-152 Hz	27-94 kHz, 50-160 Hz
Dot pitch (mm)	.31	.26-.29	.28	.28	.28	.22-.27
Brightness control	Yes	Yes	Yes	Yes	Yes	Yes
Contrast control	Yes	Yes	Yes	Yes	Yes	Yes
Degauss control	Yes	Yes	Yes	Yes	Yes	Yes
Front-mounted controls	Yes	Yes	Yes	Yes	Yes	Yes
On-screen controls	Yes	Yes	Yes	Yes	No	Yes
Controls description	Digital	Digital	Push-button	Push-button	Digital	Push-button
Basic geometric controls	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation	Pin cushion, trapezoid, parallelogram, rotation, raster
Advanced geometric controls	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	Convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain	Moire, convergence, color temperature, RGB gain
Tilt stand	Yes	Yes	Yes	Yes	Yes	Yes
Swivel stand	Yes	Yes	Yes	Yes	Yes	Yes
Screen glare reduction	Antiglare coating	Antiglare coating	Dark-tinted, antiglare coating	Antiglare coating	ARAGAS coating	Antiglare, antistatic coating
Magnetic field correction	No	No	Yes	Yes	Yes	Yes
Microphone/speakers module	No	No	No	No	No	Yes
Standards compliance	TCO '92, MPR-II, VESA DPMS, Energy Star	TCO '92, MPR-II, VESA DPMS, Energy Star	—	TCO '95, MPR-II, VESA DPMS, Energy Star	TCO '95, MPR-II, VESA DPMS, Energy Star	TCO '95, MPR-II, VESA DPMS, Energy Star
Warranty	13 months full warranty	13 months full warranty	1 year return to manufacturer	Contact vendor	1 year on-site, 3 years on parts, labor and CRT	3 years on parts, labor and CRT
List price ($)	2,100	4,000	1,850	Contact vendor	Contact vendor	1,499

*Company offers additional large-format monitors

Large-Format Monitors

	ViewSonic* G790	ViewSonic* P815
Screen size (inches)	19	21
Viewable image size (inches)	18	20
Case footprint (HxWxD in inches)	17.7x17.8x18.3	19.2x19.9x20.4
Original manufacturer	ViewSonic	ViewSonic
Tube technology	Flat square	Flat square
Maximum pixel resolution	1,600x1,280	1,800x1,440
Maximum refresh rate	150 Hz @ 640x480	160 Hz @ 800x600
Maximum refresh rate at maximum resolution	74 Hz @ 1,600x1,280	76 Hz @ 1,800x1,440
Scanning frequencies (kHz) (kHz horizontal, Hz vertical)	20-95 kHz, 50-180 Hz	30-115 kHz, 50-160 Hz
Dot pitch (mm)	.26	.25
Brightness control	Yes	Yes
Contrast control	Yes	Yes
Degauss control	Yes	Yes
Front-mounted controls	Yes	Yes
On-screen controls	Yes	Yes
Controls description	Digital	Digital
Basic geometric controls	Pin cushion, trapezoid, parallelogram, rotation, H/V size/position	Pin cushion, trapezoid, parallelogram, rotation H/V size/position
Advanced geometric controls	Moire, ViewMatch, color control	ViewMatch color control, H/V moire
Tilt stand	Yes	Yes
Swivel stand	Yes	Yes
Screen glare reduction	ARAGAS coating, super contrast	ARAGAS coating, super contrast
Magnetic field correction	Yes	Yes
Microphone/speakers module	No	No
Standards compliance	TCO '95, MPR-II, VESA DPMS, Energy Star, Nutek	TCO '95, MPR-II, Energy Star, Nutek
Warranty	3 years on parts and labor	3 years on parts and labor
List price ($)	999	1,699

*Company offers additional large-format monitors

Companies Mentioned in Survey

ADI Systems Inc.
2115 Ringwood Ave.
San Jose, CA 95131
Circle 200

CTX International Inc.
748 Eppeson Drive
City of Industry, CA 91748
Circle 201

EIZO Nanao Technologies Inc.
5710 Warland Drive
Cypress, CA 90630
Circle 202

Hewlett-Packard Co.
19310 Pruneridge Ave.
Cupertino, CA 95014
Circle 203

IBM Corp.
3039 Cornwallis Road
Research Triangle Park, NC 27709
Circle 204

Iiyama North America Inc.
575 Anton Blvd., Ste. 590
Costa Mesa, CA 92626
Circle 205

Intergraph Computer Systems Inc.
One Madison Industrial Park
Huntsville, AL 35894
Circle 206

KDS USA Inc.
12300 Edison Way
Garden Grove, CA 92641
Circle 207

Mitsubishi Electronics America Inc.
5665 Plaza Drive
Cypress, CA 90630
Circle 208

MultiVideo Labs Inc.
29 Airpark Road
Princeton, NJ 08540
Circle 209

NEC Technologies Inc.
1250 N. Arlington Heights Road
Itasca, IL 60143
Circle 210

Nokia Display Products Inc.
123 Second St.
Sausalito, CA 94965
Circle 211

Optiquest, a ViewSonic Company
438 Cheryl Lane
Walnut, CA 91789
Circle 212

Panasonic Computer Peripherals Co.
2 Panasonic Way
Secaucus, NJ 07094
Circle 213

Philips Electronics Inc.
64 Perimeter Center E.
Atlanta, GA 31146
Circle 214

Pixie Technologies Inc.
46771 Fremont Blvd.
Fremont, CA 94538
Circle 215

Princeton Graphic Systems
2801 South Yale
Santa Ana, CA 92708
Circle 216

Samsung Electronics America Inc.
105 Challenger Road
Ridgefield Park, NJ 07660
Circle 217

Smile International Inc.
1575 Sunflower Ave.
Costa Mesa, CA 92626
Circle 218

Sony Electronics Inc.
3300 Zanker Road
San Jose, CA 95134
Circle 219

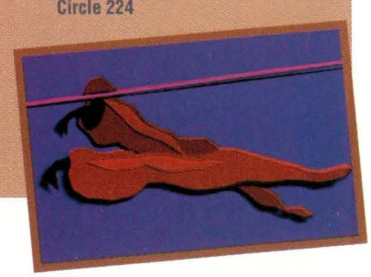
Sun Microsystems Computer Co.
901 San Antonio Road
Palo Alto, CA 94303
Circle 220

Tatung Science and Technology Inc.
1840 McCarthy Blvd.
Milpitas, CA 95035
Circle 221

Taxan Ltd.
Cookham Road
Bracknell, Berks
England RG12 1RB
Circle 222

Techmedia Computer Systems Corp.
7301 Orangewood Ave.
Garden Grove, CA 92841
Circle 223

ViewSonic Corp.
381 Brea Canyon Road
Walnut, CA 91789
Circle 224



Q&AIX

by Jim Fox

The Preprocessing Payoff

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

wizard's apprentice (one hat)

super user (two hats)

wizard (three hats)

Q: Your October article, "Virtual Windows" Page 75, mentioned two ways to customize the `rc` file used by the `fvwm2` window manager when it starts. One was `cpp` and the other was M4. I thought `cpp` might be easier because I know how to program C, but I haven't been able to figure it out. Whenever I try to use the `cpp` preprocessor option, I get all sorts of errors. What am I doing wrong? Would I be better off going right to M4? (one hat)

Beverly Rhodes
City University

A: Preprocessing is a common way to add flexibility to a program's configuration data. It also lets you set up a common look and feel to your configuration files–even for disparate programs. Often, a program will invoke a preprocessor for you; `fvwm2`, the C compiler and `xrdb` do this. Other times, you might have to run the preprocessor as a completely separate step.

Learning to use a preprocessor will be well worth the effort. We'll consider `cpp` this month and M4 next month. First, you've got to get into the right frame of mind for `cpp`–you're programming a different language now. Those old `fvwm2` comments just won't do anymore.

Remember, `cpp` is expecting C code. Enclose your comments in `/*` and `*/`, just as you would in a C program. Then, use the normal # style directives that you would also use in a C program. The most common and useful are the following:

- `#include` *`filename`*

Includes the named file, interpreting any commands it finds in the file. This allows you to break up a large `.fvwm2rc` file into smaller, more manageable pieces, and allows you to easily share parts of your file with other users.

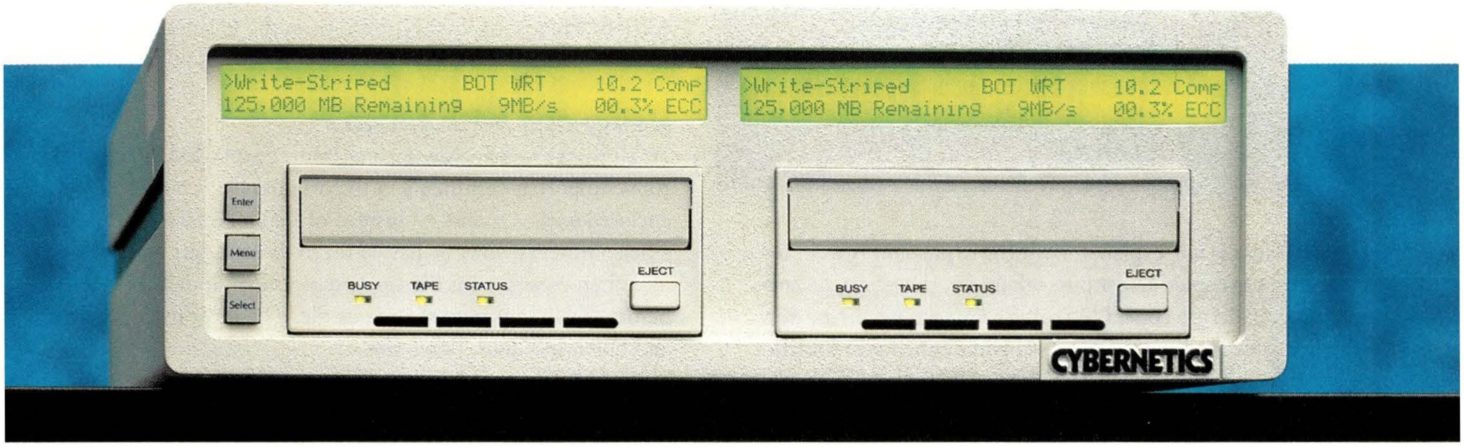
- `#define` *`name value`*

Defines a new macro, *name*, giving it the value indicated.

- `#if` *`expression`*

```
#if expression
    true code
#elif expression
    else true code
#else
    false code
#endif
```

Backup 64 GB An Hour To The Strongest Tape Ever Made



Plug Compatible With

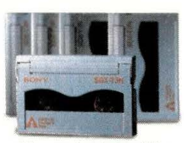
Alliant
Alpha Micro
Altos
Amdahl
Apollo
Arix
AT&T
Basic-4
Bull
Concurrent
Convergent
Data General
Digital
Gould/Encore
Harris
Honeywell
HP
IBM PC/Compatible
IBM Midrange/Mainframe
ICL
Intergraph
Macintosh
McDonnell Douglas
Motorola
NCR
NeXT
Novell
Pertec
Prime
Pyramid
Sequent
Silicon Graphics
Stratus
Sun
Texas Instruments
Unisys
Ultimate
Wang
Windows NT

Let's face it, your backup is only as good as your tape. And all the performance in the world won't get your data back if your tape is weak or dirty. Fortunately, there's no need to compromise. The CY-8000 is the safest, the most reliable, *and the fastest* 8mm tape drive on the market.

Compact in size, the CY-8000 can store up to 125 GB on each tape.

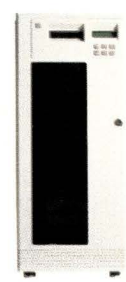
The CY-8000 uses ***Advanced Metal Evaporated*** media, a 100% cobalt, 2-layer tape that features a diamond-like coating for exceptional durability. And it's the *only* 8mm drive with a ***built-in head cleaner*** to keep the tape path free of contaminants, further ensuring data integrity and virtually eliminating the time and expense associated with cleaning kits.

In addition to superior design, the CY-8000 offers unbeatable performance. Able to store ***25 GB at 3 MBS***, uncompressed, you can achieve up to ***125 GB at 9 MBS*** with optional data compression. With 257% more capacity and 500% greater speed* than industry standard 8mm drives, the CY-8000 can backup faster to fewer tapes.



The superior design of the AME tape makes it suitable for 20,000 passes.

For maximum flexibility, our exclusive Advanced SCSI Processor option provides five recording modes — ***striping, mirroring, cascade, independent,*** and ***offline copy/verify***. So you can easily make duplicate tapes for off-site storage or data exchange, build fault tolerance, or simply maximize performance to accomplish bigger backups in less time. With the Advanced SCSI Processor, you've got a complete data storage management tool.



Automate access to up to six drives and 126 tapes with our intelligent tape library.

Available in a single or multi-drive desktop, rack mount, or library configuration, the CY-8000 is scalable to ***15.75 terabytes***. If you need to ensure the safety of your company's critical data, don't trust anything less.

* *Uncompressed; CY-8000 performance advantages are even more impressive with data compression.*

(757) 833-9000 ext.126

CYBERNETICS

111 Cybernetics Way • Yorktown, VA 23693 • Fax (757) 833-9300

Circle No. 28

Figure 1. Useful Definitions Passed from fvwm2 to the cpp Preprocessor

`WIDTH`	Width of the screen in pixels
`HEIGHT`	Height of the screen in pixels
`BITS_PER_RGB`	Measures the number of colors available
`COLOR`	"Yes" or "No"
`USER`	Username

The `if` clause is self-explanatory. If the expression is true, the `true code` is copied to output; otherwise, the `else if` code or `false code` are copied. *`Expression`* can be any normal C-style expression, mixing numbers and defined symbols. In addition, you can use the phrase `defined(`*`name`*`)`, which is true if the name is defined. There can be zero or many `#elif` clauses and zero or one `#else` clause.

- `#ifdef` *`name`*

Same as `#if defined(`*`name`*`)`.

- `#ifndef` *`name`*

Same as `#if !defined(`*`name`*`)`.

For more information, consult almost any C programming reference. My personal favorite is *The C Programming Language*, 2nd Edition, Brian Kernighan and Dennis Ritchie, Prentice Hall, ISBN 0-13-110362-8. Make sure you get the second edition: There were many additions to the C language, and the `cpp` preprocessor, after the first edition was published.

Using cpp with fvwm

Now we're ready to write a custom, `cpp`-style `fvwm2rc` file. Remember that comments in the original file, `.fvwm2rc`, are enclosed with `/*` and `*/` instead of being prefaced with `#`. The comments won't be passed on to `fvwm2`, but that's OK.

When `fvwm2` runs the `cpp` preprocessor, it defines several names which you can use in your file. The most useful of these are shown in Figure 1. See the `FvwmCpp` man page for the rest.

Here is a common use for the `cpp` preprocessor. Suppose you work at various locations where there are different-size X terminals; maybe a large-screen terminal at your office and a smaller one at home. You might want to use different fonts, depending on the screen size. You could make some definitions related to screen size at the start of your `rc` file. Notice that these examples follow the usual convention that all capitals represent defined names:

```
/* Define screen sizes */
#define BIG_SCREEN WIDTH>=1500
#define MID_SCREEN WIDTH>=1100
#define SML_SCREEN WIDTH<=1100
```

Later in the file you can make use of those definitions:

```
/* Choose larger window manager fonts
    for larger screens. */

#if BIG_SCREEN        /* large screen */
WindowFont 7x13
IconFont 7x13
#else if MID_SCREEN   /* medium screen */
WindowFont 6x10
IconFont 6x10
#else                 /* small screen */
WindowFont 5x8
IconFont 5x8
#endif
```

Then, start `fvwm2` with the `cpp` option:

```
fvwm2 -cmd "FvwmCpp rc_file"
```

Some documentation tells you to use the `-f` option for this command, but that won't work–you have to use `-cmd`, enclose the argument in quotes and specify the `rc` file.

The `cpp` preprocessor is a surprisingly useful tool. You might find other uses. It'll work on any text file; just pipe the file through it like this:

```
cat source | cpp > output
```

Despite the obvious utility, don't go converting all your files to `cpp` code just yet. Next month, we'll look at the other `fvwm2` preprocessor, M4, a more powerful macro processor that just might make you decide never to use `cpp` again.

Q: One of the most convenient features of `fvwm` is the window list module. It's similar to `twm`'s icon manager and allows for a lot of "icons" in a small area of the screen. The problem is, it's unsorted. The window names just appear in random order. I have 20 to 30 windows in that list. I need to have them sorted.

Jim Fox
University of Washington

Figure 2. The Sorted fvwm Icon List

A: Well, I don't expect software authors to think of everything, and it's especially awkward to complain about programs I get for free. Still, it's hard to forgive actual regression from one generation to the next. `twm` sorts that icon list; `fvwm` ought to also–it's easy enough.

Let's take the attitude that if we want something done right we have to do it ourselves. And we can do it ourselves because `fvwm2` is free software for which we get source code, and how hard can it be to sort a little list anyway? Actually, no sorting will be necessary. Because windows are added to the window list one at at time, all we need to do is insert them at the proper point–instead of at the end. Look at the patches (see the Web address at the end of the column) to see how this was done.

And, as long as we're hacking away, let's fix something else. In the window list, iconified windows show up in parentheses. They also show up in a different color. Let's make the parentheses optional, so we can just use color and have a nice tidy list. We'll define a new `.fvwm2rc` file command to specify no parentheses. It might look like this (suppose we're using that `cpp` preprocessor from the last question):

```
#if defined(COLOR)
*FvwmWinListNoIconParens
#endif
```

Our resulting list is shown in Figure 2. It looks good enough. And just in time to make a holiday present. Get your copy from `http://weber.u.washington.edu/~fox/fvwm2/`. There, you'll find patches to the source, along with precompiled binaries for AIX and Linux. Happy holidays.

by John S. Quarterman

Innovation at BBN

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

Someone remarked: "I just saw an ad in the *LA Times* yesterday for BBN, whose name I don't know, ..."

I suppose it's not surprising that even knowledgeable Internet users (or reporters, in this particular case) don't know much about the origins of the Internet. When BBN, for Bolt Beranek and Newman Inc., was big in the Internet there were only tens of thousands of Internet users, not tens of millions like today. Only about one in a thousand of today's Internet users was on any network back then. Fewer, considering that many people have retired in the intervening 20 years. (For more on network growth, see `http://www.mids.org/growth/internet/index.html` and for user growth, see the *MIDS Internet Market Report* `http://www.mids.org/market/`.)

But I do have to admit being surprised that someone has never even heard of BBN. I'll get to that in a moment. First, about a million words of network history.

For those who aren't familiar with the early history of the ARPANET and the Internet, there are at least three books:

- *The Matrix*, by John S. Quarterman, Digital Press, 1990, 746 pages, ISBN 1-555-58033-5 – *The Matrix* covers approximately every network and conferencing system (ARPANET, JANET, CYCLADES, Internet, USENET, CSNET, BITNET, EARN, EIES, CompuServe and so on) worldwide through 1989.
- *Casting the Net*, by Peter Salus, Addison-Wesley, 1995, 300 pages, ISBN 0-201-87674-4 – *Casting the Net* concentrates on the development of the protocols and specifications that make the ARPANET and the Internet possible.
- *Where Wizards Stay Up Late*, by Katie Hafner and Matthew Lyon, 304 pages, Simon & Schuster, 1996, ISBN 0-684-81201-0 – Hafner and Lyon's book concentrates on personalities and politics, and the earliest ARPANET prehistory and history.

All three mention BBN prominently. Read any one of them and you'll see why. In brief, BBN was the prime contractor for the ARPANET, and it developed numerous key networking technologies, ranging from the first geographically distributed packet-switching nodes and the Interface Message Processors (IMPs) to the @ sign (see below).

In addition to the ARPANET, BBN helped to develop CSNET, NEARNET and BBN Planet. BBN ran the ARPANET Network Operations Center (NOC) and was a key organization in the early Network Working Group, which was the predecessor to the Internet Engineering Task Force (`http://www.ietf.org`).

BBN cultivated a unique corporate culture that encouraged creative thought and innovation. If bigger organizations said it couldn't be done, BBN often ended up doing it. It employed more Ph.D.s than the average college, and it used paid staff instead of graduate students. Of course, many of them were also graduate students because BBN encouraged further study. For that matter, the company probably graduated more people who moved on to other organizations than did the average college. Ex-BBNers tend to stick together, having their own mailing list and otherwise communicating with each other. (In case you're wondering, yes, I used to work there, 1977-1980.)

The Origins of Computer Networks

If BBN had been able to capitalize on its inventions, it would be huge today. For only one example, BBN invented the modem. Yes, the modem. Unfortunately, packaging and marketing were never its strong points. Much of its funding came from government grants, which often precluded selling the immediate results of the research so supported.

There are some who argue that BBN's glory days preceded the ARPANET. The company began in 1948, when its founders developed the acoustics for the United Nations building. For 30 years of BBN science and technology, see `http://www.InternationalOnline.com/san/bbn/BBN.htm`.

The name BBN now lives only in memory, history books and advertisements because BBN was recently bought by GTE Corp.

Let's examine a specific BBN innovation in more detail: a network solution we all use every day. BBN sent the first electronic mail message that traveled across a computer network and, in the process, invented the @ sign syntax. To be more specific, Ray Tomlinson sent the first networked mail message in 1970, in collaboration with others at BBN and elsewhere.

This was never a secret, but nobody had taken much interest in it as a significant phenomenon, and few people remembered who did it, until I spent several months following leads to get to whom I probably should have just asked in the first place: Ray. Peter Salus followed up with interviews and published a write-up in *Matrix News* 502 (February 1995) "Mail: The application that hadn't been thought of" and in his book, *Casting the Net.*

Networked electronic mail may seem an obvious application for the first geographically distributed packet-switching network, it wasn't even part of the original plans for the ARPANET.

Please note that this was not the first electronic mail message. Electronic mail had existed since around 1965 on the Compatible Time Sharing System (CTSS) that had been developed by Fernando Corbato. It had probably been reinvented on almost every time-sharing system since then. But BBN and Ray Tomlinson were the first to send electronic mail *between* two computers across a network.

Although, in hindsight, networked electronic mail may seem an obvious application for the first geographically distributed packet-switching network, it wasn't even part of the original plans for the ARPANET. It was a hack. A convenience. A timesaving device, to avoid carrying tapes around or talking on the telephone. Soon, it was an indispensable tool. This is the way many network applications have developed. Other examples include anonymous FTP, archie, Gopher and WWW. But electronic mail was the first such example, the ur-example, the archetype of all the others.

The @ sign was very important for the development of computer networks. I don't mean the specific character @, although that character is a particularly appropriate choice, having the appropriate meaning already built in. But I want to concentrate on the syntax and the semantics of the use of the @ sign. One reason my first book was called *The Matrix* was that in the middle of it is a matrix, a two-dimensional table, of methods for sending mail among networks with different addressing syntaxes. These included UUCP's `a!b!c!d`, CompuServe's `1234.56789` and FidoNet's `1:151/299.0`, as well as mixed syntaxes such as `a!%c@d`. Most of those syntaxes are now dead or clearly moribund. Even CompuServe has recently been sold, and the current leader in outfits most like old-style conferencing systems, America Online, now permits symbolic `username@aol.com` syntax. The Internet DNS `local_part@domain_part` syntax, which is merely an elaboration of Ray's ARPANET format of `user@host`, has won.

The beauty of `local_part@domain_part` is threefold. It is simple and often mnemonic. This is important, if people are to remember addresses and if they are to fit into common business conventions such as business cards. I couldn't even remember FidoNet syntax; I had to look it up for this article. Anybody can remember `user@bbn.com`.

In addition, `local_part@domain_part` is complex enough to facilitate internetworking. The syntaxes used on conferencing systems such as CompuServe, Prodigy and EIES were not. Connecting such a system to a network required shoehorning its local addresses into a network mail address syntax. The @ sign syntax recognized from the beginning that the networked world would be diverse, and at least one level of visible hierarchy would be necessary to handle that diversity. Each host might be a universe unto itself (as conferencing systems tried to be), but a host that wants to talk to other hosts must recognize some sort of external address for other hosts together with a way to specify local users on other hosts. That is exactly what `user@host` does.

Less obviously, but equally importantly, `local_part@domain_part` leaves network routing to lower layers. Both UUCP and FidoNet spelled out routing in their visible electronic mail addresses. This was partly because neither of those networks had many applications other than electronic mail. They had USENET news and Echomail, but that was about it. The ARPANET and the Internet always did have several other applications, starting with FTP (file transfer) and Telnet (remote login). Those applications needed a host (or later a domain) address to connect to a remote host, but might not need a username or `local_part` at all. The utility of network routing common to numerous applications was more obvious on the ARPANET and the Internet.

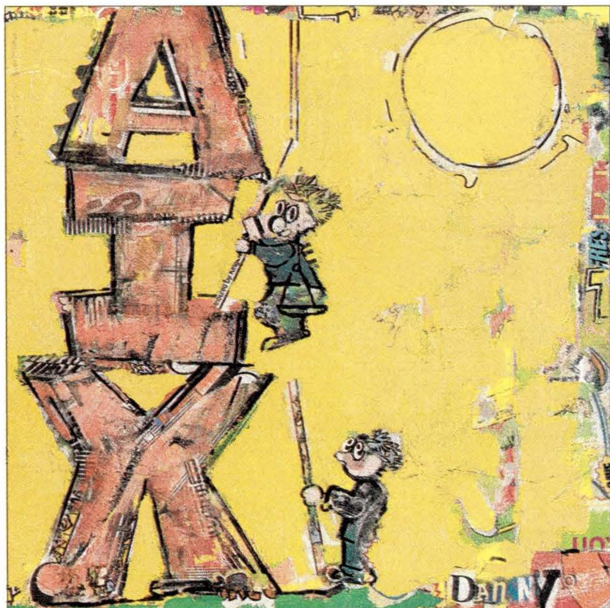
Of course, UUCP and USENET were popular as a poor man's ARPANET for those who couldn't get access to the ARPANET, which at the time required government approval. FidoNet was invented as a poor man's USENET for MS-DOS users. The inventors of these later networks knew electronic mail as the most popular ARPANET application.

If Nobel prizes were given for internetworking, I would nominate Ray Tomlinson for one. Vint Cerf and Van Jacobson would be other obvious candidates. Why isn't there an internetworking Nobel Prize, by the way? I think it is easy to argue that internetworking is changing the world, from academic to business to personal, in at least as many and profound ways as, for example, economics. There is at least as much academic rigor in internetworking as in, for example, economics. Electronic mail may have originated as a hack, but so did plenty of physics or medicine Nobel innovations.

Plenty of people in the computing industry have enough money to endow such a prize–for example, Michael Dell, Andy Grove, Rick Adams, Bill Joy, Steve Jobs, among others. I suppose one problem might be that some of the very people who could endow such a prize would be candidates for it. Another might be that many of the richest people in computing got their money from PCs, and don't really appreciate networking as more important than individual computers. Maybe George Soros could endow it.

It's a thought.

by Jim DeRoest



Process Management 101

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

This month, I thought I would step back from technology's bleeding edge and talk about some of the basics of the AIX operating system–specifically, AIX process architecture and management. My daughter, just beginning her foray into the world of computer science, reminds me that there are always new programmers and administrators out there looking for a hand up from us old-timers. Even those of us who have waged and won OS battles with one flavor of UNIX can always use a hint or two when it comes to another. With this in mind, what follows is a top-level description of AIX process architecture. You won't find a detailed description of threads, mutexes or multiprocessor scheduling; I'll tackle those topics another time. What you will find is enough information to understand and manage the process space from the command line. Basically, it's meat-and-potatoes AIX process administration.

Process Basics

A process comprises an executing program and its associated resources. Processes are created in the system address space by invoking the `fork()` and `exec()` system calls. A parent process creates a new child process by invoking `fork()`. The kernel reserves a vacant Process Identifier (PID) for the child and copies the attribute data associated with the parent into the child's process structures. The child is essentially a clone of the parent until either the child, the parent or a privileged authority modifies the child's attributes via a system call. The most common method of altering a child process is by invoking a new program image using the `exec()` call.

The PID is a pointer into the kernel process table. Process table entries point to per-process kernel data structures that represent process attributes and resources. These structures are represented in the `/usr/include/sys/proc.h` header file. Some process attributes are listed in Table 1.

Active process attributes can be interrogated from the command line using the `ps` command or by using SMIT (System Management Interface Tool). AIX supports two flavors of `ps`, SYSV and BSD. SYSV is used when the command-line arguments are preceded by a hyphen; otherwise, BSD is used.

`ps -elk`	SYSV process display format
`ps auxw`	BSD process display format

When displaying the active process table, you may notice a set of processes listed as `kproc` under the command column. These are a special set of kernel processes that collect accounting data for system overhead. One `kproc` process in particular usually displays a very high CPU utilization. No need to panic; this process collects system wait and idle time and represents it in the `ps` CPU fields (see Figure 1).

Along with the PID, each process records its Process Parent Identifier (PPID) and its group affiliation as the Process Group Identifier (PGID). Process groups are collections of one or more processes. The group leader has a PGID equal to its PID. Each group member has a PGID that matches the leader. Unless reset by a `setpgrp()` call, a process inherits the PGID of its parent.

Process groups provide a mechanism for signaling all processes within the group using the PGID. This eliminates the need to know each member's PID. The PID, PPID and PGID are the primary handles used by systems administrators to control process behavior. There's a nice public domain tool called `pstree` that will graphically map process relationships on the screen. It's available from `aixpdslib.seas.ucla.edu` via WWW or FTP.

Other basic handles that may be used to control process behavior include the owning user identifier (UID), group identifier (GID) and controlling terminal (TTY). UID and GID associations are mapped to accounts and groups listed in the `/etc/passwd` and `/etc/group` files. The process UID or GID represents two mappings designated as "real" and "effective": The real UID and GID identify the process owner; the effective UID and GID identify the privileges available to the process. The real and effective mappings don't have to be the same. The TTY identifies the default device for standard input, output and error channels, and for sending signals.

In AIX Version 4, the process structure is further broken down into a set of execution structures called "threads." Threads provide the means for overlapping, multiplexing and parallelizing operations within a process. Threads are peer entities within the process and share global resources like the process address space. As such, they can usually be controlled via signals at the process level. This is not always true, however, because threads may be scheduled and executed independently on different processors in a multiprocessor environment.

I'm not going to say more about threads in this column. My intent here is to offer a description of basic AIX process architecture. Nevertheless, it is important to remember that AIX processes comprise thread structures. A full discussion of process threads, locks and signals must wait for another time.

Table 1. Process Attributes

Process Identifier
Process Group Identifier
Process Parent Identifier
Process Owner
Real/Effective User and Group Identifiers
Priority
Controlling Terminal
Address Space
Size in Pages
Paging Statistics
Resource Utilization
Process State

Figure 1. Process ps Output

F	S	UID	PID	PPID	C	PRI	NI	ADDR	SZ	WCHAN	TTY	TIME	CMD
303	A	0	0	0	80	16	--	808	4		-	0:00	swapper
200003	A	0	1	0	0	60	20	505	212		-	0:01	init
303	A	0	516	0	120	127	--	909	0		-	7:30	kproc
303	A	0	774	0	0	36	--	606	8		-	0:00	kproc
303	A	0	1032	0	0	37	--	c0c	40	*	-	0:00	kproc
40201	A	0	1874	0	0	60	20	1f5f	8		-	0:00	kproc
240001	A	0	2114	1	0	60	20	1736	64	7737158	-	0:00	syncd
40201	A	0	2368	1	0	60	20	13d3	8	19dbaa4	-	0:00	kproc
240001	A	0	2766	3588	0	60	20	1998	652		-	0:00	dtsession
40001	A	0	3052	1	0	60	20	f4e	296		-	0:00	dtlogin
240001	A	0	3270	11444	0	60	20	14b6	144		-	0:00	pppauthd
40201	A	0	3362	1	0	60	20	13b3	12	1959b60	-	0:00	kproc
40001	A	0	3588	3052	0	60	20	564	628		-	0:00	dtlogin
40201	A	0	3968	1	3	61	20	1270	8	7737898	-	0:02	kproc
240001	A	0	4594	3052	3	61	20	1b5a	3340	54a9e94	-	0:14	X
240001	A	0	4658	1	0	60	20	d2f	152	74adc7c	-	0:00	cron
40401	A	0	4940	1	0	60	20	fce	308	95318	-	0:00	errdemon
240001	A	0	5266	1	0	60	20	15d4	232		-	0:00	srcmstr
240001	A	0	5546	5266	0	60	20	12f3	124		-	0:00	syslogd
40001	A	0	5758	1	0	60	20	567	1600	*	-	0:00	pmd
240001	A	0	6068	5266	0	60	20	200	584		-	0:00	sendmail
240001	A	0	6334	5266	0	60	20	705	232		-	0:00	portmap

Process Priorities

AIX uses a priority-based set of run queues to allocate CPU resources among the set of active processes as shown in Figure 1. Priority values range from 0 to 127, each of which is represented by a run queue. Low numbered queues are scheduled more often than high numbered queues. Processes within a run-queue level are scheduled in a round-robin fashion. Each process' queue priority is calculated from the sum of its short-term CPU usage, its nice value and the minimum user process level. The priority value increases for processes that execute frequently and decreases for those that are waiting for execution. Processes with a priority value exceeding 120 will execute only when no other process in the system requires CPU resources. Process short-term CPU usage, priority and nice value are displayed in the PRI, C and NI fields using the SYSV `ps -l` option.

The nice value is an integer that represents coarse priorities between processes. AIX supports both the BSD nice value range of -20 to 20 and the SYSV range of 0 to 39. The larger the number, the lower the scheduling priority. The two value ranges are mapped such that BSD -20 corresponds to SYSV 0 for highest priority, and BSD 20 to SYSV 39 for lowest priority.

New processes inherit the nice value of their parents. The nice value may be altered dynamically during the process lifetime. The owning UID for a process can lower a process' nice value. Only the superuser can improve nice priority. The nice value can be set from the command line using the `nice` command (think of the `nice` and `renice` commands as throttles for controlling process CPU utilization):

```
nice -n <value> <command>
```

Process owners and the superuser can modify existing process nice values by using the `renice` command:

```
renice <value> -p <PID>
```

Before you lower the hammer, however, be aware that the BSD %CPU field represents the percentage of CPU resources that a process has used in its lifetime. You may see short-lived processes shoot up to very high %CPU numbers. A better gauge for identifying CPU crunchers or runaway processes is the TIME column.

The scheduler parcels out CPU time slices at a frequency that makes it appear as if all processes are executing at the same time. In fact, they are being scheduled one at a time, except in the case of multiprocessor systems. When a process isn't executing on the CPU, it may be waiting on a resource or lock, sleeping on an event, suspended or moving through some dispatch or scheduler state. The process state is maintained as part of the `proc` structure information. The process state is displayed by `ps` in the STAT column when either the BSD `l` or SYSV `-l` flag is used. For processes that are flagged `W` (for waiting), the WCHAN column identifies the address of the event being waited on. Refer to Table 2 for a list of process state tags displayed by the `ps` command.

Table 2. Process State Tags

A	Active
O	Nonexistent
S	Sleeping
W	Waiting
R	Running
I	Intermediate
Z	Canceled
T	Stopped
K	Available kernel process
X	Growing

Controlling Processes

We've already talked about lowering a process' priority using the `nice` and `renice` commands. What do you do when process management requires a heavier hand? You use `kill`! The `kill` command sounds much more ominous than it is. What `kill` does is send a specified signal to a process. The signal does not necessarily cause process termination. Note that `kill` is a built-in command for some shells, for example, `csh`. Be aware that the behavior of the shell version of `kill` and `/usr/bin/kill` may be quite different.

```
kill [-Signal] [PID PID PID ...]
```

If you want to send a signal to all your processes except the sending process, use the `killall` command:

```
killall [-signal]
```

To display the set of supported signals, use the `-l` argument to `kill`:

```
kill -l
```

AIX signals are based on the SYSV implementation. However, some BSD signals are mapped to their SYSV counterparts and BSD signal system calls are available. When writing or porting programs that use BSD signals and calls, note that signals are not automatically reset after being caught. They must be specifically reset to the required behavior in the signal handler routine.

Rules of Thumb

It seems to be a common practice to use the `KILL (9)` signal to terminate a process. I recommend that you do this only as a last resort after first trying `HUP (1)` and `ABRT (6)`. The latter two signals allow a process to terminate gracefully. In the case of `ABRT`, a core file is produced that may be used for debugging. The `KILL` signal basically attempts to yank the process out of the process table without permitting any cleanup activity.

`kill -1 <PID>`	First try `HUP`.
`kill -6 <PID>`	Then try `ABRT`.
`kill -9 <PID>`	Use `KILL` if all else fails.

Occasionally, a user may try out some ingenious bit of C code that contains a statement along the lines of:

```
while(1) fork();
```

I'm not insinuating that this is done on purpose, but it can be a pain in the neck to stop. New processes are created as fast as you can kill them. One little trick you can try is to kill them by PGID. Use the formatted output, `-F`, option with SYSV `ps` to display the PGID. Then, send a signal to the negative PGID:

```
ps -el -F pgid,runame=<procname>

kill -6 -<pgid>
```

Scheduling Processes

One way of controlling overall consumption of resources is to schedule execution off shift. The UNIX `cron` utility provides a basic means for scheduling jobs to be run at a particular time of the day or on a periodic basis. `cron` can be used to take care of regular system housecleaning tasks such as synchronizing disk writes, cleaning out `/tmp` and running accounting programs. Such periodic tasks may be tailored using `crontabs`. A `crontab` is a list of commands and scripts with designated run times that will be invoked by `cron` under the effective UID of the owner. `cron` reports any errors or output information to the owning user after the commands are executed. `cron` logs errors to a log file, `/var/adm/cron/log`, and if AIX auditing is enabled, produces audit records.

To create a `crontab`, use your favorite editor and create a table with the following fields:

```
minutes   hours   day   month   weekday   command
```

Each of the time-associated fields may be represented as a comma-separated list. An asterisk (`*`) may be used to represent all possible times. For example, if I wanted to display uptime statistics every 30 minutes on the system console, I would add the following line to my `crontab` file:

```
0,30  *  *  *  *  /bin/uptime >  /dev/console
```

Once you have your `crontab` file tailored to your liking, hand it off to `cron` by invoking the `crontab` command:

```
crontab <YourCrontabFile>
```

The systems administrator can enforce access controls on who may use `cron` services by listing usernames, one per line, in the `/usr/adm/cron/{cron.allow,cron.deny}` files. `cron` checks these files' authorization before invoking a user's `crontab` file. The default is to allow access to all users.

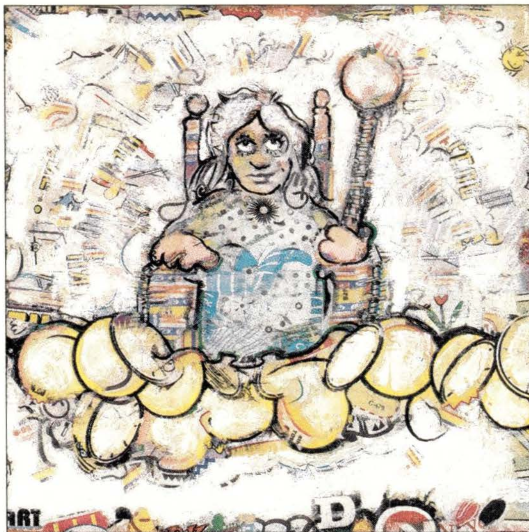
Suppose you want to run a job off hours but don't want to create a `crontab` entry for it. It may be a one-time-only run. You can do this using the `at` and `batch` commands. Note that `batch` is just a script that invokes `at`. Execute `at` jobs by specifying the time and the input stream of commands on the command line. The job stream is copied to the `/var/spool/cron/atjobs` directory, `cron` then executes the job stream at the specified time. As with `cron`, authorization is controlled by listing usernames in the `/usr/adm/cron/{at.allow, at.deny}` files. The default is to allow access to all users.

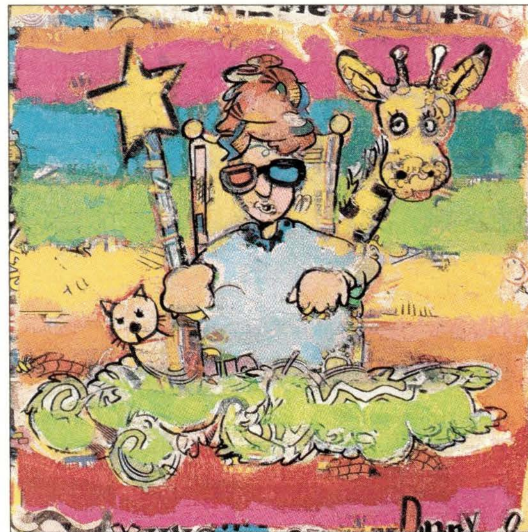
`at <time> input <Ctrl-D>`	Start a job at *time*.
`at -r jobnumber`	Remove a job.
`atq <username>`	List scheduled jobs.

More Information

I hope I've presented enough background information to assist you in managing processes in AIX. If you're interested in more detail, then I would recommend you take a look at a text dedicated to AIX systems administration. It just so happens I have a new book on AIX Version 4 systems administration, appropriately titled *AIX Version 4: System and Administration Guide*, published by McGraw-Hill, ISBN 0-07-036688-8. Pick one up for all your friends and relatives. I'm shameless. There are a number of other good AIX texts out there. You'll find a list of AIX references in the AIX FAQ distributed in the `comp.unix.aix` newsgroup. Use your favorite Web search tool to track down a copy on the Web.

by Jeffreys Copeland and Haemer





Comparing Text, Part 1

Jeffrey Copeland (`copeland@alumni.caltech.edu`) *is at Softway Systems Inc. in Boulder, CO, working on UNIX internationalization. He spends his spare time rearing children, raising cats, and being a thorn in the side of his local school board.*
Jeffrey S. Haemer (`jsh@usenix.org`) *works at QMS Inc. in Boulder, CO, building laser printer firmware. Before he worked for QMS, he operated his own consulting firm, and did a lot of other things, like everyone else in the software industry.*

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

You're all familiar with the `diff` utility. It's one of the more powerful tools we have for keeping track of what's changed in a text file. Over this past summer and fall, we have been working on a series of documents in different stages of completion, with different revisions, and we've realized that there's a misfeature in the operation of `diff`: If we are trying to compare formatted versions of a document rather than the document source, `diff` gives us thousands of lines of spurious differences.

To steal a short example from the Free Software Foundation's GNU `diff` documentation, consider two files, `lao` and `tzu`, with slightly different formatting:

```
$ cat lao
 The Way that can be told of is not the eternal Way;
 The name that can be named is not the eternal name.
 The Nameless is the origin of Heaven and Earth;
 The Named is the mother of all things.
 Therefore let there always be non-being,
 so we may see their subtlety,
 And let there always be being,
 so we may see their outcome.
 The two are the same,
 But after they are produced,
 they have different names.
$ cat tzu
 The Nameless is the origin of Heaven and Earth;
 The named is the mother of all things.

 Therefore let there always be non-being, so we may see their subtlety,
 And let there always be being, so we may see their outcome.
 The two are the same,
 But after they are produced, they have different names.
 They both may be called deep and profound.
 Deeper and more profound, The door of all subtleties!
```

Even though the text beginning with `Therefore...` is identical in both files, the remainder of the file is reported by `diff` as different because the formatting is different. Not even the useful `-b` or `-w` flags, which are used to ignore white space, can help us. What's worse, if we only have Microsoft Corp. Word files, we normally extract the text with a line like:

```
strings foo.doc | fmt -75 >foo.txt
```

This gives us a reasonable ASCII file to peruse, so we don't have to rely on the Microsoft tool. Unfortunately, this is the equivalent of a formatted document, so we're back to square one and unable to compare the old text with a new version. (OK, we'll concede that if we were willing to use one of the what-you-see-is-what-you-get word processors, we could use its "redlining" feature to mark the differences for us.)

We could delve into the source code of `diff` and add a new flag, or we could retreat to the original papers on `diff` and write something from scratch. (The papers are: "An O(ND) Difference Algorithm and its Variations," by Eugene W. Myers, *Algorithmica* , Vol. 1 (1986), pp. 251-266; and "A File Comparison Program," by Webb Miller and Eugene W. Myers, *Software–Practice and Experience,* Vol. 15 (1985), pp. 1025-1040.) Alternatively, we could graft a filter onto the input or output of `diff` to remove the spurious text differences.

We considered each of these approaches. Writing a new program from scratch struck us as the most interesting, though doing all the work inside the `diff` source code is probably more practical because it wouldn't necessitate rewriting the code for traversing the difference tree. However, in the interest of getting something to work in the short term, we opted for the third approach and built a shell script to achieve our desired output.

Why do it this way? It's a time-honored prototyping technique for UNIX tools. Remember that the original version of `spell` was a half-dozen-line shell script. Exercise for the reader: Given the prototype we're providing, either write a new program or modify the GNU `diff` source to do the function we are creating here.

A Shell Script

We need a way to compare the running text without having the line breaks get in the way. We can do this by breaking each line from each file into individual words, using a command like `fmt -l 2 foo.txt >foo.words`, and then comparing the two files of words against each other. Thus, our first cut at a script called `redline` might be something like:

```
#! /bin/sh
fmt -l 2 $1 >/tmp/$$a
fmt -l 2 $2 >/tmp/$$b
diff -b /tmp/$$a /tmp/$$b
```

We're deliberately not doing error checking or cleanup yet–we're just trying to prove the concept–we'll get to a properly constructed shell script shortly. Also, you might have to modify those command lines. If your system is based on Free BSD, for example, the `fmt` command line would be `fmt 2 $1`. This gives us output that begins:

```
2,24d1
<        Way
<        that
<        can
<        be
<        told
<        of
<        is
<        not
<        the
<        eternal
<        Way;
<        The
<        name
<        that
```

That output is not of much use: It presents us with a difference output consisting of one word per line, which, while correct, is difficult to read. Further, we still don't have context for the differences because they appear in a vacuum.

We can improve the situation by generating a side-by-side difference of the word lists, like this:

```
#! /bin/sh
fmt -l 2 $1 >/tmp/$$a
fmt -l 2 $2 >/tmp/$$b
diff -y -b /tmp/$$a /tmp/$$b
```

Which gives us a full context, beginning like so:

```
The          The
Way       <
that      <
can       <
be        <
told      <
of        <
is        <
not       <
the       <
eternal   <
Way;      <
The       <
name      <
that      <
can       <
be        <
named     <
is        <
not       <
```

Note: If you're not using the GNU `diff`, then you may need to use the `sdiff` command.

We have the full context again, but it's still painful to read.

Unfortunately, we can't do something as simple as pipe the text back through `fmt`, because the difference markers will be folded into the formatted text, which will make it even harder to read and make the differences even more difficult to spot. We really want to be able to postprocess the output of `diff` in some way to make the output easier to read.

Also, notice that we've had to use the `-b` flag to `diff` to prevent spurious differences caused by the differing number of blanks at the beginning of lines. We should probably remove all the blanks at the beginning of lines to prevent this. However, this means that we need to add a blank line between indented paragraphs too. With that in mind, and postulating a postprocessing filter named `reddiff`, our next cut at the shell script looks something like this:

```
#! /bin/sh

#  begin by breaking files into a word per line;
#   ensure that paragraphs are handled nicely
#    whether they're indented or preceded by
#    blank lines
expand $1 | sed -e 's/^  */\
/' | fmt -2 >/tmp/$$a
expand $2 | sed -e 's/^  */\
/' | fmt -2 >/tmp/$$b

#  now do an sdiff, and collect the differences
diff -y /tmp/$$a /tmp/$$b | reddiff
```

We'd normally have used a character class in the `sed` regular expression that matched either space or tab, but instead we used `expand` to convert tabs to spaces in this example because it's easier to see what the code is doing–feel free to fix this in your version. In the best of all possible worlds, we'd be able to use POSIX character classes in our `sed` expressions, and use a line such as `sed 's/[:blank:] *//'`.

That leaves us with two tasks: First, we must add file cleanup and error checking to the script; second, we must write the `reddiff` program. Let's do the easier task first.

We begin by providing a description of the program, and an RCS identification string. We follow the commentary by checking the file arguments and issuing a usage message if one is needed. Next, we set the cleanup of temporary files through the use of a shell `trap` command. For those of you not familiar with it, `trap` executes the given code when any of the named signals are received by the script–an older version required you to provide the signal *number*, which made it fairly nonportable. Then, we proceed with the code as outlined before:

```
#! /bin/sh
# $Id: $
#  This does a diff on running text,
#   in the same style as a Word or
#   WordPerfect red line comparison.

#  set the cleanup
trap 'rm -f /tmp/$$*'  EXIT HUP QUIT INT TERM

#  check that file arguments are present
[ -z "$1" -o -z "$2" ]  &&
  echo usage:  $0 file1 file2  &&
  exit

#  begin by breaking files into a word per line
#  ensure that paragraphs are handled nicely
#  whether they're indented or preceded by
#  blank lines
expand $1 | sed -e 's/^  */\
/' | fmt -2 >/tmp/$$a
expand $2 | sed -e 's/^  */\
/' | fmt -2 >/tmp/$$b

#  now do an sdiff, and collect the differences
diff -y /tmp/$$a /tmp/$$b | expand | reddiff
```

Because `diff -y` produces tabs as part of its white space on output, we're expanding those tabs to make parsing by the `reddiff` filter easier.

The next task is a little more complicated.

The Postprocessing Filter

We can make our development task easier by capturing a sample of the intended input to `reddiff` for testing purposes. We simply substitute `cat` into the `redline` script in place of `reddiff`. The logical first routine to provide for our `reddiff` program is one to parse the output of `diff -y`, and return the words. There are four possible forms to a line of output from `diff -y`. We can have the input be identical:

```
The          The
```

The input can be changed between the files:

```
Named       | named
```

The line can appear in the first file only:

```
that       <
```

The line can appear in the second file only:

```
             > called
```

All of the example outputs have possible text, a tag character and possible text. In this case, "possible text" represents a single word:

```
/* parse the actual output of sdiff */
char
parse( char *line, char **wp1, char **wp2 )
{
```

We provide the line of input itself, and pointers to locations where the words should be returned. The actual value returned by the function is the `tag` character. We keep the words on the input line as local `static char` pointers. Also, we need some local variables:

```
static char *word1, *word2;
char *s, tag;
```

If we have a completely blank line, it represents a paragraph break, so we return an empty tag and new lines for the words:

```
/* a completely blank line */
if( *line == '\n' )
{
  *line = 0;
  word1 = word2 = line;
  *wp1 = *wp2 = word1;
  return ' ';
}
```

In the normal course of events, though, the `tag` is at a fixed position on the line–we've been compressing the blanks in the example `sdiff` lines we've been showing you; the default line is much wider. We get pointers to the two words:

```
tag = line[62];
word1 = &line[0];
word2 = &line[64];
```

We also need to put `NULL`s at the end of the words, so they can be used as strings:

```
if( (s=strpbrk(word1, " ")) != NULL )
  *s = 0;
 else
  line[21] = 0;
if( (s=strpbrk(word2, "\n")) != NULL )
  *s = 0;
else
    line[84] = 0;
```

Notice that we're doing some defensive programming for words that don't have a terminating blank.

Last, we stuff the pointers to the words into the return locations and return:

```
*wp1 = word1;
*wp2 = word2;
return tag;
}
```

That's all we have time for now. We'll finish showing you the code for the rest of the `reddiff` program next month as our New Year's gift.

Until then, happy holidays and happy trails.

To advertise your product/service in the next issue of the RS/Magazine MARKETPLACE section or for more information, please call Carol Flanagan

RS/Magazine MARKETPLACE

(508) 839-4016

Circle No. 388

Circle No. 389

Circle No. 368

NORDISK™

TRY TO BEAT THESE DEALS!

- Equipment is 1 yr. old
- All configurations available
- Optional 1 yr. warranty
- CALL for deatils!!!

IBM RS/6000 SYSTEMS

IBM Systems	Nordisk Price	Savings
• Model 7012-G40's	from $15,500	40 - 87%
• Model 7013-595's	from $32,000	38 - 74%
• Model 7024-E20's	from $5,000	30 - 58%
• Model 7030-3BT's	from $10,900	43 - 81%

IBM Displays	IBM List	Nordisk Price	Savings
• 15" Green/ASCII	$577	$350	39%
• 17" Color P70	$1,486	$1,000	33%
• 20" Color P200	$2,660	$1,660	40%
• 20" Color P201	$3,600	$2,200	40%
IBM Tape Drives			
• 4MM 4-8GB	$2,695	$1,650	40%
• 8MM 5-10GB	$5,395	$2,700	50%

Much More Available: Systems, Memory, Adapters, Graphics, Disk, Tape, RAID, Displays, ect...**CALL!!!**

CALL 888-275-RISC (7472)
TEL: 503-275-9999 FAX 503-275-9998
E-mail: rs6000@nordisk.com

IBM Business Partner

Circle No. 452

COMPUTER® MARKETPLACE
A PUBLICLY TRADED COMPANY • NASDAQ: MKPL

RS/6000 Specialist

Give us a call and let us earn your business!

1-800-858-1144

Memory • Upgrades
Disk • Peripherals

Memory by Kingston® TECHNOLOGY

phone:(909) 735-2102 • fax:(909) 735-5715

Circle No. 342

BIG SAVINGS ON MEMORY

MEMORY PRICES HAVE NEVER BEEN LOWER

Memory for all IBM, HP, SUN & SGI Models • Immediate Availability
Lifetime Warranty

Complete Technical Support
Flexible Terms
Satisfaction Guaranteed

ENCORE
TECHNOLOGY GROUP

Kingston TECHNOLOGY CORPORATION

CALL: 1-800-880-0202 • FAX: 1-210-308-0255 • E-MAIL: sales@encoretech.com

Circle No. 373

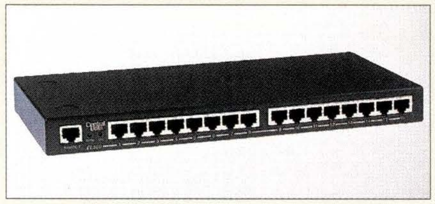
NEW PRODUCTS

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

Serial Port Server Out

Central Data, supplier of I/O expansion products for UNIX and Windows NT platforms, has introduced the EL-160 EtherLite Port Server, which autodetects the presence of 10BaseT or 100BaseT Ethernet links to smoothly operate in either mode, according to the company. Sixteen asynchronous serial ports support speeds of up to 230K baud to provide fast connection to modems, terminals, printers and other RS-232 peripherals.

Because the EL-160 has local serial ports, it doesn't need to carry telnet, rlogin, reverse telnet or other complex network terminal server overhead. Ports appear as local `ttys` under UNIX and as native `COM` ports under Windows NT. Traffic from all 16 ports is serviced by one TCP/IP session, rather than a "one-session-per-port" method. The unit decreases overhead at the host, lessens Ethernet traffic, and local administration gives users greater control over the server ports, Central Data says.



The EL-160 works with Solaris, AIX, HP-UX, SCO UNIX and Windows NT. The company also offers a serial and parallel port driver for Java applications and applets. The EL-160 EtherLite Port Server costs $1,795.

Central Data Corp.
1602 Newton Drive
Champaign, IL 61821
http://www.cd.com
Circle 101

HSSI Adapter for Sun's PCI Bus

LAN Media has introduced a High-Speed Serial Interface (HSSI)-to-PCI adapter for Sun's 33-MHz PCI-enabled servers and Ultra 30 line of workstations for high-speed access to wide-area networks (WANs).

Called the LMC5200, the adapter allows Sun's PCI-equipped servers and workstations to attach to various Digital Service Unit (DSU) equipment at speeds ranging from 2 Mb/s to 52 Mb/s. T1 connections, in contrast, support up to 1.5-Mb/s data rates. HSSI supports three connection methods–inverse multiplexing, fractional T3 and E3, and full T3 and E3–via an external DSU. LAN Media is working with several DSU manufacturers to ensure broad HSSI compatibility.

The LMC5200 adapter attaches directly to the PCI bus to allow information to quickly move from the server's memory to the WAN. The LMC5200 supports fractional T3 data rates in increments ranging from 3 Mb/s to 45 Mb/s, the company says.

The LMC5200 costs $2,995, including the adapter, Solaris 2.5.x driver, technical support and a one-year warranty. A starter kit priced at $4,995, consisting of two LMC5200 adapters

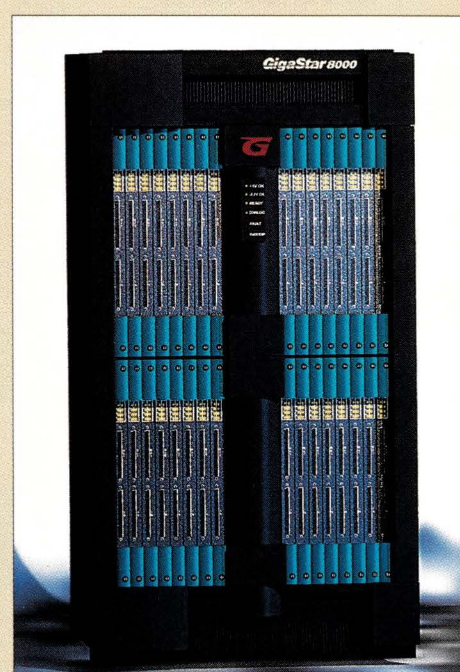
Multigigabit Enterprise Switch

GigaLabs has introduced a super-size gigabit switch, the GigaStar 8000, that is said to provide a total backplane capacity of 128 Gb/s and switching throughput capacity of 64 Gb/s.

The GigaStar 8000 is the first switch to offer 2 Gb/s of dedicated bandwidth for each of the 32 chassis slots in its backplane, according to the company. It supports Gigabit Ethernet and High Performance Parallel Interface (HIPPI) technology. It is designed for bandwidth-intensive applications, speeding up Internet communications or connecting two or more complete networks together. The protocol-independent switch can provide dedicated multigigabit bandwidth at critical network junctures.

The GigaStar 8000 enables I/O switching using GigaPipe technology for high-speed server-to-switch, storage-to-switch or switch-to-switch connectivity. GigaPipes connect directly into a computer's raw data flow (PCI, SBus or SCSI, for example)–typically more than 1 Gb/s–and send data from one point on a network to another at speeds as high as 2 Gb/s. GigaPipes channel the bus directly into the switch, avoiding protocol translation and increasing performance dramatically, the company says. Pricing starts at $350,000.

GigaLabs Inc.
290 Santa Ana Court
Sunnyvale, CA 94086
http://www.gigalabs.com
Circle 100



and a loopback cable, is also available.

LAN Media Corp.
686 W. Maude Ave., Ste. 102
Sunnyvale, CA 94086
http://www.lanmedia.com
Circle 102

Widget Adds Printing to UNIX Apps

Motif developers wishing to add text and image printing, formatting and pagination to their applications can now use PageFormatter, a new C/C++ toolkit from KL Group that generates PostScript-compatible documents.

Documents created with PageFormatter can contain sophisticated formatting options, for example, multiple columns and text flows, running headers and footers, multiple fonts, text sizes and colors. They can also contain embedded bit-maps and encapsulated PostScript (EPS) images. Documents can contain any ISO-Latin-1 (Western European) font.

KL Group says the PageFormatter toolkit "understands" standard PostScript printer description (PPD) files, so that particular features of specific printers–for example, half-toning, paper tray selection or output scaling–can be easily accessed. Developers can also create reusable templates and style files that can be used within or across applications. This, KL Group says, helps establish a uniform "look and feel" to documents.

PageFormatter costs $1,995 per single developer's license–no royalties or runtime fees.

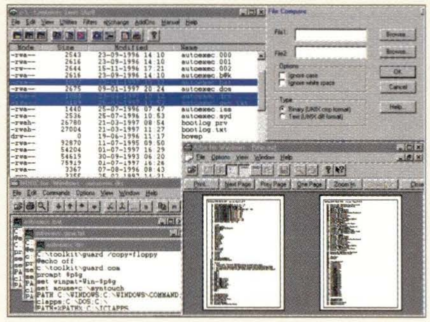
KL Group Inc.
260 King St. East
Toronto, Ontario
Canada M5A 1K3
http://www.klg.com
Circle 103

UNIX Utilities on Windows PCs

ICL aims to give Windows NT users who are connected to UNIX networks easier access to UNIX utilities with Centrivex Swift, the first release of a planned line of software tools available for evaluation on the company's Web site.

Centrivex Swift lets users access more than 45 commonly used UNIX utilities from a graphical user interface featuring menus and toolbars within the Swift shell (many are also available from the DOS command line). Utilities include `mkdir`, `uuencode`, `unix2dos`, `dircmp` and `cmp`, ICL says.

Centrivex Swift includes A2pr, a Windows program for printing text files, and also includes many characteristics of



A2ps, a commonly used UNIX program. Other features include support for all Windows fonts loaded in the printer, printing of page headers and line numbers, and support for large file printing.

Centrivex Swift is available for $159 and requires a 486-based PC running Windows 95 or NT with 8 MB of RAM and 3.5 MB of disk space.

ICL Software Technologies Ltd.
Ambassador House
Concord Business Park
Threapwood Road
Manchester, UK M22 0NE
http://www.iclsofttech.com
Circle 104

Armor for Your CD-ROMs

Digital Armor has introduced a product that helps protect CD-ROMs from damage–by dust, abrasions, fingerprints and so on. Called CD Armor, the protection system is made of a clear, nonrefractive polymer shield that should in no way damage image or sound quality, or cause data loss, the company says.

CD Armor installs with the help of the CD Armor Installer Kit, a small device that keeps fingerprints and other contaminants off the CD-ROM while CD Armor is being installed. CDs that have been protected with CD Armor retain their original size and can be kept in the original jewel case, the company says. CD Armor is appropriate for music CDs as well as CD-ROMs.

The CD Armor Installer Kit, which includes six shields, has a suggested retail price of $19.95. Shield replacements come in packs of six, 15, 25 and 40, ranging in price from $4.95 to $19.95.

Digital Armor Inc.
520 5th Ave. S.W., Ste. 600
Calgary, Alberta
Canada T2P 3R7
http://www.digitalarmor.com
Circle 105

NCD Rolls Out Network Computers

Network Computing Devices, a key player in the Network Computer (NC) marketplace, has introduced its latest line of NCs, the Explora 400 Series (Explora 400 and 450) and the Explora 700. All three NCs use Citrix Systems' ICA protocol to allow Windows application access over 100BaseT network connections, in addition to access to UNIX, legacy and Java applications, in keeping with the NC1 specification.

The entry-level Explora 400 is driven by a 33-MHz PowerPC processor and supports screen resolutions of up to 1,152 by 900 pixels, while the Explora 450 includes a 66-MHz version of the same processor and supports up to 1,280-by-1,024-pixel screen resolutions. At the high end of the new terminal line, the Explora 700 is powered by a 64-bit MIPS R4700 RISC processor, and supports screen resolutions of up to 1,600 by 1,200 pixels. All three units ship with Version 5.0 of the company's NCDware operating system, which includes the ICA client, local Java Virtual Machine, local browser, wireless connectivity and light pen support.

Pricing for the Explora 400 and 450 models starts at less than $700, and at $1,695 for the Explora 700.

Network Computing Devices Inc.
350 N. Bernardo Ave.
Mountain View, CA 94043
http://www.ncd.com
Circle 106

New Products

Trio of Disk Arrays Out

Cybernetics has introduced the XP series of high-capacity hard disk arrays. The XP series consists of CY-50XP, CY-25XP and CY-10XP. The arrays use a hardware implementation of RAID 0/ Striping, which harnesses the power of multiple drives to allow CY-50XP and CY-25XP to provide 30 MB/s and CY-10XP to provide 25 MB/s throughput, the company says.

The XP arrays can reportedly deliver information of more than 50 GB to a user in less than 10 msec. The CY-50 XP array can also be configured with a RAID 1/Mirroring option to add a level of fault tolerance. Data is mirrored on two sets of disks within the array to provide a continuous backup for complete redundancy. In Mirroring mode, users can still achieve 15 MB/s and 25-GB capacity, Cybernetics says.

The XP series features several hard disk drives combined in an enclosure with Cybernetics' Ultra SCSI controller. To the host system, the company says, each XP array looks like a large, single hard disk drive. The CY-50XP comes with a 51.2-GB capacity and costs $11,995, the CY-25XP offers a 25.6-GB capacity and costs $6,995, and the CY-10XP has a 10.2-GB capacity and costs $3,995. Desktop cabinet and rack-mount enclosure units are available for all drives, and the CY-10XP is available as an internal unit for integration into high-performance PCs, workstations and servers.

Cybernetics
111 Cybernetics Way
Yorktown, VA 23693
http://www.cybernetics.com
Circle 107

SunExpert MARKETPLACE

To advertise your product/service in the next issue of the SunExpert MARKETPLACE section or for more information, please call Carol Flanagan at

Email: caflanag@aol.com

(508) 839-4016

Circle No. 409

Matrix

For quick response & competitive pricing get into
THE MATRIX

Call for fulfillment all of your **SUN®** requirements

Workstations
CPU's
Memory
Disk & Tape Drives
Upgrades

Authorized Distributor of **KINGSTON®** Memory
with a Lifetime Warranty

Call 603/433-7500...Extension 223 or 227
Fax 603-433-1613

Circle No. 454

Discover Solar Systems with hundreds of Suns.

Refurbished **Sun Microsystems** equipment at great prices. Fully-tested inventory on hand, same-day shipping, satisfaction guaranteed.

- *Workstations & Servers*
- *Upgrades & Parts*
- *Storage Options*
- *Rental & Leasing Available*
- *Cycle 5 Master Reseller*
- *SunSoft Authorized Reseller*

To buy or sell,
1-800-253-5764
Ext. 220

SOLAR SYSTEMS & Peripherals, Inc.

Outside U.S. call 1-425-222-7588 Fax 425-222-7388
http://www.solarsys.com

SPARC International Member

Circle No. 408

CD-R for SUN

GEAR, Elektroson's premiere CD-Recordable software, enables Sys. Administrators to:

- distribute data on cross platform media
- archive data safely and inexpensively
- cut patches and updates to CD
- create custom audio and video CDs

GEAR supports the most extensive number of optical file formats, including ISO 9660 with Rockridge extensions. Elektroson products are compatible with the latest in CD-R technology from all major drive manufacturers.

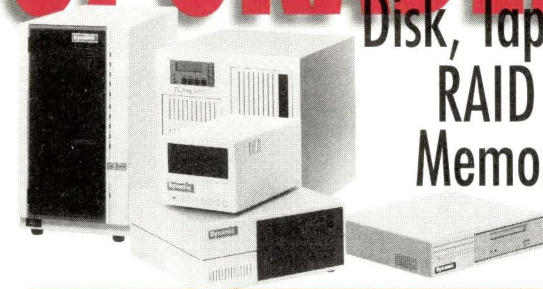
We support the latest versions of:
Solaris and SUN OS

ELEKTROSON
1 (800) 606-6116
www.elektroson.com
The leader in UNIX CD-R software for over a decade.

Circle No. 325

UPGRADES

Disk, Tape, RAID & Memory



External Disks

	Narrow	Fast Wide	FW Diff.
2.1 Gb Ultra SCSI 7200 rpm 8ms	$ 587	$ 697	$ 753
4.5 Gb Ultra SCSI 7200 rpm 8ms	749	841	887
9.1 Gb Ultra SCSI 7200 rpm 8ms	1170	1262	1308
23 Gb Ultra SCSI	2401	2513	2564

External Tapes

	Narrow	Fast Wide	FW Diff.
8 Gb DDS2 DAT	966	1041	n/a
96 Gb DDS2 DAT Loader	2416	2491	n/a
24 Gb DDS3 DAT	1403	1478	n/a
14 Gb Exabyte 8mm	3870	3995	4058
40 Gb Mammoth 8mm	3198	3260	3323
40 Gb DLT	3198	3260	3323
70 Gb DLT	7229	7291	7354
280 Gb DLT Loader	8084	call	call

RAID

	N&F Wide	FW Diff.
18 Gb expandable hot swap	6986	7286
36 Gb expandable hot swap	9118	9418

*includes redundant power & 16Mb cache

Up to 500 Gb available

Memory

Dataram & Kingston Memory Upgrades — **Call for current low prices**

CALL FOR
- expanded price list
- internal drive mounts
- cables & enclosures
- media
- custom solutions
- backup software
- A/V drives
- repairs

DYNAMIC ADVANTAGE
- low cost
- guaranteed compatibility
- new brand name products
- unlimited technical support
- 5 year disk warranty
- real-time help
- superior product knowledge
- over 30 years in the industry

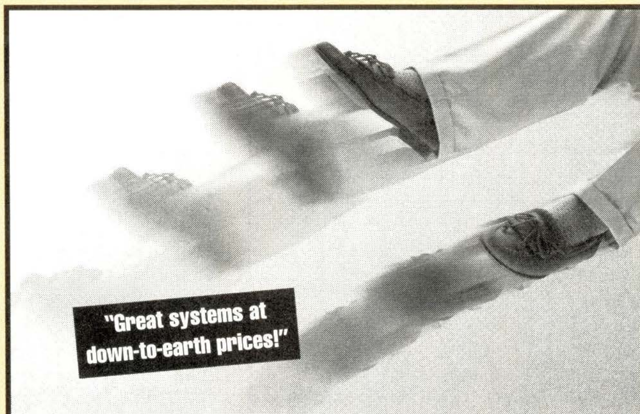
Platform Support: RS/6000, SUN, SGI, HP, COMPAQ, DEC + Novell & NT

1-800-714-SCSI

Dynamic
COMPUTER PRODUCTS

233 Greenwood Avenue, Bethel, Connecticut 06801
Tel: 203/791-9511 • Fax: 203/778-4535
www.dynamicdisk.com • email: info@dynamicdisk.com

Circle No. 374



Customer Blown Away By Low Prices

Work Stations • Servers • Peripherals • Parts
Sales • Rentals • Leases • Exchanges • Repairs
Maintenance • 120 Day Warranty

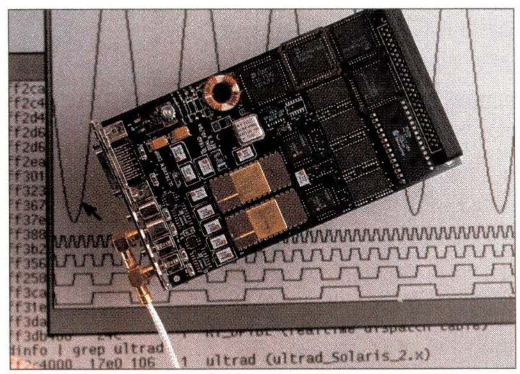
Call today to buy, sell or trade SUN and Silicon Graphics equipment with Security!

SECURITY COMPUTER SALES

622 Rossmor Building • 500 North Robert Street • St. Paul, MN 55101
612/227-5683 • FAX: 612/223-5524 • seccomp@seccomp.com

Circle No. 376

ULTRA*FAST* SBus A/D



10 MHz DATA ACQUISITION

The ultimate **12-bit** data acquisition board can acquire 8 Million A/D samples while *simultaneously* outputting 8 Million D/A samples and TTL vectors, all without CPU intervention.

Four analog inputs, **twin 5 MHz 12-Bit A/D and D/A** converters, 5 MHz TTL input/output vectors, and **huge 16 MB RAM** allow use in the most demanding scientific and industrial applications.

ULTRAVIEW CORPORATION
34 Canyon View, Orinda, CA 94563
Telephone: (510) 253-2960 Fax (510) 253-4894
email: ultrav@netcom.com
www.ultraviewcorp.com

Circle No. 375

SunExpert MARKETPLACE

NIPrint™ Completes Win/95/NT-to-Unix Integration

NIPrint™ is both a LPR and a LPD print server for Winsock. NIPrint is installed on the Windows PC only. NIPrint works with Unix's LPD/LPR or your print servers LPD - no host files or modification required. NIPrint is fully compatible with Windows, Windows 95 and Windows NT (3.51 and 4.0).

- BI-DIRECTIONAL, WORKS WITH LPD ENABLED PRINTERS/DEVICES
- IMMEDIATE PRINTING (NO WAITING, NO POLLING)
- PRINT JOBS ARE TRANSPARENTLY SPOOLED TO/FROM UNIX
- FULLY LPR/LPD COMPLIANT - WORKS WITH ANY UNIX OR PRINT SERVER (EMULEX, JETDIRECT, TEKTRONIX, ETC)
- FULLY INTEGRATED INTO PRINT MANAGER, JUST CLICK FILE, PRINT
- COMPLETE 16- AND 32-BIT VERSIONS INCLUDED
- CAN BE RUN AS A SERVICE IN NT OR NTAS (3.51 AND 4.0)
- INSTALLS IN MINUTES - REALLY!

DEMO ALSO AVAILABLE FROM OUR WEB SITE OR CALL (612) 932-9899 FAX (612) 932-9545

NIPRINT STARTS AT $29.00 PER PC

5-PC $119, 10-PC $189
25-PC $349, 50-PC $595
HIGHER USER COUNTS AND UNLIMITED SITE LICENSES AVAILABLE

NETWORK INSTRUMENTS

www.networkinstruments.com

CALL 800-526-7919 FOR A FREE 21-DAY DEMO

Circle No. 316

Customer Goes Ape Over Great Service

Call today to buy, sell or trade SUN and Silicon Graphics equipment with Security. Unparalleled service, unbeatable value – No wonder so many people are going ape.

SECURITY COMPUTER SALES

622 Rossmor Building • 500 North Robert Street • St. Paul, MN 55101
612/227-5683 • FAX: 612/223-5524 • seccomp@seccomp.com

Circle No. 401

EXA-"Bitten"??

Extend your EXABYTE Warranty

EXB-820x, 12 hr Repair (6 mo war): $ 250
"Hot Swap" Repair (6 mo Warr.): $ 300
EXB-850x, 12 hr Repair (6 mo war): $ 350
"Hot Swap" Repair (6 mo Warr.): $ 400

DLT-"Bitten"!!

DLT-2000, DLT 4000, DLT4700: Call

SUN Microsystems W/S

Buy, Sell, Spare Parts, Repairs

WEX

West Coast Computer Exchange, Inc.
11167-A Trade Center Drive
Rancho Cordova, CA 95670

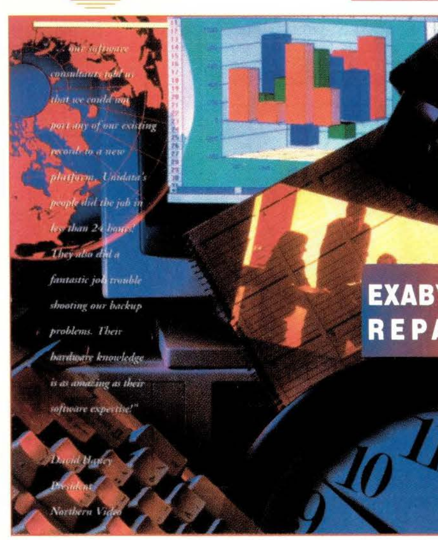
Call: 916-635-9340 or FAX: 916-635-9485
Catalog at Web Site: www.wccx.com
email: sales@ wccx.com

Circle No. 453

UNIDATA SINCE 1981 ENTERPRISE SOLUTIONS WORLDWIDE

DIGITAL SUN HP

YEAR 15 SERVING YOU



ciscopro

UNLIMITED CASH FOR YOUR SURPLUS EQUIPMENT

EXABYTE REPAIR Includes Upgrade and Cleaning at NO Extra Cost!

•BUY
•SELL
•RENT
•REPAIR

Fully Integrated Systems • New and Used Equipment
SCSI Tapes/Disks • Workstation • Servers

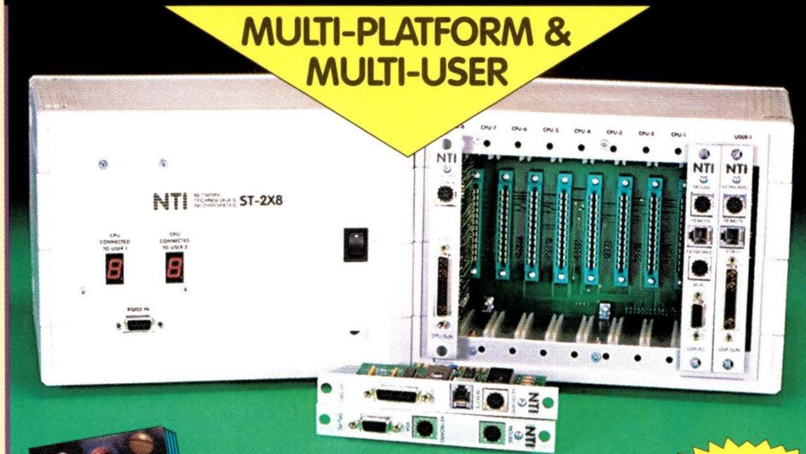
Manufacturers of encompass SOFTWARE
The All Encompassing Distribution & Accounting Software

Call UNIDATA Today!
1-800-427-0400
Fax: (916)797-1414
e-mail: sales@uc.unidata1.com
8331 Sierra College Blvd. • Suite 212
Roseville • California • 95661

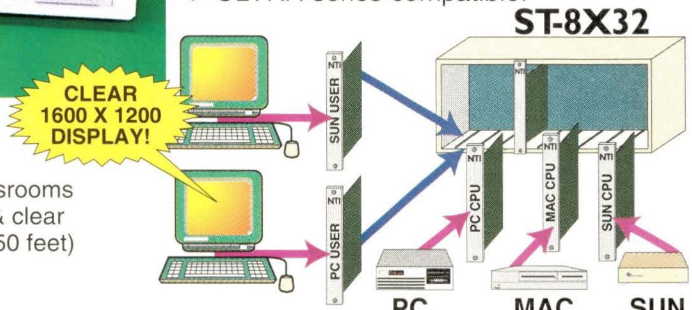
VISA

Circle No. 317

8 USERS COMMAND 32 SPARCS WITH 1 KEYBOARD & MONITOR



- Supports any mix of PC, Sun & Mac computers and peripherals.
- Select port with keyboard, RS232 or optional remote.
- All users can access any computer simultaneously.
- Connect 8 users & 32 computers to one switch.
- This switch can be powered down without causing host failures.
- ULTRA series compatible.



FREE CATALOG

Products compatible with SUN, PC & MAC

- Video Splitters
- KVM Switches
- KVM Splitters
- Interactive Classrooms
- Cables (Sharp & clear video through 250 feet)

NTI
Network Technologies Inc
1275 Danner Drive • Aurora, OH 44202
800-742-8324 • 330-562-7070 • FAX 330-562-1999
E-mail: se@networktechinc.com

www.networktechinc.com

Circle No. 366

WTE/WORLDWIDE TECHNOLOGY EXCHANGE

■ Sun Microsystems ■ HP ■ Silicon Graphics

- Workstations/Servers/Peripherals
- Lowest Prices/Extended Warranties
- Will purchase all excess hardware

3198 Cains Hill Place, Suite 230
Atlanta, Georgia 30305

Tel. 404-816-9998 Fax: 404-816-9986
888-983-7866
Email: sales@worldtx.com www.worldtx.com

Circle No. 421

WebServer Magazine OnLine

The latest information to help Web professionals manage and optimize their site is just a click away.

NO PASSWORD REQUIRED.

http://webserver.cpg.com

◆ RS/6000 ◆

SAVINGS UP TO 75%!

- FEATURES
- UPGRADES
- PCs
- NETWORKING
- BEST VALUE FOR REPLACEMENT PARTS
- 55+ COMPONENT LEVEL REPAIR TECHNICIANS AT YOUR SERVICE!

- BUY-SELL-REPAIR
- 6 Month Warranty
- Advance Exchanges
- Parts
- Parts Repair

6205 Bury Drive
Eden Prairie, MN 55346
http://www.amcomcorp.com
Contact us via e-mail:
tbalko@amcomcorp.com
jeffk@amcomcorp.com

800-328-7723

AMCOM CORPORATION
THE INTELLIGENT CHOICE

Circle No. 422

ADVERTISER'S INDEX

The Ad Index is published as a service to our readers.
The publisher does not assume any liability for errors or omissions.

New England/Upstate New York/ Eastern Canada
CAROL A. FLANAGAN
212 Worcester Street
North Grafton, MA 01536
Phone (508) 839-4016
Fax (508) 839-4226
email: carolf@cpg.com

New York/Mid-Atlantic/Southeast
ROBERT WENTZ
110 Pig Pen Point Court
Queenstown, MD 21658
Phone: (410) 827-5695
Fax: (410) 827-5789

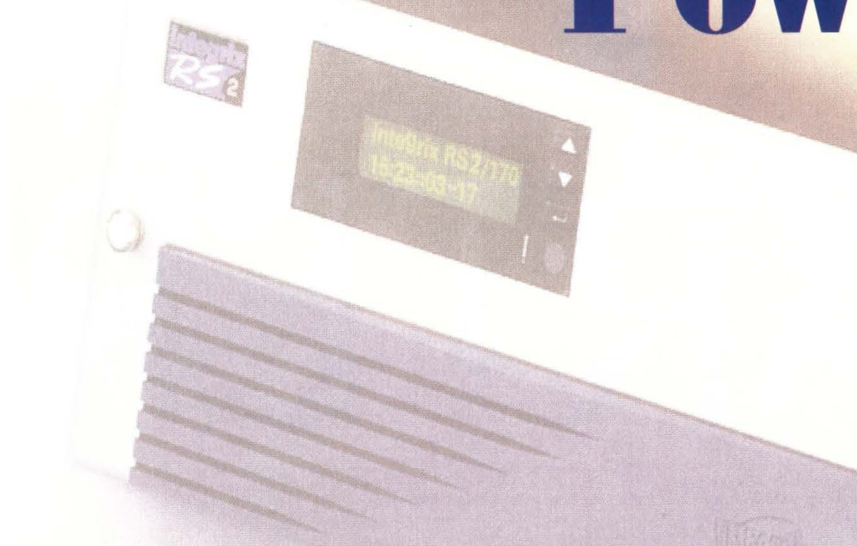
Mid-West/Southwest/Central Canada
LINDA LIEBICH
9600 Great Hills Trail, Suite 150 W
Austin, TX 78759
Phone: (512) 502-3035
Fax: (512) 502-9988
email: lindal@concentric.net

Southern California/Arizona/ Nevada/Hawaii
TARA DUDAS
30 Paseo Alba
San Clemente, CA 92672
Phone: (714) 361-4908
Fax: (714) 361-1564
email: tara@cpg.com

Northern California/Oregon/ Washington/Western Canada
JUDY COURTNEY
640 Forest Lake Drive
Pacifica, CA 9404
Phone: (415) 738-2132
Fax: (415) 738-2432
email: jcourtney@cpg.com

Product Showcase/ Classifieds/ Postcards
CAROL FLANAGAN Mgr, Telemarketing Sales
212 Worcester Street
North Grafton, MA 01536
Phone: (508) 839-4016
Fax: (508) 839-4226
email: carolf@cpg.com

RACKMOUNTABLE
SCALEABLE
POWERFUL



The RS2 is a true rackmount solution. Integrating into your existing rackmount environment, the RS2 gives you easy front access to all storage components. A modular based 64-bit UltraSPARC™ 2 architecture delivers unparalleled speed and performance. 2GB of memory gives you abundant on-board memory capacity. System health is verified, locally or remotely, via the built in diagnostic monitor, the DM100. Built in 100baseT fast Ethernet, fast-wide SCSI-2 interface with optional dual internal hard drives, and a host of SBus capabilities handle multiple users and applications effortlessly.

RS2 Features

- 19" Rackmount Chassis
- DM100 Diagnostic Module
- 20 MB/sec Fast Wide SCSI Interface
- UPA Multi Processing Ready
- 100 Mb/sec twisted pair Ethernet (AUI optional)
- Supports up to 2GB of main memory
- Four 64-bit SBus slots
- 100% Binary Compatibility applications

Finally, a true rackmount solution that brings value to your Inter/Intranet applications- the Integrix RS2 Rackmount UltraSPARC 2 server.

Corporate Headquarters
2001 Corporate Center Drive
Newbury Park, Ca. 91320 USA
Tel: 800-300-8288 / 805-376-1000
Fax: 805-376-1001
E-mail: sales@integrix.com
http://www.integrix.com

Beijing, P.R. China
Tel: 86-10-6253-5305
Fax: 86-10-6253-5306

Seoul, Korea
Tel: 82-2-515-5303
Fax: 82-2-515-5302

integrix®

Circle No. 35