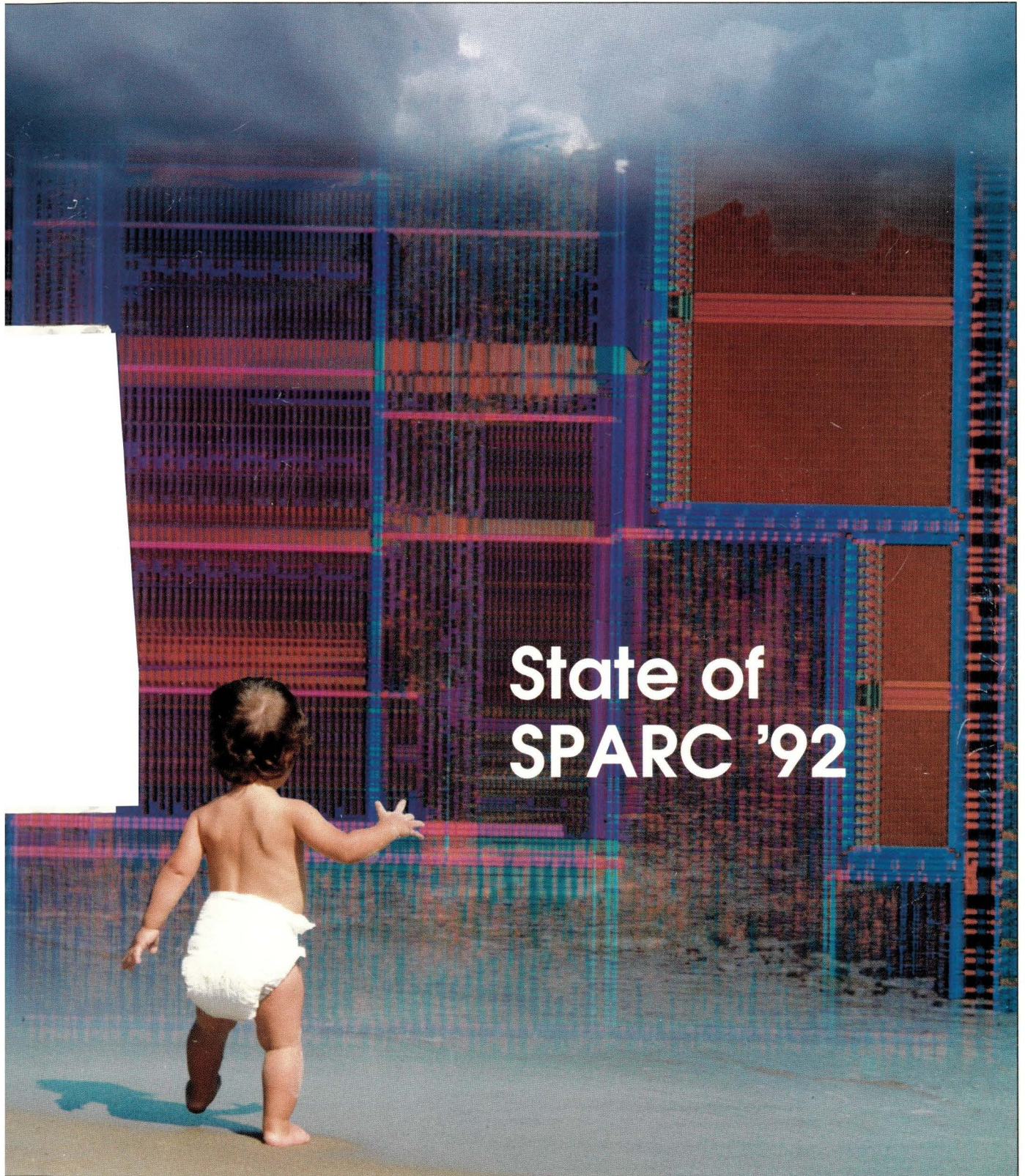


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An Independent Forum for Open Systems

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State of SPARC '92

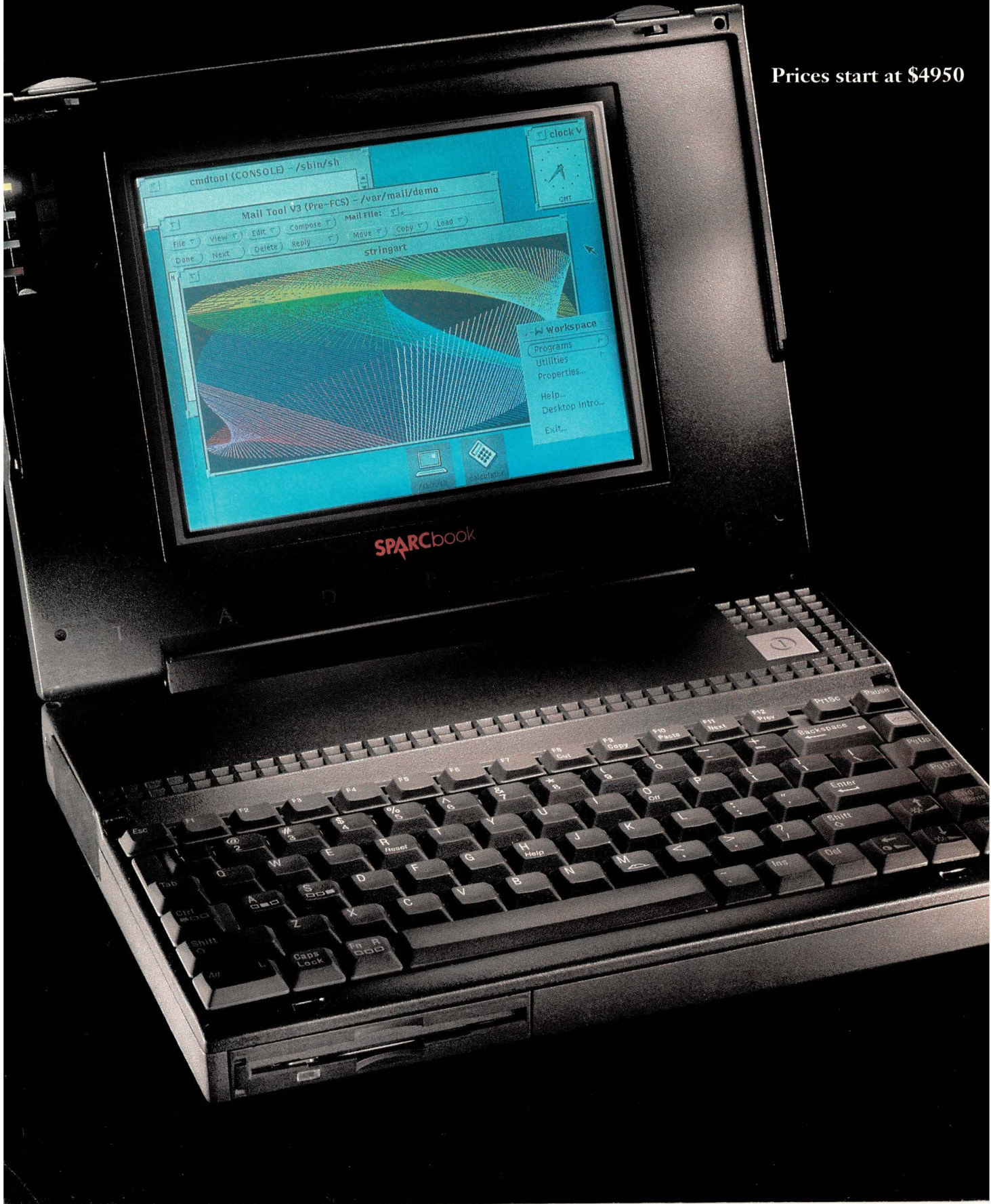
eWSprint Debate

Printer Survey

News: 600MP Update

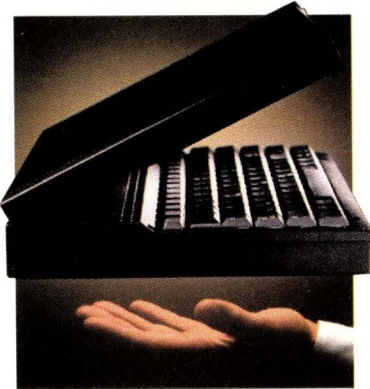
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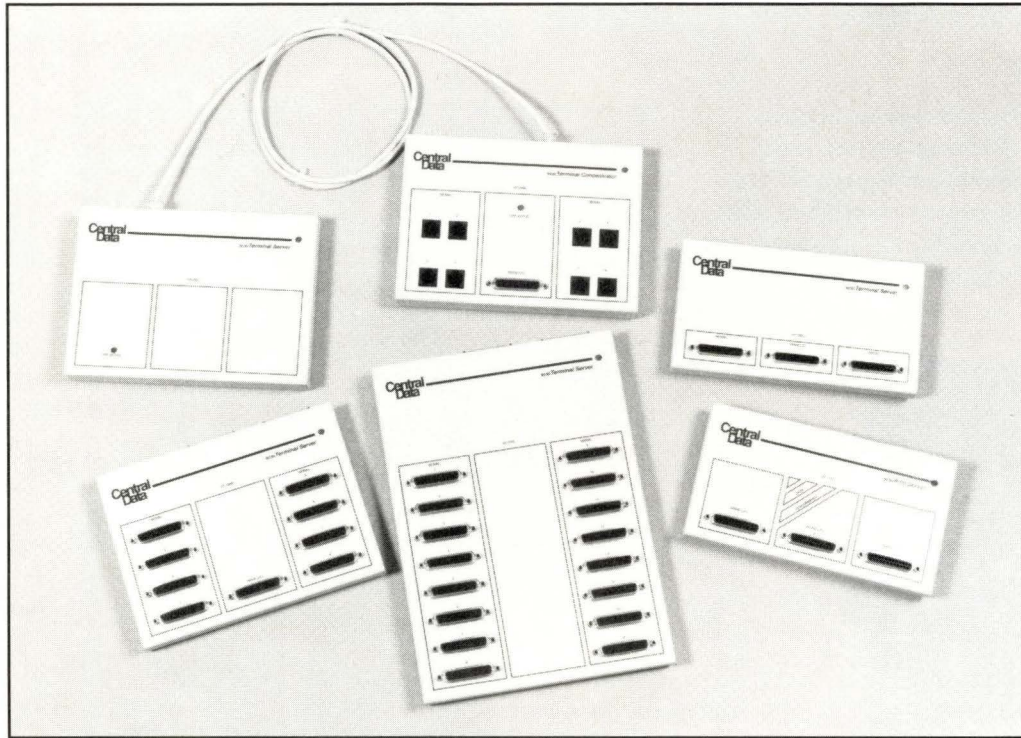
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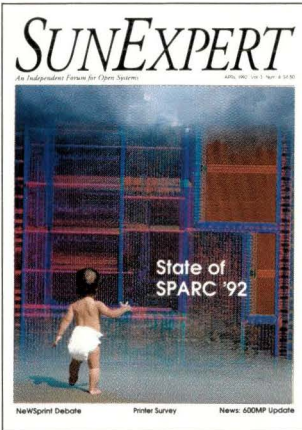
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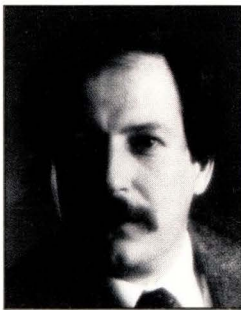
serves the UNIX workstation environment, emphasizing Sun, SPARC and Sun-compatible systems.

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Editorial

Souls for the New Machines

As the most successful merchant RISC CPU, SPARC has changed the dynamics of the workstation market. Now, other system vendors, IBM with its POWER chipset, DEC with its new Alpha, HP-Apollo with PA-RISC, are emulating the Sun Microsystems Computer Corp. strategy of licensing technology as a route to garner market share for an instruction set. The resulting



competition is all well and good, but the performance numbers, clock rates, SPECmarks, device densities and prices bandied about for these new architectures have unsettled some Sun users. If you've been wondering about SPARC's future and your migration path, check out this month's cover story, "The State of the SPARC '92." In it, Michael Jay

Tucker picks up the trail of Super-SPARC, Sun's next-generation, high-performance CPU.

Many of these new CPUs will be used to upgrade 600MPs, the two- to four-CPU multiprocessors. Naturally, we wanted to know how many 600s would be out there when Super-SPARC appears, so we asked. The lead story in our "News" section provides feedback from the field. So far, the sales are good, but the reviews mixed.

Also in this issue, two industry insiders debate the merits of NeWSprint from SunPics. SunPics, one of the new Sun subsidiaries, deals in printing and imaging systems. Paul Hammond of SRS Imaging says yes to a SPARC system and SBus board used as a RIP and PostScript engine. No to dumb devices, says MiLAN Technology's Dan Eakins, who explains an alternative printing solution. To help you decide, we offer for your consideration a big list, more than 40 companies, of printer sources. The buyers guide includes page printers with rated speeds of 12 ppm to 24 ppm.

Doug Pryor

Doug Pryor

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An Independent Forum for Open Systems

APRIL 1992 VOL. 3 NUM. 4

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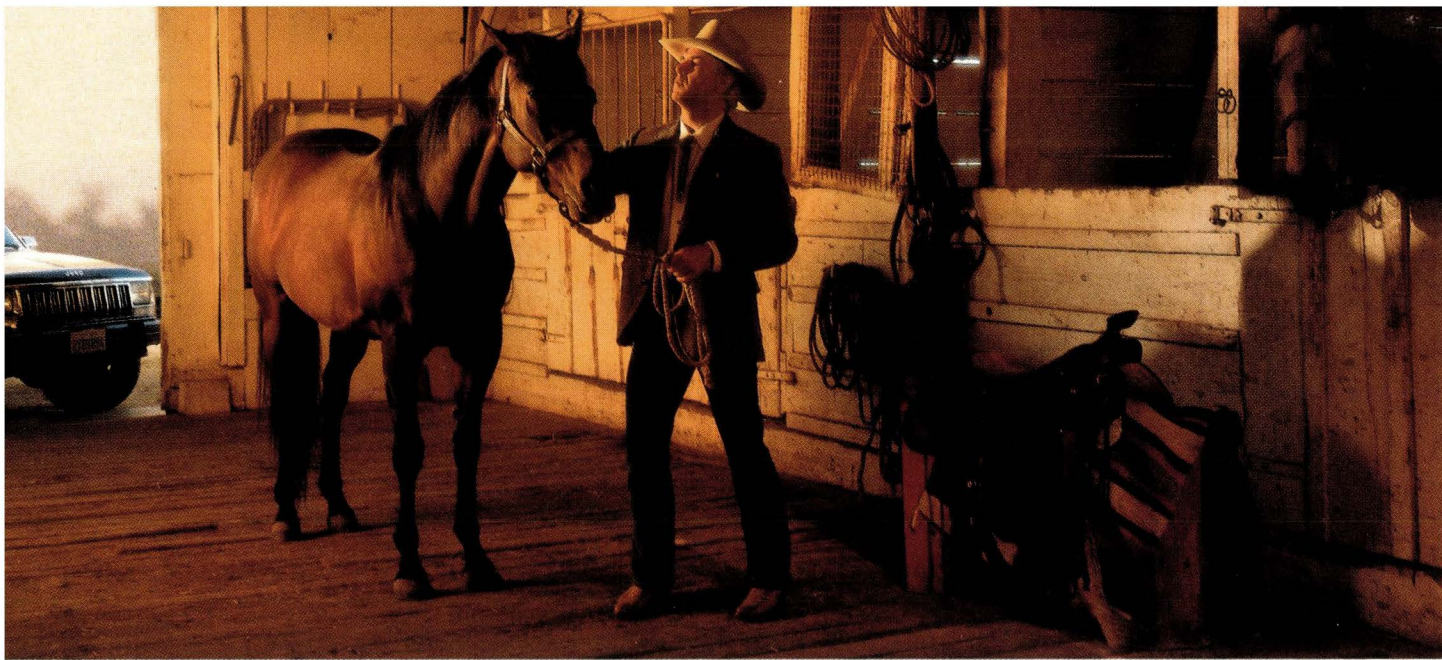
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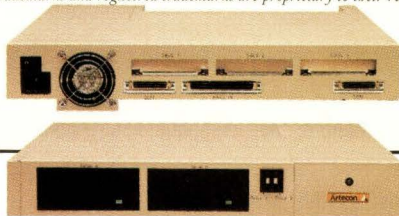
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¹ Based on latest vendor specifications dated 3/91 and 7/91 (specifications subject to change without notice).
² Based on latest vendor specifications dated 3/90, 7/90, and 11/90 (specifications subject to change without notice).
³ Based on latest vendor specifications dated 1990 (specifications subject to change without notice).
⁴ CPU burden rates based upon benchmark tests. Artecon's white paper "SBus Asynchronous Serial Card Benchmark" available upon request.
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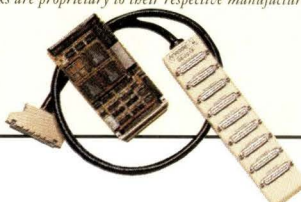
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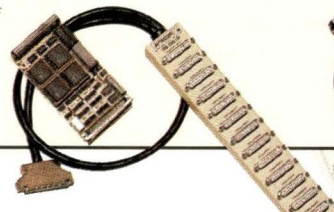
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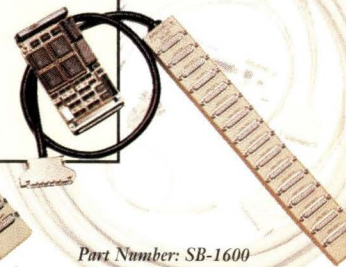
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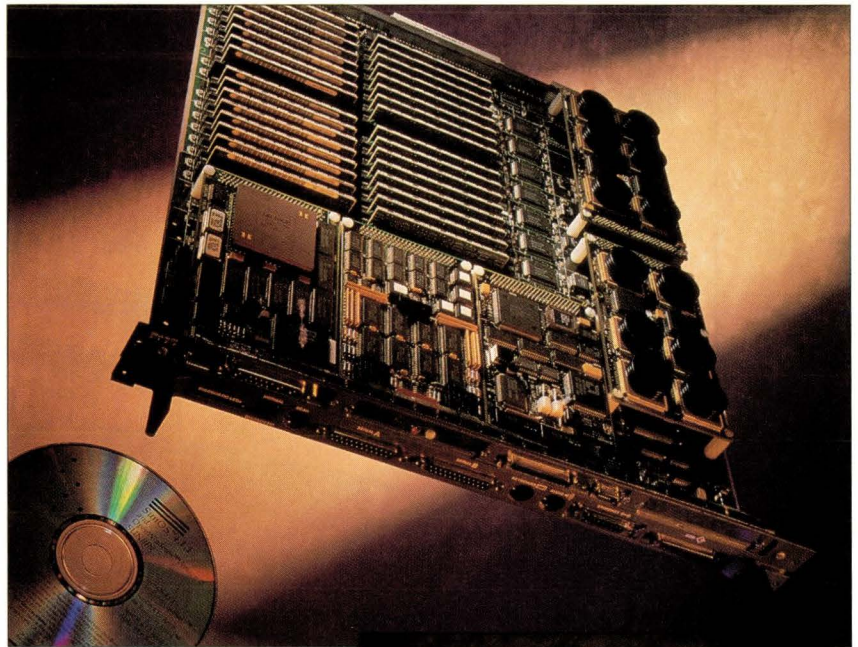
Sun's 600MPs: A Mixed Reception

Roughly six months after Sun Microsystems Computer Corp. introduced its SPARCserver 600MP family of servers, reports are beginning to trickle in from the field. The machines look like they're going to be a big hit in the database-server world. But it may be a while before they rival the compute and network servers offered by Sun's arch-competitors.

Between the first week of December 1991 and the end of February, Sun shipped 2,600 of its 600MPs, according to Mike Schafir, product line manager for the SMCC server systems product marketing organization. Half of these systems were purchased by existing Sun customers looking to upgrade; the other half went to first-time Sun buyers, he says. (For information on upgrade availability and pricing, see "SMCC's Server Upgrades.") And between 45% and 50% of the 600MPs were sold to sites outside of the United States, Schafir adds.

These are impressive numbers. To what extent this kind of growth will continue, now that Sun has filled most of its order backlog, remains to be seen. But Sun is optimistic. "We feel we've surpassed the installed bases of our competitors," Schafir says. "We expect to be the No. 1 multiprocessing server vendor very soon."

Users in the market for multiprocessing servers give the 600MPs mixed reviews, however. Because the 600MPs were introduced later than expected, most buyers were forced to benchmark Sun's SPARCserver 4/400 family, rather than the newer 600MPs, when they were making buying decisions.



The 600MP board accommodates two to four processors; currently, however the entire server family uses the same 40-MHz chips.



And quite a few claim that even when they were allowed to benchmark the 600MPs, the machines weren't as fast as other servers on the market. This isn't too surprising, since the 600MPs still employ 40-MHz SPARC processors—albeit two or four of them.

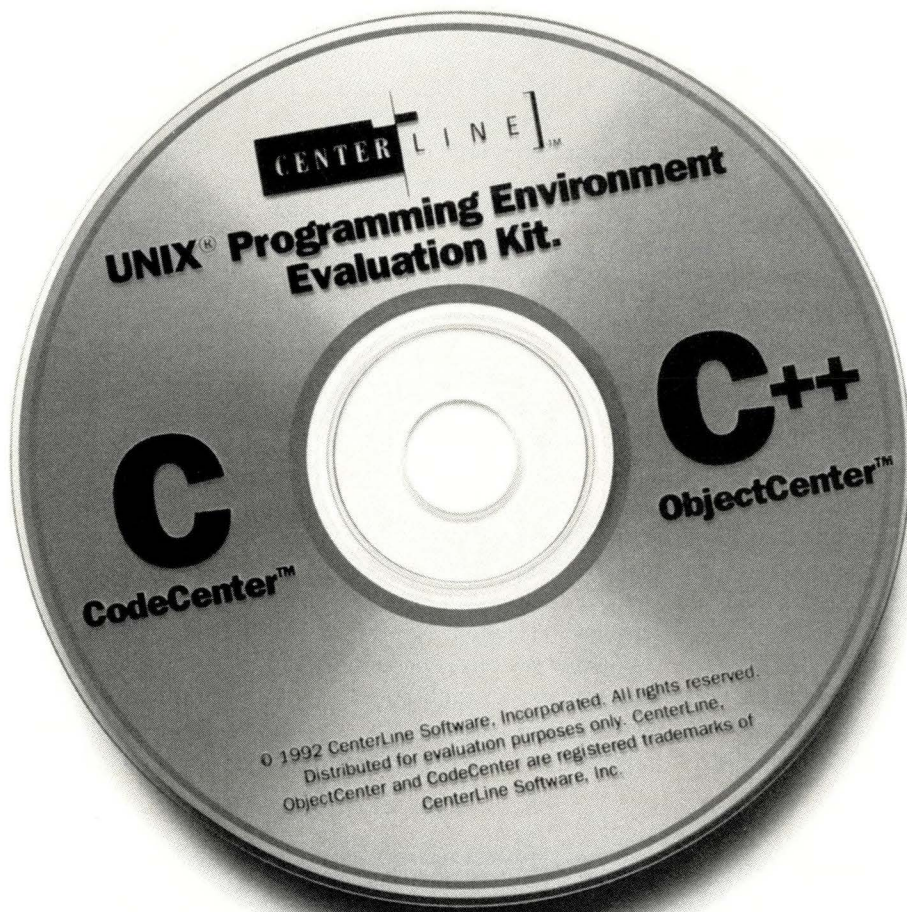
"We were eagerly anticipating the enhanced SPARC processor [SuperSPARC]," says Maurice Allen, manager of computing services for the ASIC division of Motorola Inc. in Chandler, AZ. "It's been a real disappointment for an engineering-driven organization like ours" that it isn't yet available, he says. [According to recent reports, Sun and Texas Instruments Inc. are expected to unveil Viking in May or June.] As a result, when Motorola's ASIC division was looking to add systems to its network recently, it opted for four Hewlett-Packard Co. Series 700s.

The ASIC division operates via four Ethernet networks tying together the engineering, IC development, software development and "option" develop-

ment organizations. The four networks run off of a Digital Equipment Corp. VAX cluster. Also on the network are eight Solbourne Computer Systems Inc. Series 5, 7 and 9 servers; two new Sun 670MP servers; and a total of 190 assorted client workstations.

"We use the Solbournes for very compute-intensive jobs, where software licensing is an issue," explains Allen. With the truly symmetric multiprocessing Solbournes, one software license can serve multiple users. Allen also touts Solbourne's board and/or chassis-level upgradeability as a major selling point.

Motorola runs IC engineering tool software from Cadence Design Systems Inc., Verilog Inc. and Synopsys on its Solbourne servers. On one of its newly installed Suns, it runs Meta Software Corp.'s HSpice program, and on the other, home-grown IC-test-file-translation software. Motorola chose to run HSpice on the Sun, rather than the Solbourne, server



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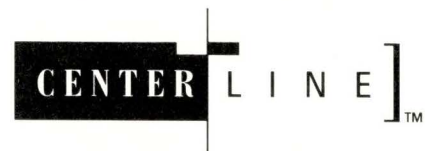
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"to avoid OS [operating-system] release incompatibilities," claims Allen. (SunOS and Solbourne's OS/MP are not binary compatible.) Plus, he points out, HSpice is more of a CPU-intensive application than an I/O-intensive one, which means the current lack of a truly symmetrical operating system isn't a stumbling block, Allen says.

Nonetheless, "We believe there are still a few 'issues' with the 670s' I/O throughput," Allen says. "In the past few weeks, we have had unexplained halts" with the 670 running HSpice system. At press time, the 670 running Motorola's in-house-developed software wasn't yet fully operational.

Throughput definitely isn't the 600MPs' strong suit, agrees Bob Burleson, CAE manager for the engineering department at Lawrence Livermore Laboratories, located in Livermore, CA. About a year and a half ago, the engineering department was looking for a machine to serve 50

or 60 diskless Sun client workstations.

The department compared an Auspex NS5000 with Sun's then-high-end server, the 4/490. "The Auspex could do large numbers of NFS transactions per second while doing other things," says Burleson. Lawrence Livermore ran benchmarks again once the 600MPs were available. "We're still finding the Auspex to be best for managing 55 or so SPARCstation 2s, miscellaneous SGIs [Silicon Graphics Inc. systems] and [DEC] DECstations," he claims.

Currently, engineering is running finite element/mechanical modeling codes, computer-aided design and office-automation software on its Auspex server/SPARCstation client system. But Lawrence Livermore also has added recently a "few" Sun 600MPs to its mix for use as database engines and compute servers. "Whether you buy from Sun [or not] depends on your application," Burleson concludes.

Another user that chose Auspex over

Sun is Cray Research's training division, based in Eagan, MN. The training division allows students using the 30 Network Computing Devices Inc. X terminals located throughout its classrooms to interface with various Cray supercomputers, via SPARCstation 2 compute servers connected to an Auspex NS5000. Cray benchmarked the Auspex against Sun's SPARCserver 4/490 and then its 690MP. "We found the Auspex to be faster," says Nicholas Franco, system administrator for software-information services. "The 600MPs' processors aren't any faster than the one in the SPARCstation 2."

We like the Auspex due to its disk mirroring, disk striping and hot plugability," Franco continues. Besides, the NS5000 supports eight Ethernet channels, as opposed to the 600MPs' six, he says.

Sun, for its part, refutes charges that the 600MPs aren't suited to serving multiple terminals while maintaining high throughput. SMCC released



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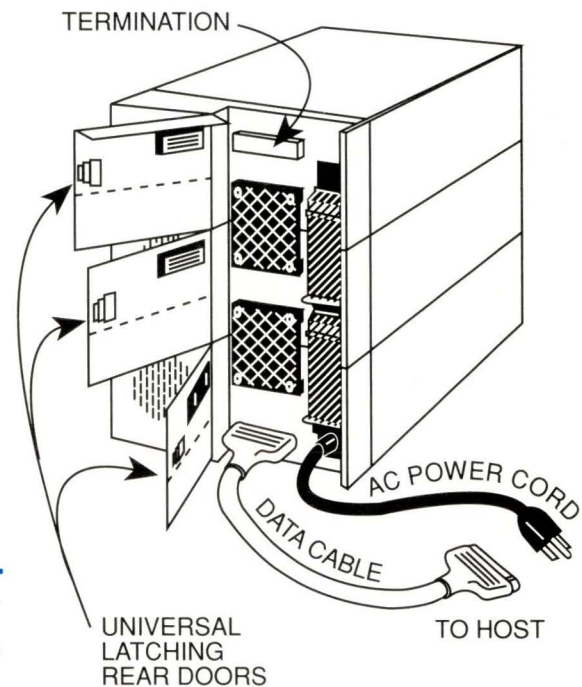
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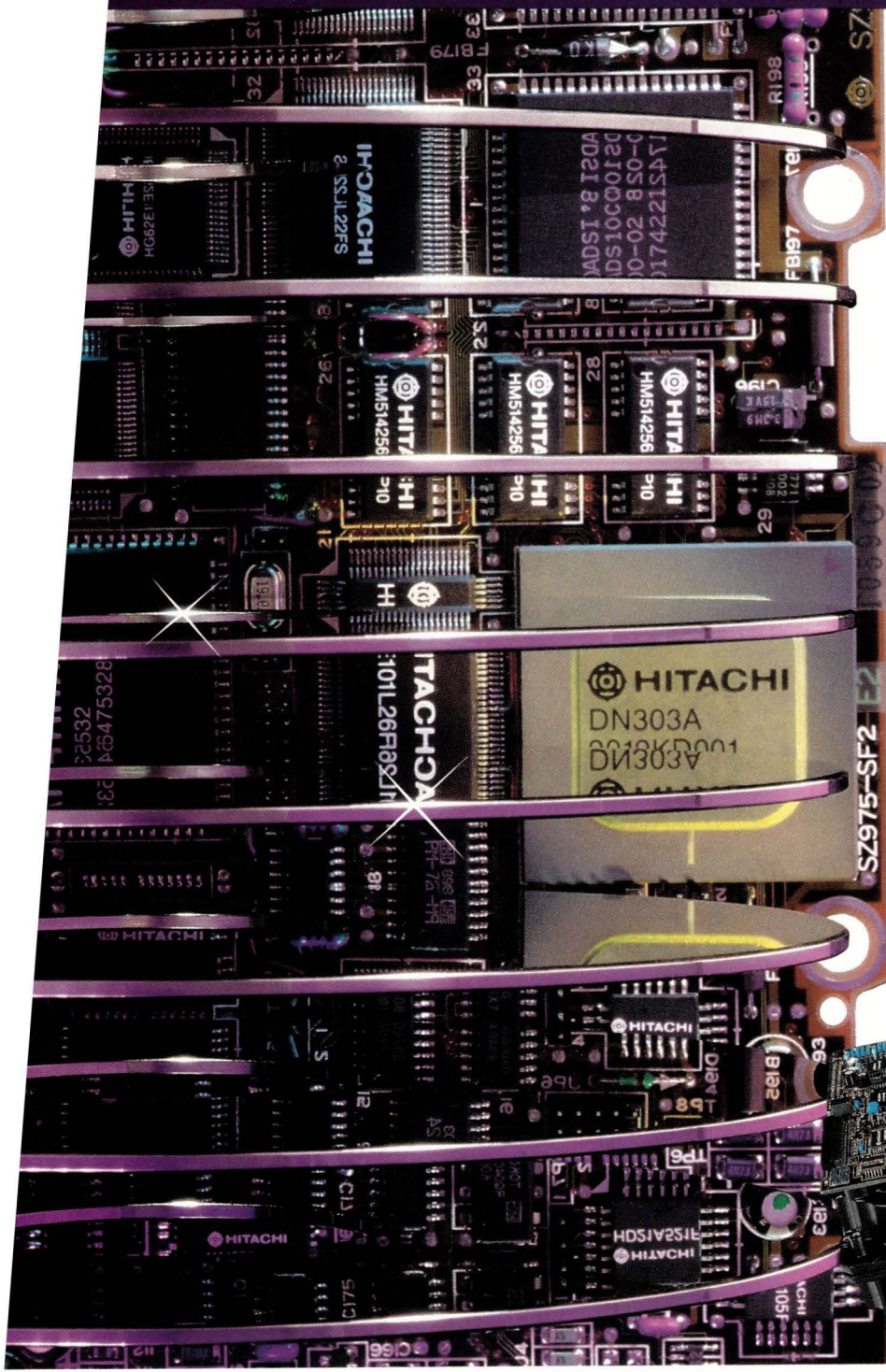
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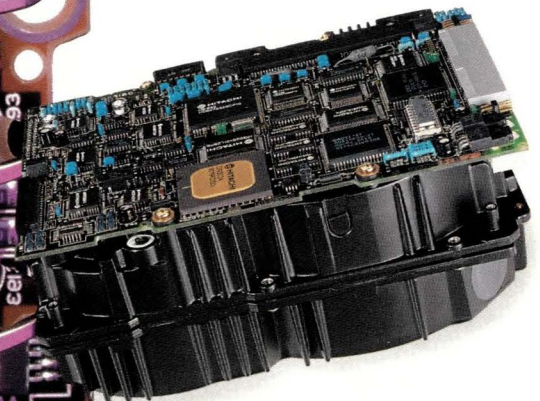
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TPC-A benchmark numbers in February that it said proved that the SPARCserver 690MP and Sybase Inc.'s Sybase SQL Server achieved the highest price/performance ratings in the industry. The TPC-A test was run with 960 terminals connected to a 690MP running Solaris 1.0. The server performed at 95.41 transactions per second with a cost/tps of \$8,836.

"As general-purpose servers, nobody can match us," boasts product line manager Schafir. He does acknowledge that the lack of SuperSPARC "means some [servers] are faster compute servers than ours. But this won't be the case for

long." In fact, a "reasonable" number of users already are running the 600MPs as "mixed-application" machines—i.e., database and compute servers, Schafir says. "These machines are good for hooking up a lot of clients."

Some large customers obviously agree. SMCC has sold 600MPs to AT&T's network management systems department, Eastman Kodak Co.'s customer service organization, Prime Computer Inc.'s ComputerVision subsidiary and Fremont Pacific Inc., among others.

Pacific Compensation Insurance Co.—an acquisition of Glendale, CA-

based Fremont Pacific, which is a writer of workers' compensation insurance—recently purchased seven 670MPs as replacements for its existing seven 4/470s. The company plans to use the systems, once installed, as the Ingres Corp. Ingres database servers as the heart of the claims-processing system.

With the merger between the two insurance powerhouses, the number of users needing access to the corporate databases has grown. At the same time, Fremont Pacific is in the process of downsizing its headquarters database from an IBM Corp. 4381 mainframe to the Sun client/server set-

SMCC is offering a full range of upgrades for its Sun-3s, SPARCserver 2s and SPARCserver 400s to its 600MPs.

SMCC's Server Upgrades

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3/280, 4/280	\$ 9,800 (8 MB)	\$42,000**	\$49,995**
3/280, 4/280	\$17,300 (32 MB)	\$42,000**	\$49,995**
3/480	\$ 9,800 (8 MB)	\$42,000**	\$49,995**
3/480	\$17,300 (32 MB)	\$42,000**	\$49,995**
4/390	N/A	\$28,000*	\$27,995*
4/490	N/A	N/A	\$26,495*

* Board Swap

** Enclosure Swap

Deskside Upgrades

From	To:SS2**	4/300	4/470	SS600MP***
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3/110, 3/140, 3/150	\$12,495 (color)	\$17,300 (32 MB)	N/A	N/A
3/160	\$11,795 (mono)	\$ 9,800 (8 MB)	N/A	\$32,995**
3/160	\$12,495 (color)	\$17,300 (32 MB)	N/A	\$32,995**
3/260	\$11,795 (mono)	\$ 9,800 (8 MB)	\$45,000**	\$32,995**
3/260	\$12,495 (color)	\$17,300 (32 MB)	\$45,000**	\$32,995**
3/470	N/A	\$ 9,800 (8 MB)	\$25,400*	\$26,495*
3/470	N/A	\$17,300 (32 MB)	\$25,400*	\$26,495*
4/110, 4/150	\$11,795 (mono)	\$ 9,800 (8 MB)	N/A	N/A
4/110, 4/150	\$12,495 (color)	\$17,300 (32 MB)	N/A	N/A
4/260	\$11,795 (mono)	\$ 9,800 (8 MB)	\$45,000**	\$32,995**
4/260	\$12,495 (color)	\$17,300 (32 MB)	\$45,000**	\$32,995**
4/330	\$11,795 (mono)	N/A	N/A	\$26,495* (to SS630MP)
4/330	\$12,495 (color)	N/A	N/A	\$26,495 (to SS630MP)
4/370	N/A	N/A	\$25,400*	\$27,995*
4/470	N/A	N/A	N/A	\$26,495*

* Board Swap

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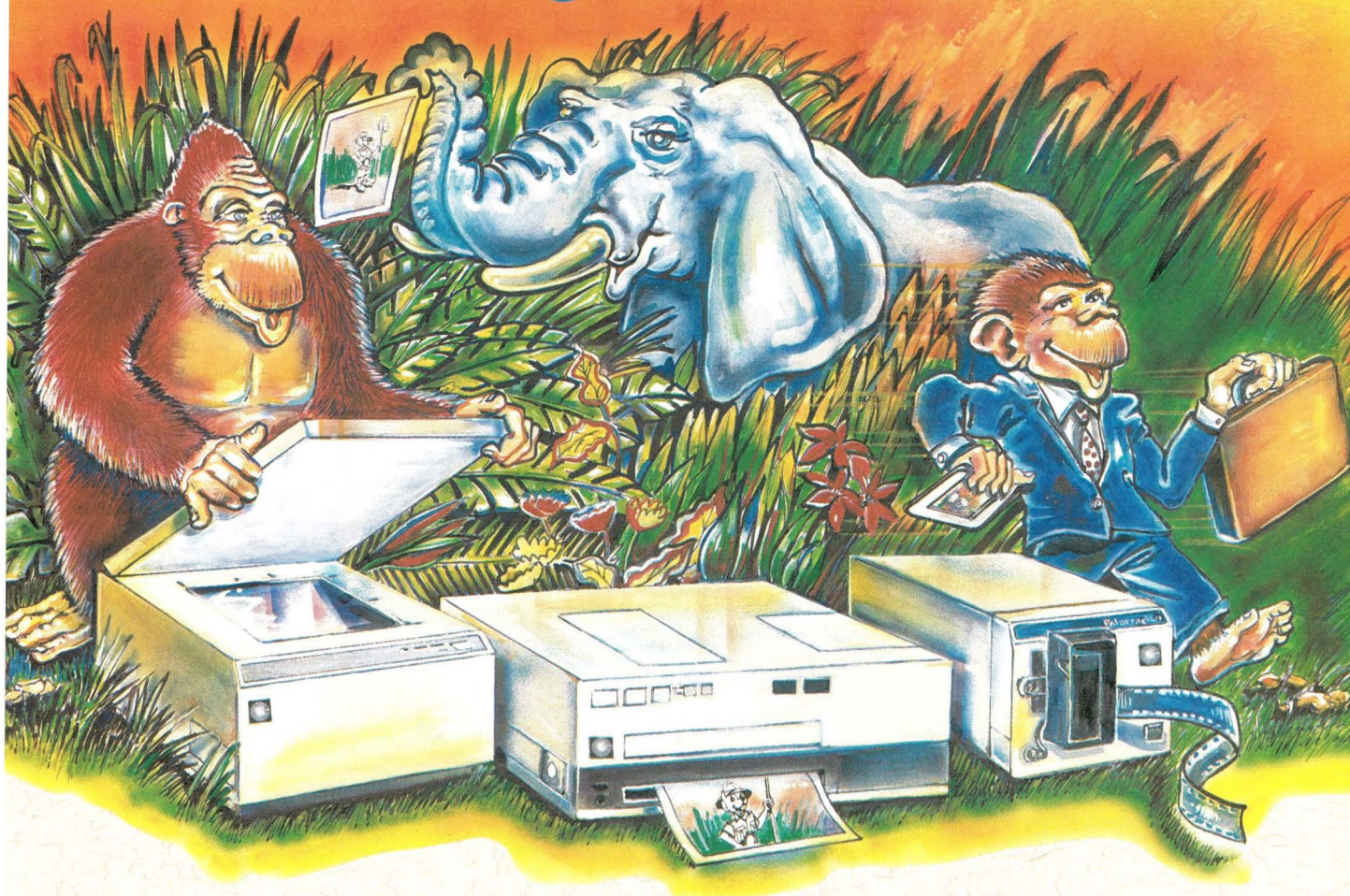
*** Upgrade to SS670MP unless otherwise indicated

Note: Upgrades to 4/300 and 4/470 are being discontinued.

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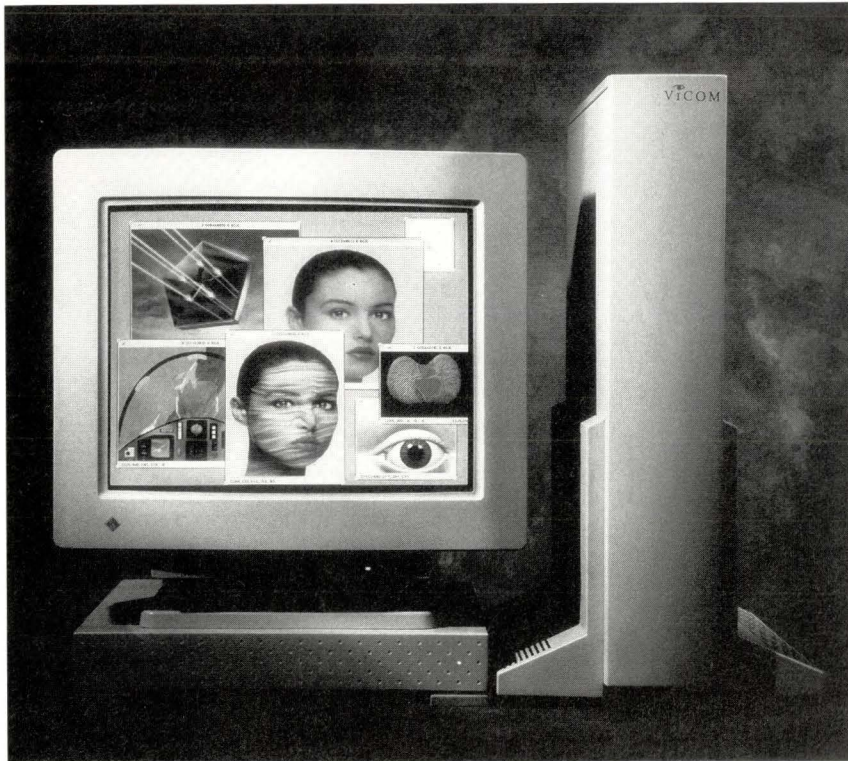


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Vicom Visual Computing, despite its Chapter 11 status, will continue to offer high-end image-processing systems.

up. "We didn't think the 4/470s could handle this," says Pacific Compensation's operations manager, Dave Pedersen. "The [600MPs'] multiprocessing will help us handle that many users and that large a database."

But even Pacific Compensation isn't considering the current-generation 670s as "the end-all to our problems," in the words of Pedersen. "We're looking forward to Viking [SuperSPARC] and Dragon [the next-generation Sun SPARC system]. We need all the CPU horsepower we can get."—mjf

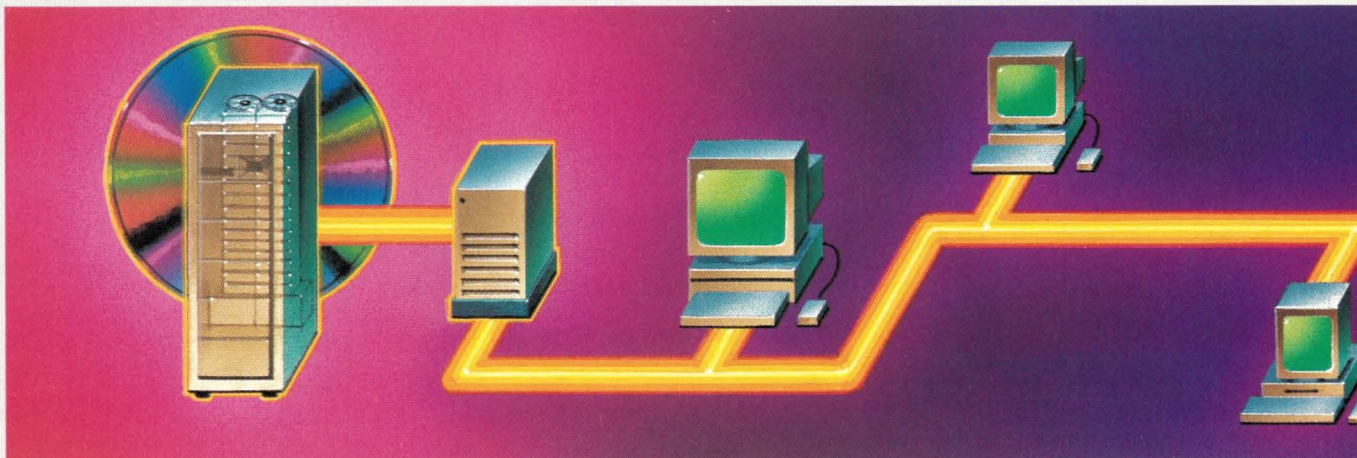
Vicom Declares Chapter 11

Image-processing vendor Vicom Visual Computing has sought protection from its creditors in bankruptcy court. "For what are very healthy reasons," says company vice president of marketing, Arun Tameja, "the company has gone Chapter 11."

The company will remain in business, and there will be no change in its product line.

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Vicom made headlines in 1991 by assuming responsibility for several of Sun's own high-end image-processing products—the Intel Corp. i860-based VX and VXM towers. Sun, which felt that the high-end graphics and imaging markets were not a good fit with its own volume-oriented systems business, licensed the products to Vicom, which has continued to sell and support them along with a number of other imaging products from earlier acquisitions.

Tameja says that business had been and still is good for Vicom, but that the company is a victim of the leveraged buy out craze of the 1980s, "Over the years the company had acquired a number of other companies...and massive amounts of debt." The company owned, among other things, the imaging-hardware business of Pixar Image Computing and the former Gould Imaging and Graphics Division. By this year, servicing the resulting debt had proved more than the company wished to handle. "The

only thing to do was cleanse away the sins of the past," Tameja says.

Vicom says that the decision to go Chapter 11 was made with the support of its major creditors, and that those creditors will finance Vicom's continued push into open systems. The company's management and product line will remain, says Tameja, although Vicom's "ownership will change. That's all I can say now."—mjt

Other Open Systems News

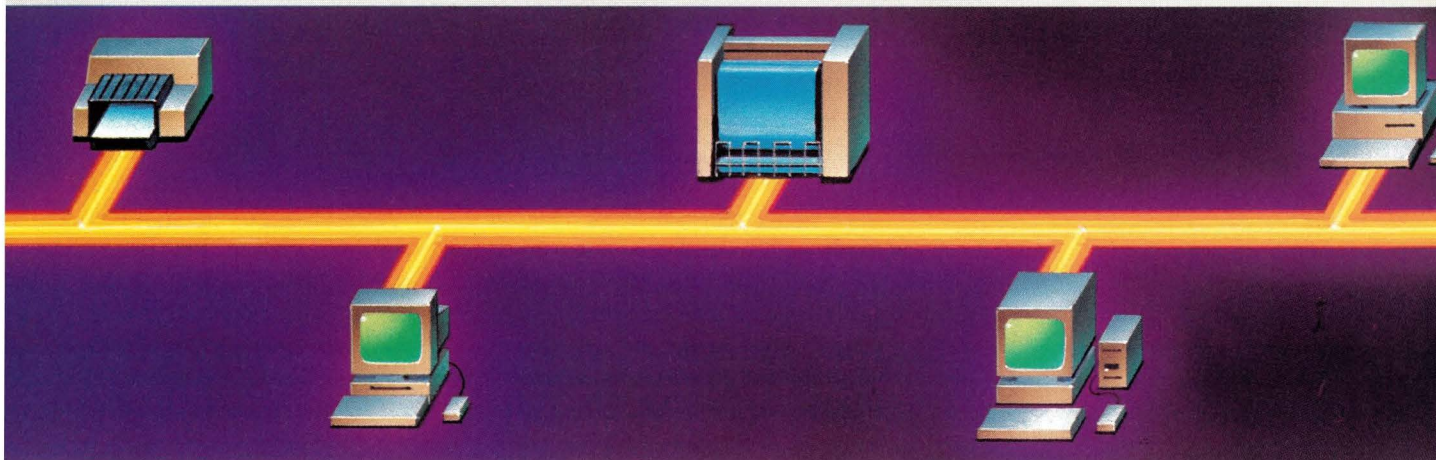
Digital Equipment Corp.

DEC has taken the wraps off its 64-bit RISC processor, the 21064, code-named Alpha. Alpha is a superscalar, super-pipelined chip that uses dual-instruction issue. Alpha currently

clocks at 150 MHz; DEC says the chip is capable of reaching processing speeds as high as 200 MHz. Peak instruction execution speeds of 300 MIPS are possible, says DEC. The company is licensing the chip—à la Sun/SPARC International and MIPS Computer Systems/the ACE Consortium—and already has at least two takers, Cray Research and Kubota Corp. (the primary outside investor in MIPS Computer Systems Inc.). The first workstations and servers manufactured by DEC that will employ Alpha are expected to be available to end users this year. The systems will run both VMS and OSF/1.

Three more software-development tools for SPARCstations are now available from DEC. These are LinkWorks Developer's Tools, DECwindows Graphical Interface Tools and DECwindows Tools Package for Motif. LinkWorks provides the information linking and navigation foundation for hypertext and hypermedia applications.

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International Spotlight

Sun, Sema Make It Official

The Anglo-French software house Sema Group and Sun Microsystems-France have signed a partnership agreement in the area of software engineering for design, development and maintenance of management applications. The agreement will make Sema's Principia software-engineering workbench available on all Sun platforms.

Hubert Tardieu, Sema's corporate technology director, says Sema will undertake the major part of developing Principia for Sun systems, while Sun will provide operating-system experts and other support. Tardieu says the development effort, in principle, should not be difficult. The main difficulty, he says, has to do with reorienting the overall use of the system from OS/2 and Windows 3.0 to the Sun environment. The project should be completed some time in September, he adds.

"Sun needs to be recognized fully in the business-applications domain," says Tardieu. "We're working with them [Sun] in the United Kingdom in [stock-] dealing rooms and with NatWest [the National Westminster Bank]. Their problem is similar to the problem Digital faced years ago when they wanted to move from the scientific and technical markets to commercial."

The intention of the agreement is to be able to distribute the product outside of France, says Tardieu. "Within Sema we have said we want to have the agreement applicable everywhere," he says.—*mwj*

The graphical-interface tools are two widgets, a graphical object editor and a network editor for designing Motif applications. And the DECwindowsTools Package combines three Motif-based software-development tools—DEC Visual User Interface Tool combined with an interactive design tool and the two products listed above.

Twelve new VAX VMS systems were unveiled by DEC. At the same time, the company announced availability of its VMS POSIX V1.0 for its VAX servers and workstations. VMS POSIX allows developers to write a single application that can run on VMS, UNIX and other operating-system environments, without modification. The new hardware systems are members of the MicroVAX 3100 Models 30, 40 and 80 families.

Also on the software front, DEC brought out version 1.1 of its transaction-processing (TP) client package, DECtp Desktop for ACMS. This version expands the number of desktops capable of acting as full clients. The system also features an enhanced suite of TP programming interfaces, allowing customer-written programs on Ultrix, SCO UNIX and VMS workstations to communicate with ACMS servers. The package also supports new networking transports (NetWare and TCP/IP) and screen-presentation services (Neuron Data's Open Interface, Motif, DECforms and Visual Basic).

Hewlett-Packard Co.

HP has come out with a Motif-based 3D design system that accelerates mechanical-engineering product design. The package, SolidDesigner, is one of a suite of HP Precision Engineering Systems that are designed to run on HP Apollo and Sun workstations, the company says. The package is based on object-oriented solid-modeling technology and is written in C++. HP also unveiled the second member of the Precision Engineering Suite, the WorkManager, which is an engineering data- and process-management system. HP says the WorkManager can be used with other mechanical engineering and electrical-

engineering environments to facilitate engineering data and process management—especially when HP InterLink, an integration toolkit, is used to bridge the different areas.

HP will be providing exception and event-handling technology for UNIX System Laboratories Inc.'s C++ language system. HP's newly announced C++ 3.0 incorporates exception handling. USL will likewise incorporate this exception-handling feature into its next major release of C++, 4.0, which is slated to ship in the first half of 1993.

IBM Corp.

IBM has launched a new supercomputing laboratory, chartered to create a family of highly parallel supercomputers. The Highly Parallel Supercomputing Systems Laboratory (HPSSL), located in Kingston, NY, will be designing, developing and delivering a series of parallel supercomputers based on RS/6000 technology. IBM expects the resulting machines to perform in the "hundreds of gigaflops...and teraflops" ranges. As part of its strategy, HPSSL is promising continued enhancement of the IBM vector facility, development of a standalone highly parallel system, RS/6000 clusters, and development of alliances with other companies working in the parallel-processing arena.

An RS/6000-based multiprotocol router and distributed network manager were unleashed by IBM. The 6611 Network Processor is IBM's first multiprotocol bridge-router. It supports Ethernet, token-ring and high-speed network-transmission technologies, such as frame relay. Supported protocols include TCP/IP, SNA, NETBIOS, AppleTalk, IPX, DEC's Network Phase IV and XNS. IBM says the 6611 is one of the first routers to support the Open Shortest Path First (OSPF) standard. AIX NetView/6000 provides the management capability for the new router and other environments requiring TCP/IP and SNMP support. IBM also announced that it intends to license its Advanced Peer-to-Peer Networking (APPN) network node support to other manufacturers.

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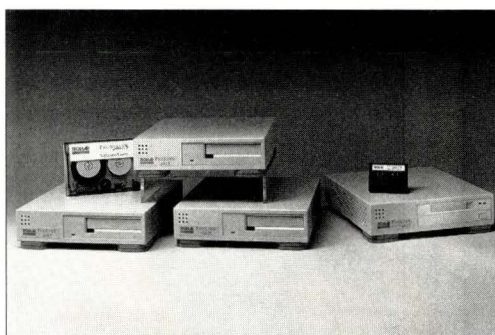
Silicon Graphics Inc.

Continuing with its color-coded naming scheme, SGI has rolled out its IRIS Crimson family of single-user deskside systems. The Crimson family is the first line of systems in the industry based on the MIPS R4000C 64-bit processor. The line is binary-compatible with SGI's IRIS 4D workstations and servers. Members of the family range from Crimson/S, "the first R4000-based server for advanced computation," to Crimson/VGXT, a system incorporating SGI's PowerVision graphics and offering high-performance texture-mapping. A base-level configuration of the Crimson/S (with 16 MB of memory) starts at \$27,900.

SGI and Atria Software Inc. have agreed to jointly market Atria's CASE software. According to the two vendors, the alliance also will result in software-development products that include Atria's version control, configuration management and development-environment management tools. Atria is based in Natick, MA.

This Just In...

- Encinitas, CA Sun reseller **Sunburst Computers** has become the first VAR to carry the Liken software package from **Xcelerated Systems**. Liken enables users to run unmodified, off-the-shelf Macintosh software on their Sun workstations. Liken supports Mac System 6 and 7 applications. Liken originally made its debut on the RDI Computer Inc. product family. Following legal battles between Xcelerated and RDI, Xcelerated decided against RDI's carrying the product.
- PC backup vendor **Tecmar**, Solon, OH, has introduced a line of backup solutions for Sun. The ProLine series



combines Tecmar's 1/4-inch DAT and 8mm helical-scan tape drives with its backup and restore software, ProServe S. ProServe S is based on Legato Systems' NetWorker product. Available ProLine capacity options include 250-MB, 525-MB and 1-GB 1/4-inch DC600 and 2-GB DAT systems.

- **Alfa Software Inc.**, Cambridge, MA, has introduced Poste 2.0, a UNIX electronic-mail product for the commercial market. Alfa says the product gives users new options in managing, sending and receiving email and fax messages. The product includes a new command-line interface, allowing users to access all Poste

features from ASCII terminals, terminal-emulation packages and Poste's X Window System-based GUI. Users can tap into their email from a dial-up line at home or another remote location, if they so desire. A single-user copy costs \$395 and is available for SPARCstations, DECstations, RS/6000s, MIPS RISC/OS, Sony NEWS4.0, SGI

IRIS, Apollo Domain, HP/Apollo workstations and SCO platforms.

- **IBM Corp.** has announced that its Optimization Subroutine Library (OSL) will now run on all Sun Microsystems Inc. SPARC-based workstations. OSL is a collection of high-performance subroutines used to solve mathematical optimization problems, such as scheduling, planning and logistics... And third-party **VISystems Inc.**, Dallas, TX, has signed a porting agreement with Sun to move its VIS/TP transaction-processing product line, known affectionately as "CICS on UNIX" to Sun workstations and servers. VISystems claims that, "By providing IBM CICS/COBOL application compatibility, portability and interoperability, Sun will be able to continue to gain market share in IBM's high-margin proprietary business."

- Another porting surprise comes from **Transarc Corp.**, Pittsburgh, PA. Transarc announced that it is shipping an Open Software Foundation Distributed Computing Environment (DCE) Developers Kit for

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SPARCstations running SunOS 4.1.2/Solaris 1.0 (as well as for RS/6000s). The kit includes "core" DCE components, such as RPC, threads, cell directory service and security service. The kit is priced at \$15,000 for one name server, one security server and up to 10 DCE clients.

- **UNIX Systems Laboratories**, Summit, NJ, has announced that it is working with **Tivoli Systems Inc.**, Austin, TX, to develop a unified framework for computer system and network management for System V. The product will be based on Tivoli's WizDOM environment. The resulting framework will be a reference technology for UI-Atlas, and will be interoperable with OSF's Distributed Management Environment (DME).
- The **Empress Database Server**—which consists of the Empress relational database management system with client/server, multiserver and distributed architectures for networks of

homogeneous nodes—is available from **Empress Software Inc.**, Greenbelt, MD. The product is optimized for LANs and does not require an underlying distributed file system, like NFS or RFS, the company says. Rather, it relies on the Internet Protocol to communicate across a network. Each node can be configured as a client, server, both or a standalone database.

- Other database-related tidbits: Berkeley, CA's **Natural Language Inc.** has launched Version 5.0 of its fourth-generation language. New features include an embedded GUI and an enhanced application-development environment, called ICon. And Alameda, CA-based 4GL vendor **Uniface Corp.** has cemented a deal with **Information Dimensions Inc.** to integrate Uniface with IDI's BASISplus document database. Uniface also now works with Interactive Development Environments Inc.'s CASE tool, Software through Pictures; Digital Equipment Corp.'s

DEC OSF/1; and IBM Corp.'s Software Development Environment WorkBench/6000.

- AppleTalk internetworking vendor **Cayman Systems Inc.** has introduced GatorStar GX, a LocalTalk to Ethernet router-repeater that can connect up to 96 Mac nodes to Ethernet. The product combines the active star capabilities of a 24-port repeater with the routing capabilities of a LocalTalk-Ethernet gateway. The product supports AppleTalk, TCP/IP, DECnet and SNMP and Cayman's GatorShare software, which lets Mac users access UNIX servers through AppleShare, as well as GatorPrint, which lets UNIX users access AppleTalk printers using lpr. The product also is compatible with Cambridge, MA-based Cayman's entire GatorBox line. Through the end of the month, the company is throwing in \$2,300 worth of third-party network-management software with its GatorStar GX and GatorBox CS products. →



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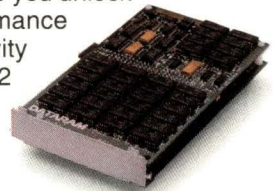
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ILLUSTRATION BY TOM BARRETT

by MICHAEL O'BRIEN

"Do you have any Grey Poupon?"

—Unknown cyclist to Steve Roberts at a random intersection in the road

"I just wanted to see whut th'hell y'all got heah."

—South Hill, VA, cop to Steve Roberts after pulling him over with lights and siren

"The question is, who is to be the master, that's all."

—Humpty Dumpty, Alice's Adventures Underground

Machine Cycle

Q:

What the heck is that thing Mr. Protocol is sitting on?

A: Probably the only thing on

Earth that could possibly tempt him into working off all those Big Stuf Ding-Dongs. It's a bicycle. (*WHAP!*) Ow! Put that down! What do you think this is, Punch and Judy? This is a serious technical column—we don't aspire to the true classics here. And it is too a bicycle. I don't care if it's 12 feet long, weighs 450 pounds, is covered with solar cells and has more antennas on it than the Johnson Space Center. It's still a bicycle.

We shouldn't even be surprised at it, in these days when the McMurdo South Polar Station is on the Internet. If McMurdo can be on the Internet, why not a bicycle? What's more inter-

esting is the story of how one man's irritation with his life style can result in what is certainly one of the greatest toys ever built, or one of the truly great technological excesses of the Western World, or quite possibly both.

What can possess a man to cease worrying about refinancing his house and start worrying instead about how to construct a taillight out of LEDs? Mr. Protocol is glad you asked.

Presented for your consideration: Mr. Steven K. Roberts, programmer, designer, batchelor. He sits in front of a screen all day, programming computers owned by other people for other people's purposes, like tens of thousands of others like him. But Mr. Roberts has decided to strike out on his own, live his own life, be a free man. Mr. Roberts has decided to become a Writer. Mr. Roberts is not about to enter the pages of American

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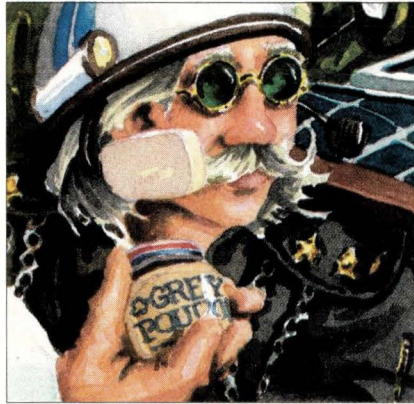
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literature, however. Mr. Roberts is about to enter the Twilight Zone.

Steve Roberts found that being a writer was startlingly like what he was doing before. He was still sitting in front of a screen all day. The only two differences he could see were that this time he owned the screen and the paycheck had stopped.

At this point Mr. Roberts had the inspiration that was to change his life and give rise to a movement of which he is (of course) the chief exemplar: High-tech Nomadness. He decided that the only two things a writer really needed were a brain and fingers and that both of those were portable. He decided to hit the road.

Jack Kerouac had already pretty much staked out the territory of seeing America by car while writing like a son-of-a-gun, so Mr. Roberts decided to go with another hobby of his and do his writing from a bicycle. He fitted out a bike with a laptop, batteries to run it and solar cells to charge the batteries. He threw in a CB for good measure and thus was born the first Winnebiko.

This machine went through another incarnation, with rather more doodads on it, and many thousands of road miles went by. The final incarnation is the BEHEMOTH (Big Electronic Human-Energized Machine... Only Too Heavy). BEHEMOTH is mostly complete—complete enough for road trips, anyway—but is still being finished. Given that it is a work-in-progress, then, let's see what we're dealing with here.

BEHEMOTH is a recliner bicycle. Like most recliners, it's longer than a typical bike, but in this case it extends

to 12 feet or so. This is due not only to the extended front wheel typical of recliners (to make room for the rider's legs) but because behind the seat is a boxy bunch of electronics topped by an aluminum-case detachable man-pack and behind that is a detachable two-wheeled trailer. The *entire* bike has radios on every conceivable band, and the computers are...well, let's just leave it at "numerous" for now. The bike comprises a single system, and it's the architecture of that system that Mr. Protocol would like to explore today. He assures you that protocols do enter into it, though perhaps not in the way one would think.

Well, what's the point of it all? Mr. Protocol is glad you asked.

The point is to package the sort of

**Mr. Roberts does
not play favorites:
There are separate
screens for a
SPARCstation, a
Mac and a DOS
machine.**

computational environment to which most of us are now accustomed and take it on the road. This means assembling the computers into a road-worthy package that can be used from a bicycle and providing a mechanical and electrical support system to allow them to run, and to provide a link or links to the outside world.

The front wheel of the bicycle is covered by a streamlined fairing, underneath which are most of the computational electronics of the bike. The front of the fairing contains a single headlight, and a bump on the fairing covers the antenna of a GPS receiver. On the flat rear of the fair-

ing, facing the rider at a convenient distance, is the main display console of the bike. It appears that Mr. Roberts does not play favorites: There are separate screens for a SPARCstation, a Mac and a DOS machine. The SPARC display is a reworked display from a Britelite, chosen because it's one of the few flat-panel displays that can be read in full daylight. The Mac display sits in front of this on a hinged flip-up panel—"mechanical display paging" as Mr. Roberts puts it. Below these is a slightly smaller display used for general status information on the bike. To one side is an even lower-resolution display, but a very clever one. This is an array of about eight by 10 LEDs, unlabeled, which display a pattern representing status information about one or another of the bike's subsystems. The resulting pattern can be recognized as "good" or "bad" by the rider on the basis of experience, without a complicated labeling scheme.

The rest of the console display is taken up with smaller, special-purpose displays, as well as a set of power switches. Since the bike's power distribution is under computer control, there must be a bootstrapping method to get enough of the bike powered up to allow power control to become automatic. These switches allow a sequence of power-up events to occur under manual control, to avoid deadlock.

The rider, then, has a full (some would say overfull) computational environment in front of him, but is busy riding a bicycle at the time. How can he interact with the display? Mr. Protocol is fond of the answer to this one, as it involves a fair amount of ancient history. The rider uses a mouse and a keyboard, just as any right-thinking individual would. But how? Well, this is a bicycle, so of course the rider is wearing a helmet. The mouse is a 6D Logitech unit built into the console and the helmet, with three transmitters and three receivers. This gives the three angular rotations plus the three spatial dimensions. The keyboard is a real piece of history.

The mouse was first developed for the NLS (On-Line System, don't ask

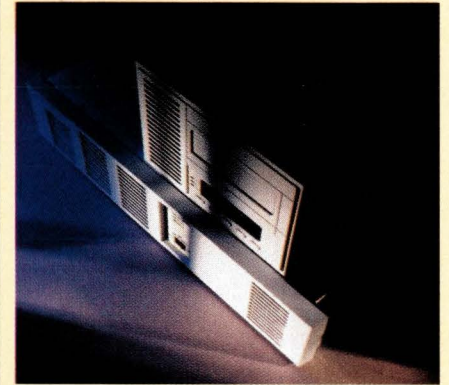
The Bicycle Control Processor consists of several Motorola 68HC11 processors running FORTH.

why it's NLS instead of OLS), built at SRI by a whole bunch of people of whom only Doug Engelbart is generally credited today. The mouse was designed to be used in conjunction with another device that has apparently been relegated to the dustheap of history: the chord keyboard. This little wonder looks like a five-key piece of a piano keyboard. With his right hand on the mouse, the user rests his left hand on the chord keyboard and drives the NLS like a piece of machinery with a series of mouse clicks and two-letter commands issued from the chord keyboard. Letters are formed by typing their five-bit binary equivalents on the chord keyboard.

And that's what the bike's computer systems have: two chord keyboards, one built into each handlebar of the bike. Of course, the user is not exactly using NLS.

There is one more display available to the user. The bike's helmet does not stop at a built-in mouse. There are dual-channel headphones built in, as well as a couple of very bright lights, a rear-view mirror (looks like a normal cyclist's dental-mirror rear view mirror, which makes it look out of place on this bike), a boom mike (rainproof of course)...and a Private Eye heads-up display. This little gem sits about an inch and a half in front of one eye and uses a vibrating mirror to provide a variable focus point, which since the display is being viewed only by one eye, makes the 720-by-280 bitmap appear to be floating in space some feet in front of the

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rider. Mr. Protocol has tried this out and uncharacteristically refers to it as "way cool."

This gives us the computational environment as seen by the user. It is possible to pedal along while composing the Great American Novel or (more typically) working on a CAD drawing of what to do next to the bicycle.

What is the computational arrangement as seen by the bicycle? This is closer to the world Mr. P. deals with, after all. This turns out to be disarmingly simple.

There is a Bicycle Control Processor or BCP, which consists of several Motorola 68HC11 processors running FORTH. The BCP is responsible for all of the low-level control processes on the bike. The most important of these is power regulation. Power is the limiting resource on the bicycle. It is possible to get around almost everything else, but it has been true since the days of Thomas Edison that anything that stores decent amounts of power can also be used as a boat anchor. Technology has progressed faster in almost every other area of

human endeavor. There are a few lighter solutions around these days, but in the first place they cost enough to put a lump in the national debt and in the second place they have a charming tendency to blow up spectacularly if you whack them hard enough. Suffice it to say that the batteries on BEHEMOTH make up a significant fraction of the overall 450-pound weight of the fully loaded bike, and they have to be babied at that. That's the job of the BCP. (Yes, 450 pounds. The bike has 105 speeds, three derailleurs and a "granny gear" that will push the thing up a phone pole if you're willing to spend a week pedaling to do it.)

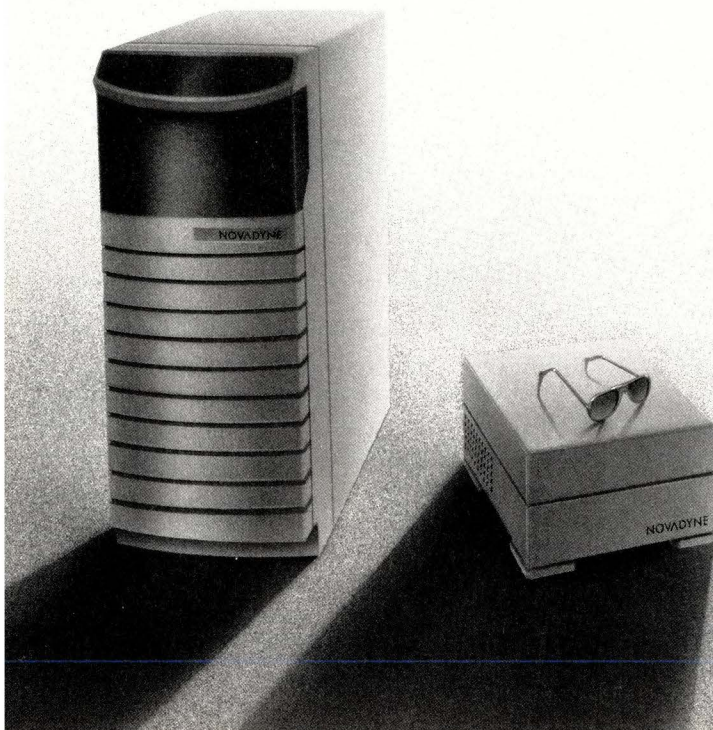
Consider the braking system, for example. The main brakes are hydraulic disk brakes and work well at converting laboriously pedaled energy into heat. To buy back at least a fraction of the human-provided power, the front wheel is fitted with a half-horsepower variable-reluctance motor-generator (and that's used up the hyphen budget for this week). The handlebar brake grips have some dead

space in their action before the hydraulic brakes are engaged, and this space is used to increase the resistance of the motor-generator, which dumps the generated power onto the bike's power bus to recharge the batteries.

It should be noted here that the motor-generator is used only as a generator. One might expect the motor section to help out with the next hill—half a horsepower is nothing to sneeze at in bike terms—but it turns out that it just isn't practical to do so. The bike's power budget is 45 amp-hours, and a half-horsepower motor would suck the batteries dry in no time. Similarly, a mechanical flywheel would add too much to the weight of the bike, plus there's nowhere to put it. This results in an extremely high-tech bicycle that still leaves the rider entirely on his own on those miserable uphill grinds.

Two other functions of the BCP have to do with routing signals around the bike. One of the primary design criteria for this whole monstrosity is that new devices should be able to replace old ones trivially, with

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ACCESS

Steve Roberts maintains a mailing list for his fans. Send mail to wordy@bikelab.sun.com to request to be added to it. Furthermore, paper books and magazines are also available from

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a minimum of fuss and bother in the control department. To this end, the main control structure of the bike at the link level is a cross-point switch. There is a cross-point switch for serial TTY lines, which are the standard method for device interconnection on the bike, and one for audio.

For example, let us assume that some miscreant is attempting to do something unpleasant to the bicycle in the rider's absence. The BCP will connect itself to the business-band radio to page the rider and will also make an audio connection to the

radio to allow the rider to listen to local audio around the bike. If things become more serious, the BCP will connect the Audaptor text-to-speech board to the cellular phone, so the bike can call the police on its own. The BCP will make another audio connection to the cellular phone to generate the tones for dialing. Furthermore, if the bike is actually moved, the GPS receiver will be able to broadcast the bike's whereabouts.

As one might imagine, there are bound to be unexpected complications. In the first go-round, the bike was programmed to page the rider over the amateur two-meter band if the bike was being stolen. The rider could then send a signal back to the bike causing it to send local audio from around the bike over two meters for 15 seconds. Now, one of the strictest regulations in amateur radio is one prohibiting profanity over the air. Naturally, the very first time this burglar system was activated and Mr. Roberts turned on the local audio, a very thick blue haze came over the air-waves as some gentlemen of the

motorcycle-and-leather persuasion were heard commenting on the strangeness of the bicycle in a vocabulary of startling sweep and power. Naturally, no provisions had been made for commanding the audio to turn itself off before the full 15-second timer had elapsed. Mr. Roberts was left to the poor expedient of attempting to jam his own signal. The bike now does its paging and local audio over business-band radio, which has no such prohibitions on content, probably on the basis that business is already pretty profane.

The typical mode of operation of the bike, then, is one of riding, writing, designing and camping by the wayside. The removable man-pack allows the bike's computer systems to be used by radio from one camping tent while the bike resides in another, all on its own. The cellular phone sports a Telebit CellBlazer modem, which allows the SPARCstation on the bike to call the SPARCstation back at the home base for UUCP transfers. This beats the old expedient of pulling the bike up to a pay phone

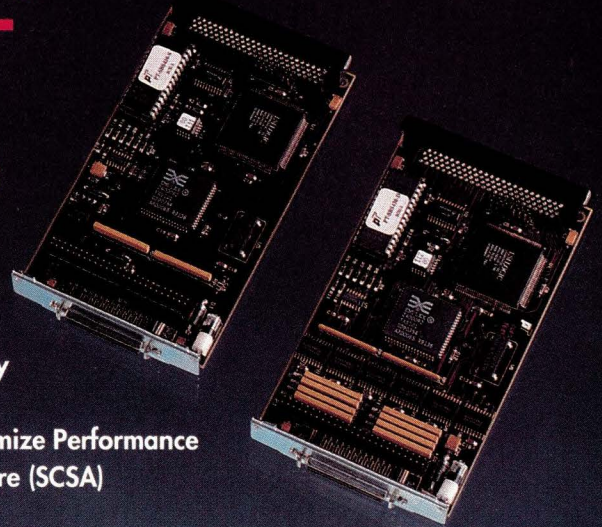
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to send material back home, which is what the Winnebiko did.

There are other means of communication, too. In addition to the business-band radio and a two-meter amateur transceiver built into the console, there is a full amateur station in the trailer, controlled via the same serial line and audio cross-point switches that control everything else: The radios can be tuned via the serial lines.

There is one more neat trick, however, with which Mr. Protocol is extremely pleased. He would be. The bike is on the Internet. This miracle is accomplished by satellite link (one is tempted to say, "Of course."). The mechanism used is an odd one. It turns out that Qualcomm Corp. markets a system for keeping track of truck fleets nationwide. This system involves the installation of a simple keypad and display terminal in each truck, connected to a small dome on top of the cab (about a foot across and six inches high) that contains what has to be the world's smallest satellite ground station. We're talking uplink here, not just reception. Inside the dome is a stepper motor driving a horizontal slot antenna with a 40-degree angle of reception centered 40 degrees above the horizon. Such a station is clamped to the rear of the BEHEMOTH trailer. At Qualcomm is a SPARCstation, one side of which is connected to the Qualcomm satellite system and the other side of which is connected to the Internet. Since the small size of the uplink antenna combined with the total number of stations sharing the satellite transponder limit the throughput per station to something like 165 b/s, Telnet and FTP service are out. However, the SPARCstation's job in life is actually to pass mail. It rewrites the headers of the incoming and outgoing mail messages and encapsulates them in the Qualcomm protocol. When they reach the bike they are routed to the Eudora mailer running on the Mac. The result is a full Internet mail connection, in real time, albeit slow, even when the bike is hundreds of miles from the nearest cell site. Mr. Protocol could use one of these little

jobs. One should never be without one's mail connection, he feels.

What does all this prove? Certainly this is a proof of concept, not a current product. While it would be possible to recreate BEHEMOTH, the lessons learned in its construction would result in a considerably different machine. Also, its various body parts are custom fiberglass, several hundred sponsors donated money, space and time, and one wonders whether Qualcomm would really like to consider itself in the business of providing traveling Internet mail. However, it does serve to show the possibilities of current technology. Perhaps a product or two will come out of it yet. Mr. Protocol hopes so. ➔

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

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

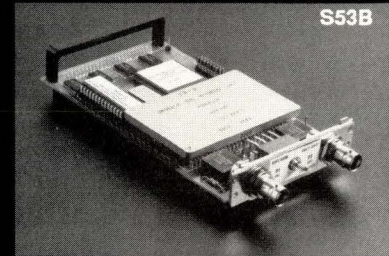
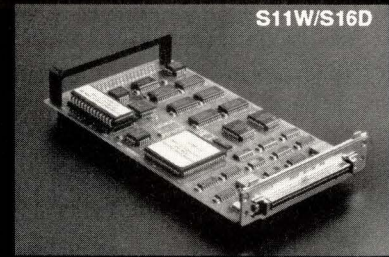
Mr. Protocol refuses to divulge his qualifications and may, in fact, have none whatsoever. His email address is amp@expert.com.

An Invitation

Mr. Protocol, gourmand of the late-night snack buffet, requests the pleasure of addressing your network and communications questions. He can be reached at amp@expert.com day or night, rain or shine.

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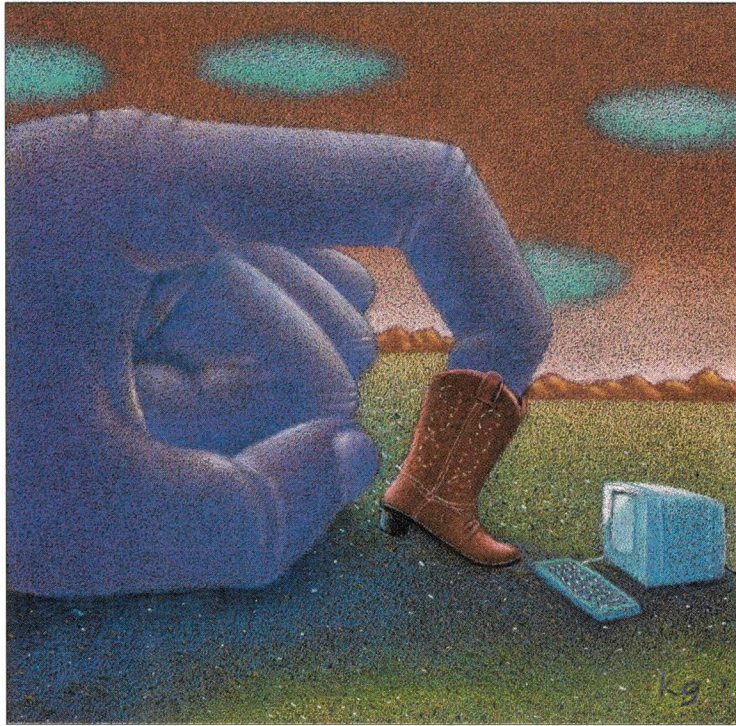


ILLUSTRATION BY KEITH GRAVES

By His Bootstraps

by PETER COLLINSON, Hillside Systems

I think that I first came across the term “bootstrap” in a short story by Robert Heinlein. This article bears the same name. The original story was published a little over 50 years ago in *Astounding Fiction*. I hasten to add that I first read it some quarter of a century later. I still have the book; sadly it’s dying the acid death of most of the cheap books in my collection. I note that it cost me five shillings, which is 25 pence these days, and translates to about 45 cents. A fortune at the time.

The term “bootstrap” or “pull yourself up by your bootstraps” is older and loosely means “use what you have to improve your position.” The word is slipping from technospeak into common parlance, and we can see various derivations: boot, reboot or warm boot.

You’ve probably gathered by now that this article is about booting the machine and getting things going. I am wandering a little into “System Administration” territory by looking at the programs that spring to life as the bootstrap proceeds. By the end, you should have a picture of why you see what you see when you log in and type `ps`.

Hardware Bootstrap

The advent of the programmable read-only memory (PROM) has revolutionized hardware bootstraps. When the machine dies or is reset, the CPU is forced to start executing code at a particular address. The memory at that address holds a program (Sun calls this the “monitor.”). The default action of the program is to restart the machine. Automatic restart after a crash is guaranteed (or nearly—see later).

When bootstrapping the system from a local disk, the monitor program first loads a small program from block zero of the disk. This program reads in the file `/boot` from the root of the file system. The block-zero bootstrap is dumb. It needs to be told the actual physical location of the blocks on the file system that constitute the `/boot` program. This avoids having to place any intelligence about the file system structure into either the monitor or the block-zero boot program.

Here’s the first “be careful.” There are a few more scattered through this article. The program on `/boot` is special. If you change its location by accidental deletion or intentional replacement, then you must tell the block-zero boot

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what you have done. Otherwise, you will be considerably embarrassed the next time you reboot (or the system falls over). The machine might appear to run, the block-zero boot program will dutifully load the requisite blocks into memory at the correct place and start them running—but they might not contain the correct contents.

The effect is unpredictable. It's certainly possible for some of the disk blocks to hold their original contents and for others to contain binary information, that is, bits of another compiled program. The resulting mixed program can leap off into the uncharted waters of previous memory contents. The symptoms are confusing, hard to predict and possibly dangerous. When this happened to me (it's confession time) it took me a long time to figure out what was happening and why. Take care.

If you have a diskless workstation, then the monitor reaches out over the network to pull the `/boot` program. I would guess that much of the code in the PROM handles IP and tftp, the protocol used to extract files from remote systems.

The `/boot` Program

Once in memory, the `/boot` program loads and starts a system, normally `/vmunix`. The `/boot` program knows how to drive the devices attached to your system. It understands quite a bit about UNIX file systems, either local or remote via NFS. It knows how to get input from the keyboard and echo any typed characters onto the screen.

When doing an automatic bootstrap, the program uses a

preloaded string to find a device and a file to use as a system image. This can be set when you are talking to the PROM. Alternatively, it can be set (and read) by the `eeeprom` program when the system is running. The PROM has several settings that can be altered to tailor the processor to your needs.

If you need to boot from a nonstandard device or start a different system, then you can type a string into the boot program. This will start off an alternative to `vmunix` or even your own standalone program.

When I am installing a new system, perhaps after a reconfiguration or a kernel patch, I will install it by:

```
# mv /vmunix /vmunix.old
# mv vmunix /vmunix
# reboot
```

This assumes that I am sitting in the kernel build directory. The idea here is that I can always revert to a known working system, `vmunix.old`, in the event of a catastrophe. This contingency plan has been invoked more than once.

I will be confident that the kernel works after a while. At that point, I will delete the `/vmunix.old`. I rely on the installation system based on the CD player to get me out of trouble should my disks die or some other nasty horror strikes.

System Start-up

Once the `/vmunix` program is loaded and started, you can say that the initial bootstrap phase is over. The kernel now

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starts to run. Its first job is to establish its internal structures. It finds out how much real memory the machine possesses and uses this to set the initial sizes of various system data structures.

It now starts to investigate its environment. The generic kernel has drivers for every type of device that you can configure into the system. It needs to find out which of the possible devices are connected to the machine and which are not.

Things will work well if the hardware allows the kernel to ask questions like: What buses are there out there?, What devices do you have on your bus?, How do I address that device? or What interrupt number are you using? We are in the hands of the hardware designer. The SPARC allows this. You can see all this activity on your machine if you look at the console during a reboot or in `/usr/adm/messages` after reboot.

If the hardware permits this type of probing, life is easy. The installation of the system is considerably more "user-friendly," since one generic kernel binary will run everywhere. Once the system is up and running, a specially tailored kernel can be installed. This will contain only the drivers for the devices that are present. Another alternative is to allow the dynamic loading of kernel drivers. Current SunOS systems permit this for some devices, although once loaded the driver cannot be discarded (except by a reboot). I believe that Solaris 2.0 will permit dynamic loading and unloading of device drivers.

Once the kernel has found its memory and devices, it pro-

ceeds with setting up the run-time environment. It needs to find a root file system and a place on the disks that can be used for paging. Usually, on a system with disks, this will be the same device that `/vmunix` was loaded from. The root device will be the "a" partition, and paging will be done on the "b" partition.

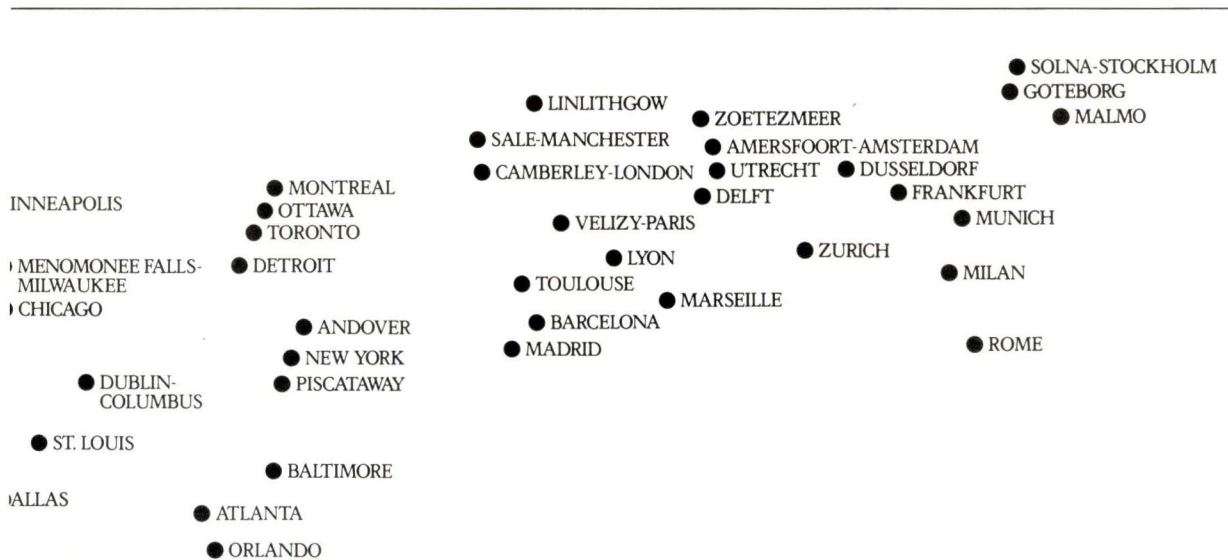
The kernel also nominates a dump device, a place on disk that it will copy an image of the machine memory if a kernel panic happens. Usually this is at the end of the swap device. The idea is that after a crash, the `savecore` program can be run to move the memory image into a disk file for later inspection.

It's possible to configure the kernel to put the root device and the initial paging area on any partition that seems sensible. I think this is a relic of the past before good quality auto-configuration was possible. It's rarely done these days. It can be useful, and I would be disappointed to see the facility disappear from the kernel.

Getting Things Going

The kernel is almost ready to spring into life and offer a user service. Up to this moment, only one program is running in the machine. It is "process 0." Now, the kernel forks and generates process 1. Process 1 immediately executes `/sbin/init`. The `init` program becomes the parent of all the other processes running on the system.

Berkeley-derived systems like SunOS also generate a process 2. This immediately dives back into the kernel code and



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starts managing the paging of the system. If you use `ps`, you will see that process 0 is called "swapper," and process 2 is called "pagedaemon." These names are both supplied by `ps`. Process 1 will be running `/sbin/init`.

It turns out that the path to `init` is somewhat more critical than the path to `/vminix`. The bootstrap system is set up to allow you to boot from an alternative kernel image. If the kernel cannot find the `init` program then this is more serious since the path is burnt into the kernel binary and cannot be changed without a compiler.

It also turns out that you need a path to a shell to get the system to go. Traditionally, cautious system administrators kept a spare root file system lying around on a disk and usually hidden from users. If disaster strikes, they could reboot the machine from the spare partition and recover things from backup. These days, I guess the CD player can be used for this purpose.

The Init Program

The `init` program is crucial to the operation of the system. Berkeley-derived systems use an `init` that owes much to the original `init` program supplied with UNIX Version 6. System V derivatives have a more complex and perhaps more general-purpose program. I intend to talk about the program you will find currently running on SunOS.

The `init` program has two basic modes of operation. It will run a shell in single-user mode, or it will start the system up multiuser. Traditionally when going multiuser, the


`init` program used `/etc/rc` as a source of commands that must be executed whenever the system is started. You will now find several files sitting on `/etc` starting with `rc` that are used to provide a standard start-up service.

The first file that is run is `/etc/rc.boot`. This puts the network up, crucial if you are a diskless workstation. It then runs the `fsck` program. This will always happen if you haven't been foolhardy and used the dreaded `fastboot` program. This will make `rc.boot` skip disk checks, which I consider a dangerous procedure. I am always unhappy about going multiuser with possibly damaged file systems. File system activity can make the damage worse, and this apparent time saving becomes false economy as you take that night-time trip into work to get the system going.

To be fast, `fsck` accesses the disks using the raw interfaces. The raw devices bypass the kernel cache and deal directly with the disk. It `fsck` is set working on a partition that is mounted and it changes the contents, then the view that the kernel has of the file system on that partition will be different from the actual newly written data on the disk. This is because the kernel caches information about the file system. We have two competing views of the file system structure. The kernel gets the last say; it writes its cache out. The result? Confusion.


There's a simple rule about this. Don't use `fsck` on a mounted partition. This in turn leads to a problem. What about the root partition? This is automatically mounted by the boot process, after all, this is where the binary for `fsck` was found.

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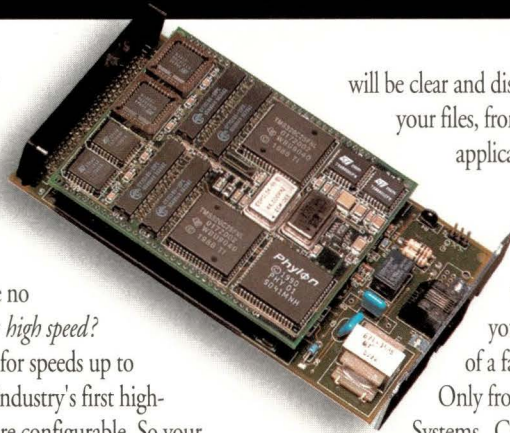
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To avoid problems, SunOS chooses to mount the root partition read-only until all the disks have been checked. If there is a problem, then the root file system will be fixed and the system automatically rebooted.

In the `rc.boot` script, `fsck` is given the `-p` switch to “preen” the file system. It will run several copies of itself, checking disk partitions in parallel. The idea here is to utilize the dead time that exists when a single physical disk is moving its head to find a particular block. If there is spare bus bandwidth and you have more than one physical disk, then it will be faster to check partitions in parallel.

The “preen” option also permits `fsck` to fix certain bugs that it may find. It will decide to stop if the decision that it must take involves the contents of files. It will return a failure condition that is passed back into the shell script. If `fsck` fails or you interrupt it using Control-C, then you will be dropped into a single-user shell. The intention is to allow hands-on access to fix the system using `fsck`. Remember that the root partition is mounted read-only.

If you are not at the console and the single-user shell is started, the system will wait until somebody arrives to tend it. Your nice, safe automatic reboot done on a machine several miles away really really late at night can so easily turn into another unwanted late-night journey. If you care or you need to get that machine up, then you will be (personally) traveling to (personally) type the necessary answers on the system keyboard clearing up the problems that `fsck` has found. Often a single “y.” Annoying, ain't it?

The rc Scripts

If the disks check out and `fsck` succeeds, the script living in `/etc/rc` is executed. This is split into two: `/etc/rc`, intended to be the same on all the machines in the local network and `/etc/rc.local`, intended to contain programs that are specific to the particular machine being rebooted.

The actions taken by the `rc` scripts fall into three main categories: clearing up the mess, setting things up and starting things off. Clearing up the mess mostly means deleting files here and there, and truncating various files that should start empty.

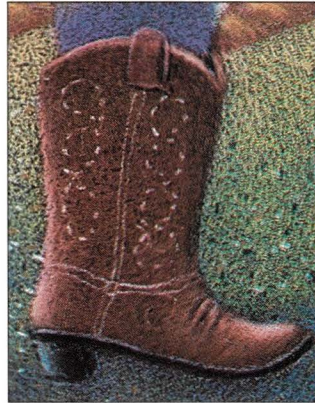
Setting things up involves much running of `rm` and also running special programs to put data files into a known state. Many programs and subsystems have data files that are established at bootstrap time. For instance, the line printer spooler and `uucp` have lock files that should be cleared before the system goes live. As an example of the creation of data, `ps` is run with the `-U` switch to make a data file containing system information. Later runs of `ps` go faster because they can use this cached information.

The scripts also start many *daemons*. These are programs that run continuously in the background performing some task. You can see many of these by running `ps` and supplying the `-a` option. You should see `update`. The program sits in the background and issues a periodic `sync` system call.

This ensures that the cache of disk blocks kept by the kernel is regularly flushed. You should also see `cron`, a program that starts programs up depending on the time.

Many of the running daemons are listening on the network for remote connections to provide some service or other. It's inefficient to have zillions of daemons sitting around waiting for that chance call, so there is a master listener called `inetd`. It knows the services that can be performed and the name of the program needed to do the work. It acts as a dating agency. It advertises contact addresses, accepts connections from the network and makes the connection between the server and the client. It doesn't expect tipping.

The `rc` scripts do a huge amount of work. On my system, around 130 processes are executed before the multiuser start-up begins. They are scripts, so you can easily change them. When you do, it's hard to test the result. Always try to be at the console for the first reboot after a change to one of the `rc` files; this means that you can watch and see if the edits have not gone well.



Multiuser Start-up

Having run the `rc` scripts, `init` starts to establish multiuser access. A process must be waiting to accept user input for every terminal that is used to access the machine. The system administrator controls this by editing the file

`/etc/ttytab`. This job used to be done by the file `/etc/ttys`. SunOS maintains this file so that it may be accessed by user processes but doesn't use it.

The `init` program reads the file to decide what to do. Each line in `/etc/ttytab` describes a terminal or port on machine. The line has several columns. If the “status” column contains “on,” then `init` will fork and that child will attempt to open the named device for reading. Of course, the child is an identical copy of `init`, and I will continue to call it by that name. However, in the discussion now, you should think that `init` is not process 1 but a child of `init` accessing the terminal line.

The open call will wait until “carrier on” is asserted on the line. This allows auto-answer modems to be used. The external user will dial the modem, and, when connected, the modem will raise “carrier-on.” The listening `init` process will be woken up. Not that it will be aware of waiting. The last thing it did was to call the `open` routine. All that it sees is a normal return from the system call.

For lines that do not have a need for this type of linkage, the system provides a mechanism in the kernel called “soft carrier.” The terminal interface can be told to act as though carrier is always asserted. This is done by specifying the “local” flag for the line in `/etc/ttytab`. When this is given, the open system call will return immediately and `init` will act as if someone had just made a connection and dialed in.

The `init` process now has an open terminal line, and it will `exec` to a program called `/etc/getty`. This is responsible for making sure that the baud rate the terminal line is using matches the setting on the interface and the remote device.

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that big Sun screen that you are using every day, then don't be too surprised to see that `/dev/console` mimics all this stuff and appears just like a normal terminal line.

The `getty` program is given an argument that dictates the baud rate of the line. Actually, the argument is a string that can be found in `/etc/gettytab`. The string accesses a database like `termcap` and is used to set various aspects of the communication. You can nominate a particular speed that things are to use, or you can specify that a terminal line will cycle through several different baud rates. The `getty` program prints the system banner and a `login:` prompt. Once you can see this clearly, then the baud rate is set correctly. On a line that will support cycling through different line speeds, you BREAK on the keyboard until something recognizable appears on the screen.

Your response to the `login:` prompt is passed as an argument to the `login` program, `/bin/login`. Again, just the `exec` call is used to overlay the `getty` process with `login`.

Since `login` has your user name, it will turn off echo and ask for your password. If you get this wrong, then `login` will print a new prompt to ask for a user name again. This prompt is often different from the one that `getty` printed. Once `login` is satisfied you are who you say you are, or more accurately, you know enough information to claim to be that user, it will set up the environment and `exec` to your nominated shell. Your shell gets on with the job of running

its start-up scripts and will finally print a shell prompt. You can now type `ps`, as I promised at the top of the article.

Notice how this sequence uses the same process that `init` forked as a child some small time ago. The process was first a clone of `init`, became `getty` to set the line characteristics, became `login` to check your password and finally, ended up as your shell. This means that the parent of your shell is always process 1.

When your shell dies, `init` (process 1) knows that it must start a new copy of itself on the line so that the whole sequence can start again.

Further Information

As usual, you should look at the manual pages that come with your system. All the commands mentioned in this article have their own manual page entry. There also several Sun documents; these are available on used trees or by looking at the screen running AnswerBook. Useful things to look for in AnswerBook are "boot," "init" and "login." ➔

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

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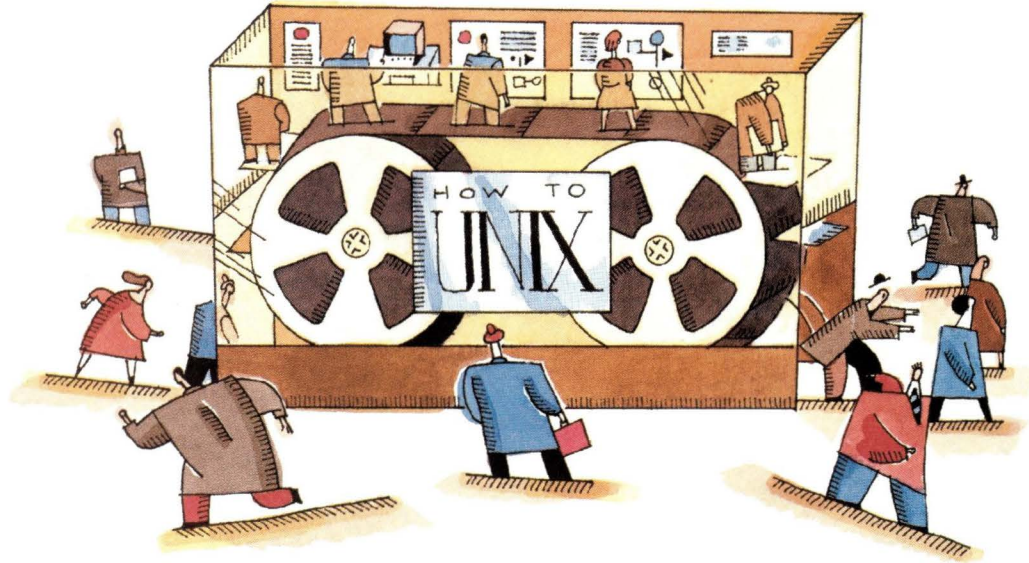


ILLUSTRATION BY ROBIN JAREAUX

UNIX Training Videotapes

by RICHARD MORIN, Technical Editor

Do you have increasing numbers of new users who need training? Limited budgets for travel and tutorial expenses? Limited staff time to spend on training? If so, videotape training courses may be a reasonable option.

A videotape isn't quite the same as a live instructor. There isn't any opportunity to ask questions or optimize the course for a specific audience. But videotapes can be a lot cheaper than live instruction, particularly when multiple sessions are involved.

Mind you, they still aren't exactly inexpensive. Prices range from \$50 to \$1,000 per tape, and the median seems to be \$300. A typical course contains several tapes, so the cost is frequently in four figures. If you have dozens of users that need training, you can amortize such prices very

quickly. If you have just a few users or programmers to train, this may be a bit too pricey. (Editor's note: What follows is a roundup of video suppliers *SunExpert* is aware of. If you use any tapes or courses that aren't listed, let us know.)

Berkeley Decision/Systems

The Berkeley Decision/Systems videos are written and presented by Ray Swartz, a well-known author on UNIX-related topics. Each course comes with a substantial comb-bound workbook and may include a floppy disk or bound textbook. The tapes are typically two hours in length.

A User's Introduction to UNIX (one tape, \$295) is not for neophytes. According to the brochure, "It is designed for people familiar with computers who need to learn how to

use the UNIX system effectively." An accompanying floppy disk holds an on-line *vi* tutorial, as well as example directories and files used in the video.

Creating Applications with UNIX Tools (one tape, \$295) shows how *sh*, *grep*, *sed*, *awk* and *sort* can be used to create database applications. The course includes Ray's book *UNIX Applications Programming, Mastering the Shell* (Swartz, Sams, 1990). *UNIX Shell Programming* (one tape, \$295) includes the same book but concentrates on Bourne shell (*sh*) programming.

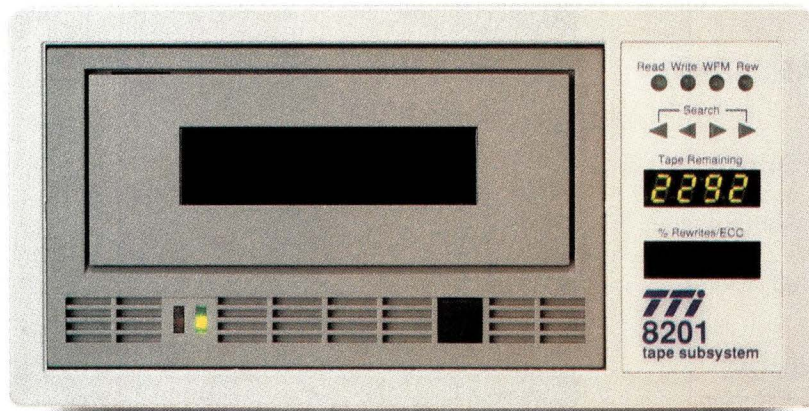
A Programmer's Introduction to C (two tapes, \$295) seems to be a bit unsure of its audience level. It explains that programs need to be compiled before they can be run, then assumes that the viewer knows what associativity is. I also have problems with the

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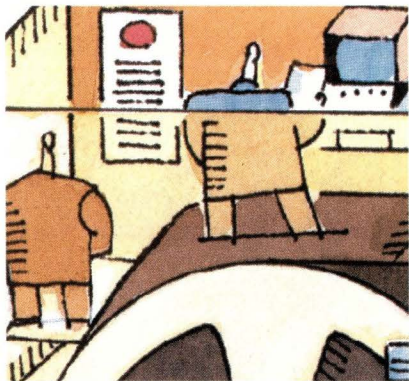


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notion that programmers should use particular programming constructs (e.g., +=, ++) to make the compiler produce more efficient code. Nonetheless, the course covers all the necessary topics and should do a pretty good job of getting a programmer going on C.

Computer Technology Group

CTG sells more than a dozen sets of UNIX and C videotapes. The entire UNIX suite adds up to slightly

you have a lot of folks to train. Predictably, CTG lists a number of large corporations and government agencies as clients.

New users should begin with *UNIX System Quick Start* (six tapes, \$1,170). They can then proceed with *UNIX Fundamentals* or *UNIX Fundamentals with VI Editor* (both 15 tapes, \$2,925). Prospective administrators should go on to *UNIX System Administration* (six tapes, \$1,170).

Programmers are offered *UNIX System Shell* (14 tapes, \$2,730) or perhaps *'C' Language Programming* (16 tapes, \$3,120) and *Advanced 'C' Programming* (three tapes, \$585). Some might profit from *UNIX System V Internals* (eight tapes, \$1,560), *Using C++* (11 tapes, \$5,500), *Open Systems for Technical Staff* (10 tapes, \$5,000), *Designing Enterprise-Wide Networks* (10 tapes, \$5,000) or *Introduction to the OSI Reference Model* (five tapes, \$2,500).

Extron Electronics

Extron isn't a UNIX vendor; the company specializes in video interfacing electronics. Nonetheless, the course (*Introduction to Computer Interfacing*, one tape, \$150) should be quite useful to some UNIX system administrators.

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If you need to present a computer display to an audience, record a videotape or feed a video signal onto a workstation's screen, this tape is for you.

It covers the basics of interfacing computers to video equipment, spanning a reasonable range of machines (mainframes, terminals, workstations and PCs) and interface standards (analog, ECL, TTL). Comfortably paced, it should prepare an administrator to specify needed video-interfacing equipment.

My only gripe with the tape is its title, which really should be "Introduction to Computer Video Interfacing." I'd like to see a tape on generic computer interfacing, covering RS232, Ethernet, SCSI, etc. Unfortunately, this isn't it.

The Gawain Group

Jim Joyce has been teaching UNIX courses for a long time. In 1975, when Ken Thompson was installing UNIX V6 on UC Berkeley's brand-new PDP-11/70, Jim was teaching UCB's first UNIX-based course. He has produced two short videos, both of which come with reference cards. These are very simple tapes, employ-

ing only screen shots and a voice-over. Nonetheless, they cover the material very well and do not seem to suffer from the lack of special effects.

Getting Started with UNIX (one tape, \$49.95) is a very gentle introduction. It covers logging on (and off!), file handling, vi and process control. *Getting Started with UNIX Mail* (one tape, \$49.95) introduces both Mail (UCB mail) and mailx (the System V variant). The tape covers sending and receiving mail, saving mail as a file, editing mail before sending, editing mail headers and mail's help screens.

Hands On Learning

Hands On Learning sells four *Video Workshops*, on UNIX, C, X and OSF/Motif. Each workshop is a collection of videotapes, books and floppy disks. The tapes are relatively short; half an hour to one hour in length. The *UNIX Video Workshop* (10 tapes, \$2,900) is handsomely packaged, but the flyer is marred by a number of small errors. Fortunately, the errors do not appear to have spread to the course materials.

The UNIX course includes a copy

of *Introducing the UNIX System* (McGilton and Morgan, McGraw-Hill, 1983), a workbook and a small set of floppy disks. The choice of McGilton and Morgan struck me as odd at first. It's a good book, even a very good book, but it's almost 10 years old. On the other hand, the material in this level of course hasn't changed much in the last decade. Looking over the topics, it appeared to me that the book might be a very good choice, indeed.

Hands On Learning sent me a copy of the second tape from this course. The production is glossy, starting with flying logos and continuing with clean computer-generated graphics for the examples. I was less happy with some of the material. The tape asserts that UNIX file names are limited to 14 characters and that the question mark (?), asterisk (*), exclamation point (!) and dash (-) are disallowed. This may seem like a safe and simple way to present UNIX file naming. The user is certain to run into files whose names break these rules, however, and confusion (at least) is sure to result. Besides, if you are going to warn folks away from shell metacharacters, a much longer list would be needed.

The *C Video Workshop* (six tapes, \$1,750) includes a copy of *Learning to Program in C*, 2nd Ed. (Tom Plum, Plum Hall, 1989). This is not my favorite book on C. The typography is stodgy (the figures are drawn using typewriter characters), and the printing is noticeably grainy. Still, it is a competent work, and Mr. Plum definitely knows his topic.

The remaining workshops are less likely to be interesting to Sun users. None of the material relates to OpenWindows or even Open Look. The low-level (Xlib) programming instruction is great for masochists, but I prefer to use higher-level libraries whenever possible. For completeness, however, here they are.

The *X Video Workshop* comes in two volumes. Volume one (three tapes, \$1,200) includes a copy of the *X Window System User's Guide for X11R3 and X11R4*, 3rd Ed. (Quercia and O'Reilly, O'Reilly, 1990). Volume two

(eight tapes, \$2,400) includes copies of the *Xlib Programming Manual* (Nye, O'Reilly, 1990) and the *Xlib Reference Manual* (Nye, Ed., O'Reilly, 1990). Volumes one and two together sell for \$3,500.

The *OSF/Motif Video Workshop* also comes in two volumes. Volume one (four tapes, \$1,300) includes a copy of the *X Window System User's Guide*, OSF/Motif Edition (Quercia and O'Reilly, O'Reilly, 1991). Volume two (seven tapes, \$2,000) includes the *OSF/Motif Style Guide and Programmer's Reference* (OSF, Prentice Hall, 1991), the *X Toolkit Intrinsic Programming Manual*, OSF/Motif Ed. (Nye and O'Reilly, O'Reilly, 1990), the *X Toolkit Intrinsic Reference Manual* (O'Reilly staff, O'Reilly, 1991) and the *Motif Programming Manual* (Heller, O'Reilly, 1991). Volumes one and two together sell for \$3,000.

Sun Microsystems Inc.

I was very impressed with the Sun videos I examined. Substantial use is made of computer graphics, and it seems to help the presentation rather than obscure it. The instructor remains a voice in the background, avoiding the problem of switching back and forth between a human face and a generated display.

The courses make very heavy use of the workbook. Every few minutes, the viewer is instructed to stop the tape and go to the book for readings, exercises, etc. In addition, the tape is set up to allow sections to be located easily. Thus, a user can find desired video segments with little trouble.

Sun resells two Hands On Learning tapes: *UNIX Video Workshop* and *C Video Workshop*. In addition, Sun sells eight locally produced videotape courses. Three of the courses cover SunOS; the rest deal with specific Sun hardware.

The software courses include *SunOS for Users: OpenWindows* (one tape, \$995), *SunOS for Users: SunView* (one tape, \$995) and *System Administration Essentials for 4.X* (one tape, \$995).

The hardware courses include *SPARCprinter Maintenance* (one tape, \$295), *Sun386i Systems Maintenance* (one tape, \$595), *SPARCstation IPC*

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Systems Maintenance (one tape, \$595), *SPARCstation IPX Systems Maintenance* (one tape, \$595) and *Sun SPARCstation 2 Systems Maintenance* (one tape, \$595).

UNIX System Laboratories

USL offers nearly a dozen courses, ranging in length from one to five days. I looked at the introductory course and ended up feeling a bit bemused. The instructor wears a tie, but his collar is unbuttoned, the tie is loose and his sleeves are rolled up. Perhaps USL is looking for the "rumpled engineer" look; I don't know. I'm afraid, however, that his appearance will endear him to neither the Usenix (t-shirt and jeans), nor the UniForum (suit and tie) crowd.

Some of the same uncertainty comes through in the selection of material.

In attempting to teach the user to log in, the instructor brings up half a dozen possible problems with terminal settings (full duplex, parity, baud rate, etc.). He explains them all, then says to go to the system administrator for help if they occur. If the user can't learn enough to fix the problem or even diagnose it accurately, why bother to bring it up?

The introductory series is entitled *Fundamentals of the UNIX System*. The series contains three courses: Basic (four tapes, \$1,000), Intermediate (four tapes, \$1,000) and Advanced (three tapes, \$1,000).

Programmers are offered *The Shell Command Language for Programmers* (15 tapes, \$1,000), *C Language for Programmers* (12 tapes, \$2,200), *C Language for Programmers, with ANSI C Supplement* (13 tapes, \$2,500), *Object-Oriented Programming in C++* (seven tapes, \$2,000) or *C Language for Programmers: The ANSI Standard* (one tape, \$300).

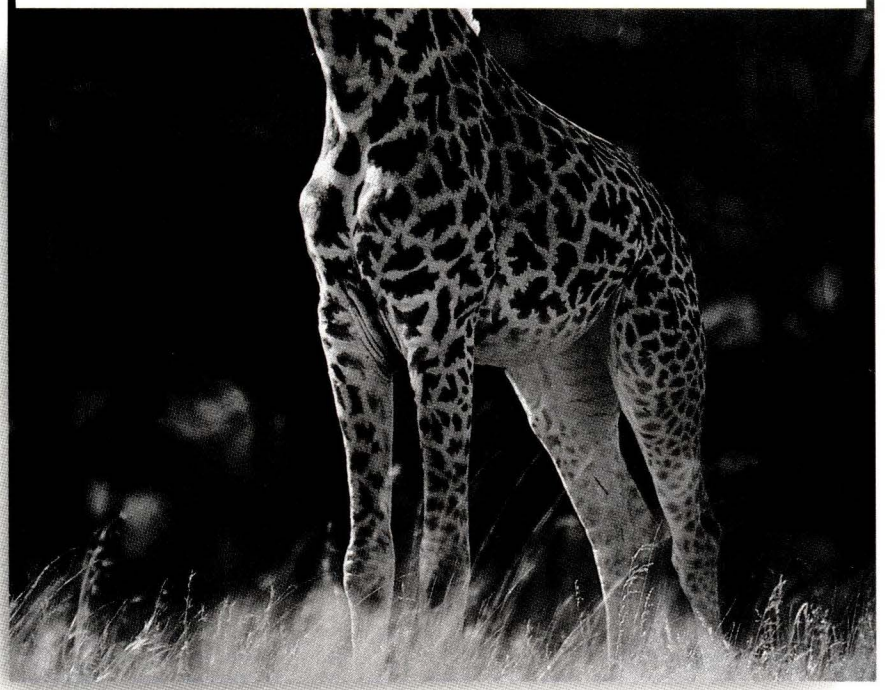
Administrators are offered *Security for the UNIX System* (four tapes, \$1,000), *System Administration for UNIX SVR4* (four tapes, \$1,000) and *UNIX System Administration (SVR3.2)* (four tapes, \$1,000). The first course sounds useful, and the second should be of particular interest to sites moving to Solaris 2.0 (SunOS 5.0).

Fade to Black

None of the courses I examined were truly bad, but none had the polish and clarity found in a typical PBS educational program. (Even the Sun course had continuity problems.) If the tapes were inexpensive, the production values would be acceptable. Good directors, camera operators, instructors, etc., aren't cheap. For several thousand dollars, however, I wonder if we cannot ask for a bit more than we're getting. ➡

Richard Morin may be reached at Cantata Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044. His electronic address is cfcl!rdm@apple.com, or he can be reached at rdm@expert.com.

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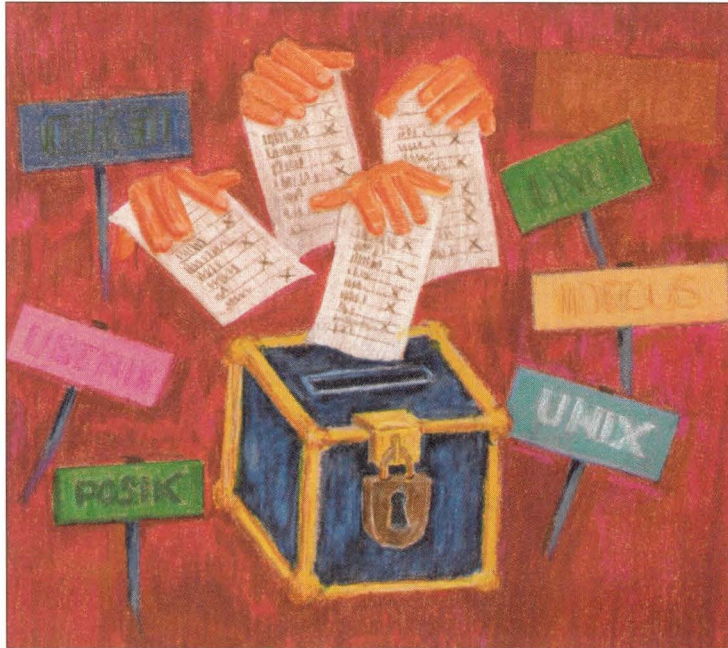


ILLUSTRATION BY JOHN W. KELLEY JR.

Something Important Is Happening!

by PETER H. SALUS

In early January, there was a strong exchange between Shane McCarron of UNIX International and Jim Isaak, the chair of the Technical Committee on Operating Systems (TCOS). The topic: POSIX representations or standardization without representation. Rather than rehash what they said, I'm printing much of what was posted.

SHANE MCCARRON: "Let me start this message by saying something inflammatory: YOU ARE IN DANGER OF LOSING YOUR REPRESENTATION AT POSIX!!!"

"There are two forces at work that are limiting the participation of the

user community in the definition of industry standards. The first is the worldwide recession. This is having a serious effect on the ability of representatives from small organizations to participate in POSIX. This was especially obvious at the October meeting, when many longtime participants from small organizations that use open systems did not attend or indicated that they may not attend in the future.

"Fortunately, to date there has been a method whereby user groups could represent their members within the POSIX committees. Whether you knew about it or not, many not-for-profit organizations have a special status within POSIX. This status, called Institutional Membership, basically

allows a designated representative from a not-for-profit organization to speak for that organization, instead of speaking as an individual (normally people in IEEE standards activities *cannot* speak for their companies). Further, people who speak for organizations have traditionally been listened to very carefully, as their input represents a potentially broad base of the standards' eventual users.

"Unfortunately, there is a second force at work. Recently there has been a move afoot to deprecate the value of the Institutional Member status within POSIX. This is taking the form of changes to the IEEE TCOS/SS/SEC procedures document as it is going through ballot. The most recent of

these changes removes Institutional Member representatives' right to vote in the POSIX Sponsor Executive Committee (SEC)—the group that oversees all POSIX activities.

Problem:

“The definition of institutional membership, and the requirements for that membership, are excellent. However, representatives of these members must be allowed to vote at the TCOS/SEC meetings in order to ensure several things:

“1) The institutions approved by the SEC must represent some critical segment of the industry, or their membership would not have been approved. As a representative of that segment, the institution must be allowed to make motions to the SEC and to voice their opinions. Only voting members may make motions. The TCOS/SS must ensure that the entire industry is able to fully participate in the open systems standards process.

‘Institutional members and the membership of those institutions are a unique resource.’

“2) Many institutions are currently funding their representatives because of their voting status. The institutions recognize that this status gives their entire membership a powerful voice in the standardization process. Loss of this status may cause some institutions to re-evaluate their participation in TCOS. The TCOS/SS must ensure that all institutions who have found it in their best interests to participate to date continue to do so.

“3) Institutional members and the membership of those institutions are a unique resource. Members enable the

TCOS working groups to have access to a broader range of reviewers by forwarding pertinent working documents to people who otherwise might not see those documents. They further help TCOS to create broader industry buy-in to TCOS authored standards. The TCOS/SS must ensure that this resource is not lost.

“4) Institutional representatives are also an important resource to the TCOS/SEC. These representatives often do not have specific roles within TCOS (unlike working group chairs). Because of this, they are often able to participate in subcommittees, drafting committees and act in positions of authority. This human resource is essential to the continued success of TCOS. The TCOS/SS must ensure that this human resource continues to be available.

Action:


“Change section 12.3 to indicate that institutional members are voting members of the SEC.

“Change section 12.1 to indicate that the total number of institutional members cannot exceed 20% of the members of the TCOS/SEC. (This should allow all current institutional members to continue to participate, and because of the strict rules about consecutive participation will virtually guarantee their continued activity within TCOS. Further, as TCOS grows, the number of institutional members can grow.)”

JIM ISAAK: “I believe your recommended resolution for limiting the IR [institutional representative] voting members is responsive to the concern raised in the balloting that IRs might dominate the SEC voting membership. In effect you’re suggesting that only IRs can fill the 20% “at-large” seats, and that other interested parties must seek some other voting position (like a SEC officer or WG chair).

“However, most of your assertions in your distributed note were not focused

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at this point, and many were misleading or incorrect.

"I would ask you to consider my comments below, and if you agree, distribute a corrective note to the same distribution list as your initial comments.

"1) IRs are not limited to user organizations; vendor consortia and other groups are welcome as well.

"2) Representation of individuals and organizations in POSIX does *not* typically include SEC voting membership. As such, the IRs without an SEC vote have as much voice (more actually) than an individual that participates directly.

"3) Any attendee or written submission can speak for an organization.

"4) If we fail to listen to IRs at the SEC level, that is a cause for great concern. I hope that voting membership in the SEC is not needed, since the 20% you propose will not allow all the current IRs to hold such status.

"5) The general public ability to attend and participate in the SEC vot-

ing activity is not affected by the IR voting status.

"Your proposal does not identify a way to maximize the overall representation of constituencies that are not represented in the SEC otherwise. Nor

Roughly 100 Wide Area Information Servers are running worldwide.

is it clear that this is the objective.

"6) It is not clear why allocating the limited percentage of voting seats to some IRs as opposed to "members at large" might cause a loss of industry support for the POSIX work. But that would be a serious problem if it were to occur."

I think that this is a very important

problem. Over the years, it has become ever clearer that the representatives of the user groups: DECUS, EurOPEN (now EUUG), SHARE, Usenix, etc., have played a vital role. It was Usenix, after all, that sponsored the POSIX workshop which literally rewrote Draft 12 into what became the standard. Despite the fact that we may associate, say, SHARE with IBM, it is the user groups that have stood above the fray, best evidenced by the 1201 GUI silliness. To be honest, I don't think that the technical and professional community can afford to leave something important in the hands of the vendors—or even vendor consortia like UniForum or X/Open. Shane may be a bit too sharp here, but I think he's right.

After my column on the National Information Standards Organization (NISO), I got the following note from Ed Vielmetti, (emv@msen.com) the VP for Research at MSEN Inc.:

"The NISO work that's of most direct application to the net right now is Z39.50, which is what WAIS is built up out of. Roughly 100 WAIS servers are running worldwide, serving up library card catalogs (Columbia University), back issues of Sun mailing lists (Thinking Machines), network addresses (CICnet) and even the P1003.2 drafts (Concert)."

WAIS stands for Wide-Area Information Server. The material in Z39.50 grew out of a Work Item presented to ISO T[technical]C[committee] 46 (Library and Information Service Standards) in 1984, and approved in 1988. The sort of thing that Ed's talking about is one of two approved by the TC: search and retrieve. There is a long article on all this in *Library Hi Tech*, Vol. 8, No. 4 (1990). But you can get more recent information by ftp from think.com:/wais. ↔

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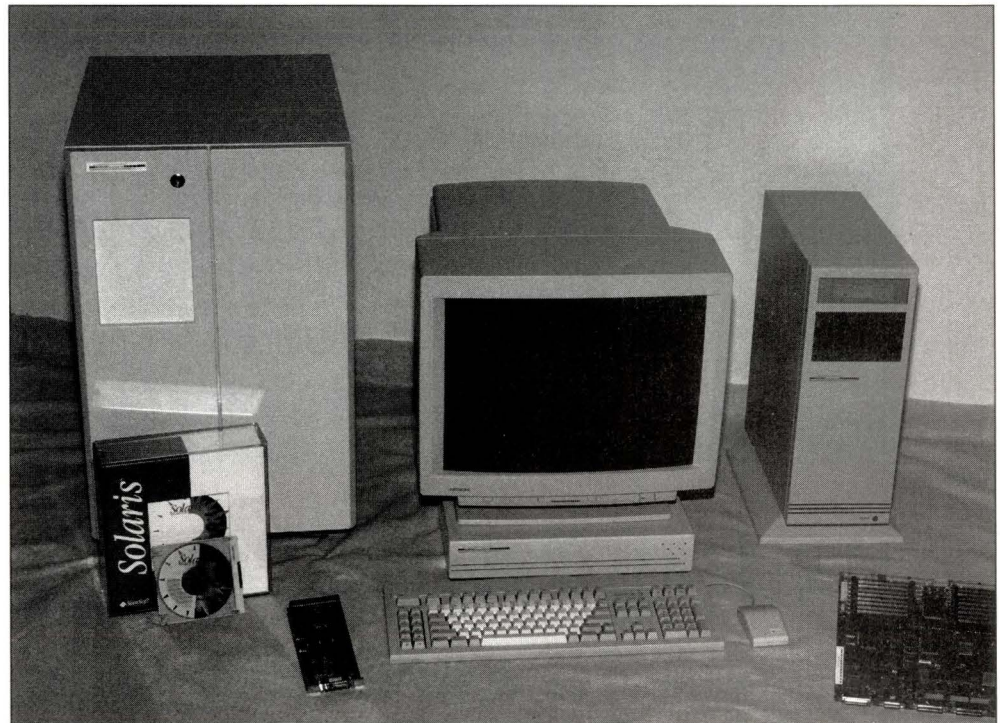
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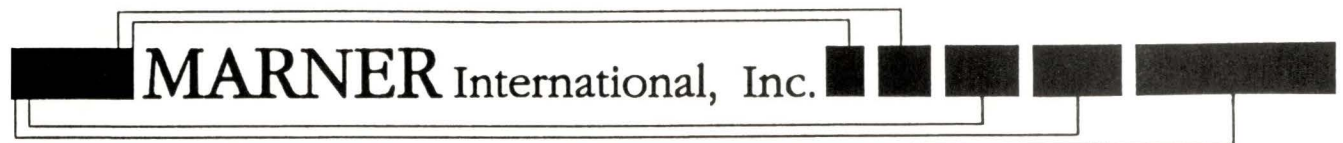
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ILLUSTRATION BY PETER KALABOKIS

Mailing Files to Applications

by S. LEE HENRY

If you'd like to allow your users to post files to an application or bulletin board using the same operations they use to mail files to each other, read on. Giving them this privilege without compromising the security of your network involves use of a simple filter and uudecode.

File manager and mailtool allow users to easily mail files of any type. With the OpenWindows 3.0 drag-and-drop model and the enclosures mechanism, users only need to drag files into mailtool's compose window, elect how to include the file and enter the recipient's address.

Mailtool, if told to include a file as an enclosure, will compress and uuencode it. For files other than ASCII text, this is mandatory. On receipt, the file can be dragged out of the mailbox and dropped into a user's home or a selected "folder."

A Matter of Trust

To post a file without recipient intervention is another matter. Out-of-the-box SunOS provides remote copy. Use of `rcp`, however, requires that the receiving system trust the sending host or the host/user pair. The `/.rhosts` file for trusted roots and the `/etc/hosts.equiv` file for trusted

host/user pairs are easily set up to allow use of `rcp` (as well as all other remote shell commands), but don't permit much selectivity on what we allow these trusted users to do. A plus sign in either of these files extends this trust to the world. The alternative is to list specific hostnames in `/.rhosts` and "hostname userid" lines in `/etc/hosts.equiv`.

If you want *any* user to be able to post files to a specified location without extending this privilege to all remote shell commands, a combination of mail (which doesn't require special privilege) and uudecode (which knows how to deposit files into a designated location) is ideal.

The decode alias in `/etc/aliases` is commented out on installation of SunOS. This is because it can be a security hole. Piping mail through `/usr/bin/uudecode` allows the sender to overwrite any file for which world write permission is set.

In typical use, decode allows users to transfer a file to a location specified when they uuencode it. If they subsequently mail this file to decode, it is uudecoded and installed. If the user does not have permission to write to the specified file, the mailer daemon will return the mail with a

Listing. Filtering to destinations

```

/*
 * mv2.c
 */
#include <stdio.h>
#include <string.h>
#include <sys/types.h>
#include <sys/param.h>

#define TRUE 1
#define FALSE 0

#define MAPSDIR "/apps/maps/"
#define ARCHDIR "/data/archive/"

char *
tail(sp) char *sp;
{
    char *cp;
    return((cp = strchr(sp, '/')) ? cp+1 : sp);
}

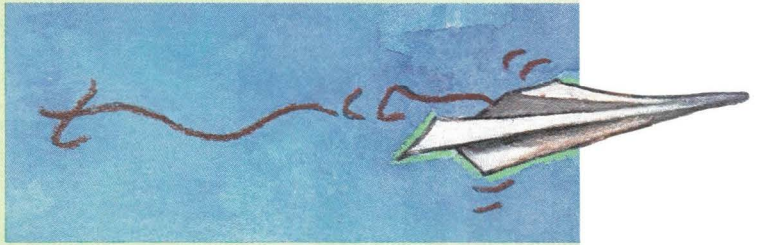
main(argc,argv) int argc; char *argv[];
{
    char text[BUFSIZ];
    char filename[MAXPATHLEN];
    FILE *fp;
    int ch;
    int i,j,k;
    int maps = FALSE, archive = FALSE;

    /* See what name we were run as */
    if(strcmp(tail(argv[0]),"mv2maps") == 0)
        maps = TRUE;
    else if(strcmp(tail(argv[0]),"mv2archive") == 0)
        archive = TRUE;
    else {
        fprintf(stderr,"Program should be named mv2maps or mv2archive.\n");
        exit(1);
    }

    (void)memset(text, (int)'\0', sizeof(text));

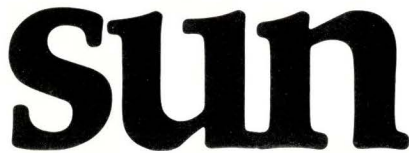
    for(i=0;(ch = getchar()) != EOF;) {
        text[i++] = ch;
        if(ch == '\n') {
            if(strncmp(text,"begin",5) == 0) {
                if(maps)
                    printf("begin 644 %s",MAPSDIR);
                else
                    printf("begin 644 %s",ARCHDIR);
                (void)memset(filename, (int)'\0', sizeof(filename));
                /* Skip past 'begin NNN' and copy out file name */
                for(j=10,k=0; text[j] != '{' && j < sizeof(text); j++,k++)
                    filename[k] = text[j];
                printf("%s\n",filename);
            }
            else if(strncmp(text,"end",3) == 0)
                printf("end\n");
            else
                printf("%s",text);
            (void)memset(text, (int)'\0', sizeof(text));
            i=0;
        }
    }
    exit(0);
}

```



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```
"permission denied" error.
wizard% echo "slee was here" > dirty.trick

wizard% uuencode dirty.trick /etc/hosts | mail
        decode
```

Returned mail will include:

--- Transcript of session follows ---

```
/etc/hosts: Permission denied 554

"/usr/bin/uudecode"... unknown mailer error 4
```

Filters in /etc/aliases

Other useful filters can be added to /etc/aliases provided they use standard I/O and that user-initiated mail is the right vehicle for the task. The decode alias in /etc/aliases, commented out, looks like this:

```
# decode: "|usr/bin/uudecode"
```

What we will do is install a filter in front of uudecode to insert a pathname in front of the filename that mailtool's encoding will provide and change the name of the mail alias to reflect the application:

```
# decode: "|usr/bin/uudecode"
```

```
maps:
"/usr/local/bin/mv2archive|usr/bin/uudecode"
```

```
archive:
"/usr/local/bin/mv2maps|usr/bin/uudecode"
```

In these examples, assume we are enabling users to mail map files (whether raster or vector maps) to a location specified in the filter mv2maps and allowing them to archive compressed data files in an archives directory.

The C code for our filter (see Listing) is trivial. Since we are going to reuse the code for two different filters (i.e., destination directories), we will compile the code as "mv2" and make symbolic links in /usr/local/bin with the names mv2maps and mv2archive so that the appropriate pathname will be installed depending on the alias used.

User Operations

Users will drag their files into the mailtool's compose window and select to encode as an enclosure. They will then address their mail to maps@maphost or archive@archivehost and send the file on its way. The pipe through uudecode will leave the file, compressed, in the target directory. For archiving applications, this is ideal. Your mapping application or a cron-initiated task might uncompress the files as needed.

Let's follow a small file through the process of being mailed to an archive directory so that we can see how this works. First, let's create a file:

```
wizard% echo "Open Systems for Open Minds"
inspire.me
```

Here's what our file looks like going into our filter:

```
From slee Thu Feb 13 09:16:30 1992
Return-Path: <slee>
Received: by wizard.Magic (4.1/SMI-4.1)
id AA13983; Thu, 13 Feb 92 09:16:30 EST
Date: Thu, 13 Feb 92 09:16:30 EST
From: slee (S. Lee Henry)
Message-Id: <9202131416.AA13983@wizard.Magic>
To: archive@sorcerer
Subject: (E)
```

```
begin 664 inspire.me.Z{}
A'YV03^"4<0-B2IXY=,JTF0/"S!LY( (.-!-$DC1LR<Q0
{}
{}
end{}
```

All our filter has to do is insert the pathname where we want the archive files to be stored. It also removes some brackets from the begin and end lines of the mail file. Here's what our file looks like after our filter:

```
Return-Path: <slee>
Received: by wizard.Magic (4.1/SMI-4.1)
id AA13901; Thu, 13 Feb 92 09:10:47 EST
Date: Thu, 13 Feb 92 09:10:47 EST
From: slee (S. Lee Henry)
Message-Id: <9202131410.AA13901@wizard.Magic>
To: archive@sorcerer,
Subject: (E)
```

```
begin 644 /data/archive/inspire.me.Z
A'YV03^"4<0-B2IXY=,JTF0/"S!LY( (.-!-$DC1LR<Q0
{}
{}
end
```

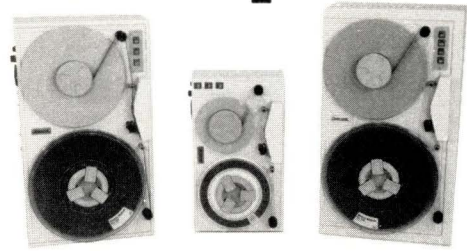
When this file is subsequently piped through uudecode, the mailing information is stripped off, and the file inspire.me.Z is left in the archives directory. -->

S. Lee Henry is on the board of directors of the Sun User Group and is a system administrator for a large network of Suns in the federal government. Slee is also president of her own firm, The NextPage Inc., specializing in software documentation. Her email address is slee@expert.com.

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State of the SPARC 1992

by Michael Jay Tucker, Executive Editor

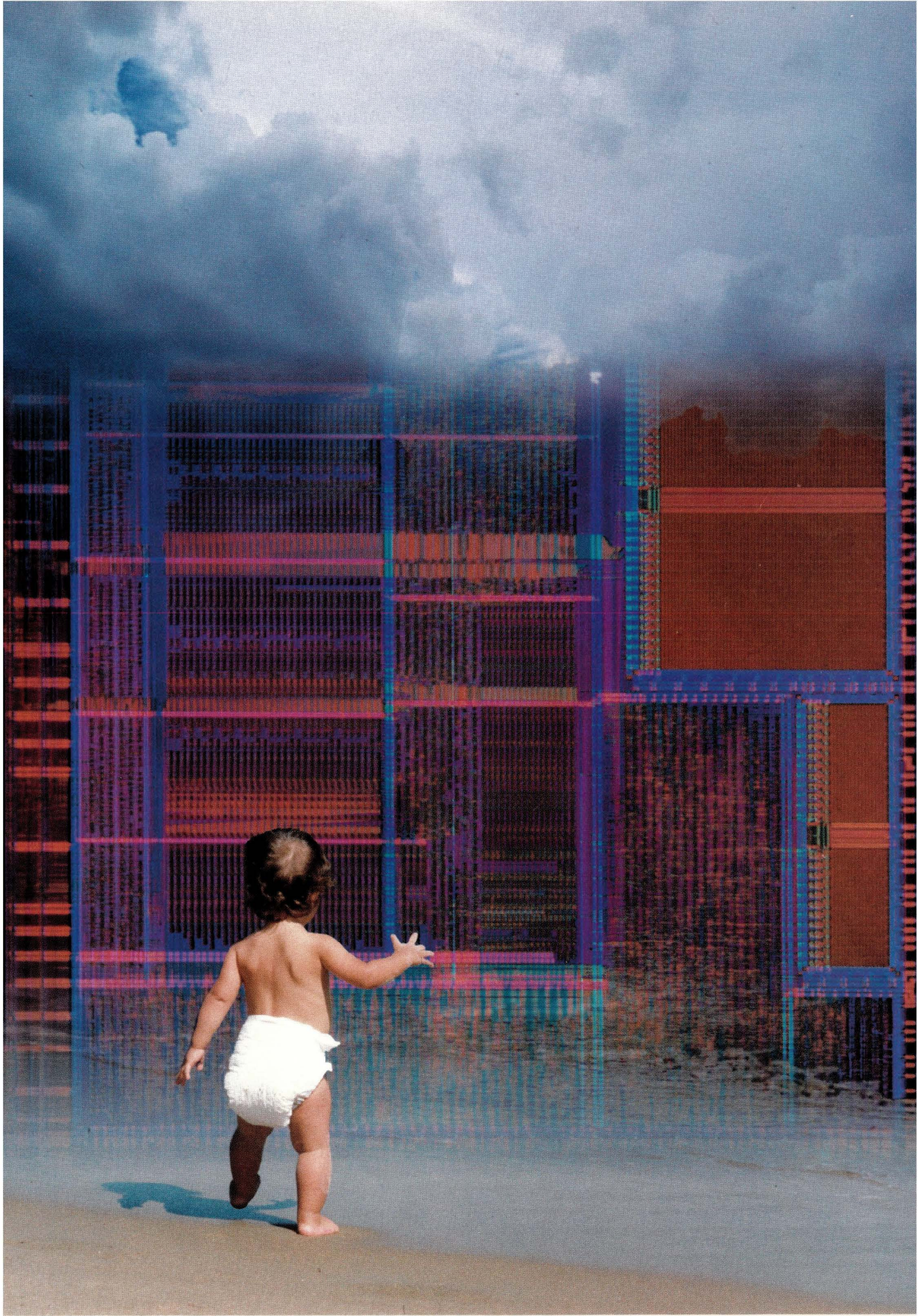
SPARC is one of *the* success stories of modern computing. At a time when the CPU market seemed to be forever dominated by Intel Corp. and Motorola Inc. processors, SPARC challenged both to become a new merchant chip. At a time when RISC was derided as another bubble-memory phenomenon, SPARC legit-

*SPARC faces a
difficult and dangerous
adolescence.*

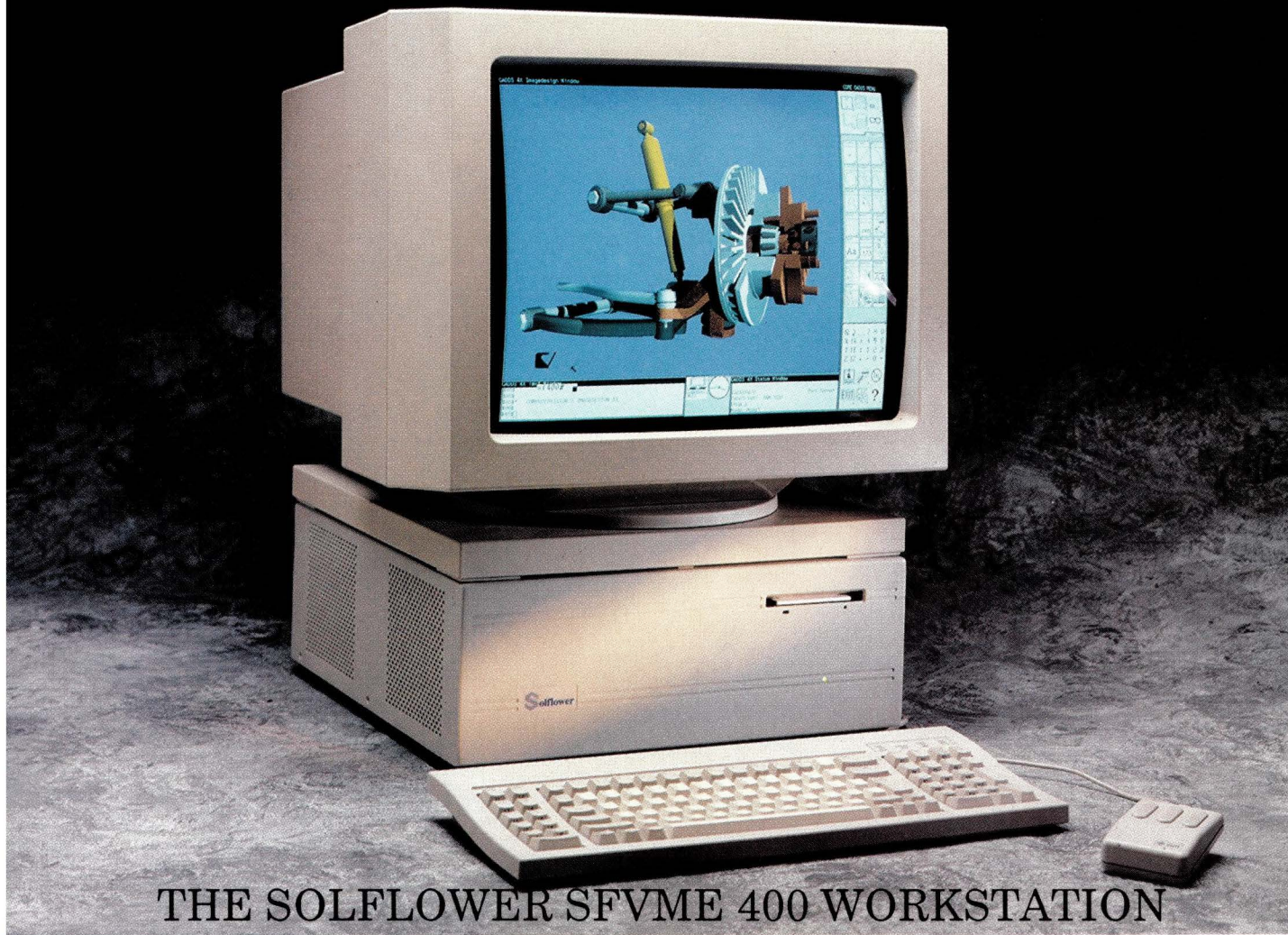
imized reduced instruction set techniques and even set the stage for today's explosion of RISC systems.

But SPARC today is at what may be the most dangerous period of its life. As the processor architecture

enters its second generation of implementations, SPARC has been beset by delays and problems. Development efforts have been canceled, rescheduled or abandoned in disgust by chip vendors. Worse, SPARC now languishes behind the performance of captive RISC products, such as Hewlett-Packard Co.'s PA-RISC and IBM Corp.'s POWER chip set, and perhaps even by a new generation of CISC processors, such as the Intel 80586.



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SPARC's partisans say that the processor architecture is actually only in transition, that new versions of it will very shortly appear and address performance and cost problems that currently trouble its users. They say that, if anything, the processor is merely in its adolescence. However, even they admit that adolescence is rarely a comfortable state of being, and sometimes it is actually dangerous.

Rebel Without a Cause

It is difficult to overestimate just how much trouble SPARC is in at the moment. At least in terms of sheer MIPS, its current implementations are significantly behind other RISC architectures. Worse, several highly publicized efforts to develop very high performance versions of SPARC have come to nothing. Fujitsu Microelectronics Inc.'s SPARC-H, which was supposed to be a very powerful CPU, was brought to an end in June 1990 for reasons that were never clearly explained. A similar project, to produce a superscalar SPARC code-named "Lightning," was begun by LSI Logic Corp., Metaflow Technologies Inc. and Hyundai Electronics America, but Lightning flickered out by 1991, again for reasons never explained.

Other high-performance versions of the architecture are coming—Sun is working closely with Texas Instruments Inc. to produce a superscalar SPARC that was originally called "Viking," though it is now known as "Super-SPARC." However, there are continuing rumors of delays in the chip production and design.

As a result, some very well-respected names in the industry are beginning to question SPARC's continued viability. "For me," says Tom Willmott, vice president of the prestigious high-tech consulting firm the Aberdeen Group Inc., Boston, "there is some question about how scalable it really is."

Willmott pulls no punches, but it's possible to find even harsher judgments of SPARC. In the shadowy realm of rumor and sources who speak on condition of anonymity, there are tales of deeply personal conflicts between corporations and individuals

who were supposed to be cooperating on the next generation of SPARC.

Particularly bitter are stories of the high-performance variants of SPARC that had been the rivals of Texas Instruments' Super-SPARC. Sources both within Fujitsu and outside it claim that SPARC-H was within months of shipping prototype silicon when Sun withdrew its support of the project. The Lightning project is said to have been plagued from the start by deep divisions between LSI and its two partners, Hyundai and Metaflow—divi-

**It is difficult to
overestimate just
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SPARC is in at
the moment.**

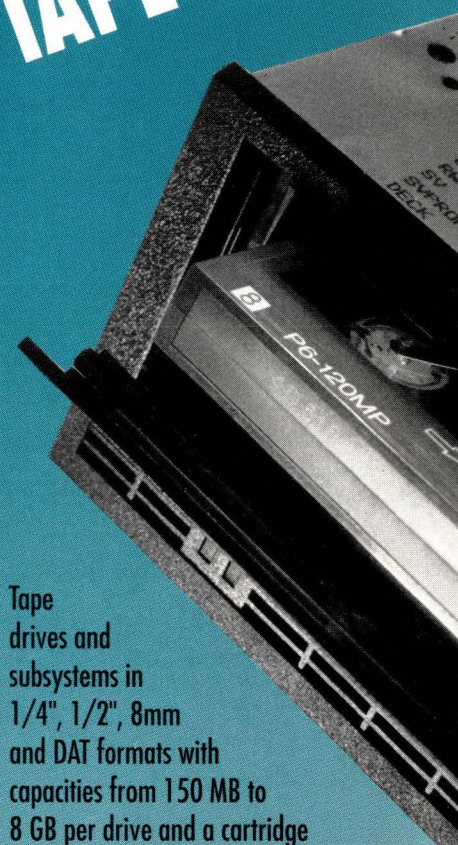
sions unrelated to technological issues.

Most serious of all, there are charges from within the SPARC community that the delays in the TI superscalar chip were not wholly technical. Rather, the story goes, once TI had a seemingly exclusive relationship with Sun and was the only company producing a high-performance chip set, the company declined to invest resources necessary to expedite Viking's completion. "TI is a great company," says one source. "But it's big. There were a lot of other projects to...distract it from SPARC."

TI hotly denies such stories, but true or false, they have deeply unsettled the SPARC community and may have seriously damaged SPARC's reputation. Indeed, at no time in its history—not even at its introduction, when some engineers declared that there were concealed bottlenecks within its design—has its credit been so low.

Fortunately for SPARC, the processor has defenders too. "SPARC is doing very well," says Agit Kapoor, senior analyst at market research firm Meta

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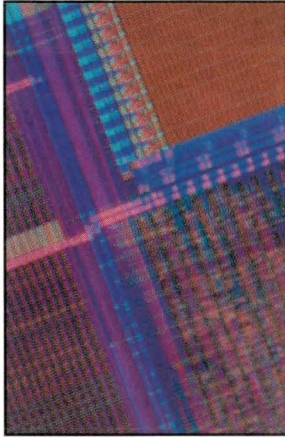
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While most computer users think of processors in terms of system CPUs, SPARC may be undergoing its most dramatic evolution in application-specific integrated circuits (ASICs) and embedded control applications. LSI Logic Corp., for instance, has taken the SPARC processor core and effectively made it a component in the company's

standard cell library. A developer can take the SPARC core and combine it, on a single piece of silicon, with, for example, a graphics processor or DSP.

The result is a SPARC that can be customized to fit, whether the application is a SPARClike that needs

on-chip graphics power or an embedded system that needs SPARC compatibility. "You won't see us in a Cray-like supercomputer," says Tom Harrington, marketing manager for the CoreWare Division of the

COREWARE AND SPARCLITE

Microprocessor/DSP products group at LSI, "but you will see us in a lot of printers, cameras, telephones..." Fujitsu too has long maintained an interest in embedded SPARCs. Its SPARC-lite was one of the first and still most famous versions of the processor optimized for embedded applications. Anthony Bozzini, Fujitsu's director of worldwide marketing and sales, says SPARClite has been exceeding expectations. "It was a pleasant surprise," he says. "We have about 20 design-ins, and we have been able to go head-to-head with Intel."

Group. He says that you have to measure a processor's performance by its units shipped as well as its MIPS. "I'd say that right now, the workstation market is a SPARC-based market."

As for performance, some analysts see SPARC's lag as a short-term problem. "Things are later than I'd like," says Michael Slater, editor and publisher of the newsletter *The Microprocessor Report*. "But I think Super-SPARC will keep SPARC competitive." He argues, in fact, that there is no technical reason for SPARC's performance being somewhat lower than other RISC chips'. The problem, he says, is that Sun hasn't been interested in very high-performance, very high-priced processors. Rather, it wants reasonably good performance at a reasonably low price.

And right now, "Sun is the only real customer out there." As a result, there's been no real pressure on anyone to produce higher performance implementations, and, in fact, the company that tries to produce one without Sun as a customer is in real trouble. "Texas Instruments, which has Sun's backing, is the only vendor that's assured of making money right now," he says.

That major customer, Sun, says that it is committed to SPARC. Asked if SPARC is really at the end of its useful life, David Ditzel, Sun's director of

advanced systems, replies with a simple, "Oh good grief! I can't imagine that people would really believe that...I mean, excuse me, but aren't we just implementing an instruction set here?"

He strongly defends the chip's scalability. "We have an ECL processor that is being used by Cray," he says. "And we have SPARC processors that are in laptops. What architecture, other than SPARC, spans from laptops to supercomputers?"

He says Viking/Super-SPARC's long development time merely reflects the complexity of the processor—which is to have both a higher clock rate than existing SPARCs and also a super-scalar design. Moreover, he says, if Super-SPARC doesn't have quite the performance of its rivals, that's not because it couldn't have done so if its creators had so desired. "Where other people focus on performance," he says, "Sun has focused on price/performance." In fact, he says that even the upcoming Super-SPARC could have been faster. "You have only so many dollars and so much intelligence to invest on a project. We've spent ours wisely, I think... It is possible to do a higher performance chip, but not at the price."

Dampen Your Diaper

Other vendors of SPARC-based systems, particularly SPARClikes, like-

wise continue to stand by their processor. "It is true that SPARC is in a trough [compared with IBM and HP architectures]," says Mark Johnson, executive vice president of SPARC-like vendor Hyundai's Workstation Division. "But these things are cyclical. I remember when the Motorola 88000 came out. At the time, it was the fastest processor. Now look at it."

Naturally, SPARC International is similarly optimistic and similarly has little patience with those who see something sinister in the processor's assorted delays. "I can understand concerns about delays," says Robert W. Duncan, chairman and CEO of SPARC International. "But, you know, I wish some of those analysts had to be part of a real R&D effort...you can't precisely schedule invention."

SI also claims not to be worried about other RISC processors outperforming current versions of SPARC. In particular, say SI officials, it isn't clear that the raw SPEC ratings of other people's CPUs really reflect performance. "You should remember what happened with MIPS [Computer Systems Inc.]," says Phillip W. Huelson, vice president and director of technology for SI. "When it came time to transfer processor performance to system performance, people found it wasn't as easy as they thought."

Companies Mentioned in this Article

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Fujitsu Microelectronics Inc.

Advanced Products Division
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HaL Computer Systems Inc.

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Hyundai Workstation Division

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LSI Logic Corp.

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Ross Technology Inc.

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Tera Microsystems Inc.

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Moreover, Duncan says that the SPARC community differs from other RISC cultures in that it is conservative in releasing performance data prior to actually shipping products in volume that meet the specifications. Duncan claims, "We could dampen your diaper with some of the things that are being talked about in the architecture community, but, the fact is, we don't like to talk about things until they're really finished."

But however promising SPARC's technology may be in the long term, in the short term it is tied to Texas Instruments. Viking/Super-SPARC is the implementation that everyone awaits, rather breathlessly, as the proof of the architecture's next generation. With the demise of SPARC-H

and Lightning, it is the only high-performance chip due to ship in the near future. It is currently the single basket into which many eggs have been placed, and should it ever ship in volume, Super-SPARC would neatly refute all of SPARC's critics at once. Should it fail to ship, or not ship relatively soon, then SPARC would have been dealt a blow difficult to overcome. Already, says Aberdeen's Willmott, "Sun is going to have some difficulty explaining away the enormous advantage of HP, for example."

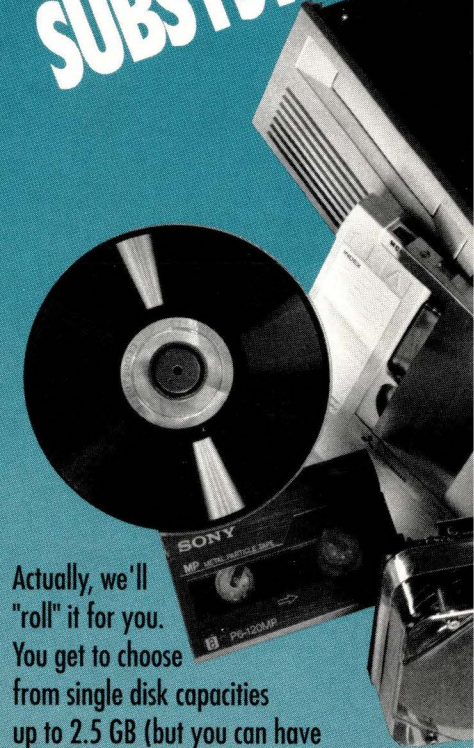
Which is precisely why reports of delays in the Super-SPARC's production have so unsettled the community. TI says, however, that there is nothing to worry about—that the chip is on schedule and ultimately will more than meet expectations. "We're proud of our progress [with Viking]," says Phil Campbell, TI's SPARC marketing manager. "We're on schedule with it. We may not be on rumor's schedule, but we're on ours."

He also denies reports that TI became indifferent to Viking once it had won Sun's backing. "Viking is probably the most visible project at TI and Sun," says TI's Campbell. "So it is not a correct statement [to say that TI is indifferent to the project]."

Campbell says that if Viking has taken longer to debut than the industry expected, that may have reflected unique goals that Sun and TI had in mind. Specifically, says Campbell, TI and Sun have been designing the chip in close consultation with systems vendors. He says they could have rushed the chip into silicon, easily, but that this would not have necessarily resulted in benefits to builders of actual computers. Instead, the Viking/Super-SPARC's enhancements will translate directly to systems performance. In fact, Super-SPARC and systems based upon it will be introduced simultaneously. "As opposed to the classic IC approach, where you just do the silicon, we have worked closely with systems people from the beginning," he says. "When we introduce the chip, there will be boxes based on it from the get-go."

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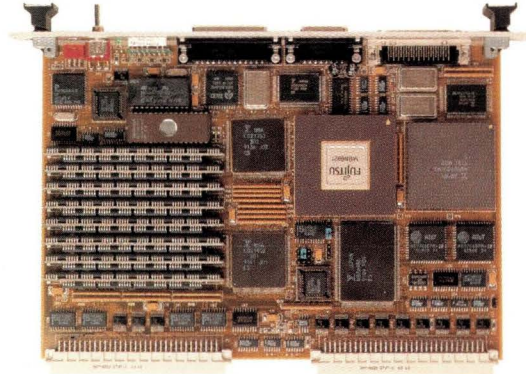
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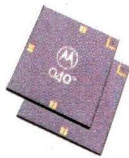
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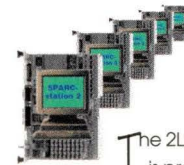
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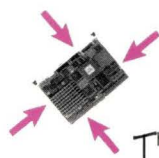
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**'When we
introduce the chip,
there will be boxes
based on it from
the get-go.'**

while, are also generally upbeat. Fujitsu, for example, produced one of the first implementations of SPARC and now says it is doing rather well. "In calendar year 1991, we shipped approximately 100,000 SPARC chips. It was a good year for us," says Anthony Bozzini, the company's director of worldwide marketing and sales.

Fujitsu Microelectronics is also notable in that it was among the first vendors to see a high-performance version of the processor—SPARC-H—abruptly canceled. Bozzini says that this was not the fault of the technology and still less that of Fujitsu. He says that Sun simply cut the project by declining to fund it in order to concentrate on TI's Viking/Super-SPARC. "And now," he notes with some amusement, "Viking is late."

Right now, Fujitsu is said to be working with Sun on a very highly integrated version of SPARC, but Bozzini won't discuss it. By like token, Fujitsu has invested heavily in start-up firm HaL Computer Systems Inc. HaL is known to be working with Fujitsu on a new implementation of SPARC, but Bozzini replies to questions about the nature of the partnership with a curt, "No comment."

HaL itself, however, is more forthcoming. Arthur Goldberg, the company's vice president of sales and marketing, will not discuss specifics, but he does note that HaL is looking at a new higher performance version of the chip to propel the company's products in the MIS world. "If you look at the SPARC architecture today, we think it is functionally deficient," says Goldberg. "But I think you can

define an upwardly compatible version of that architecture that would address any bottlenecks present."

The partnership with Fujitsu is meant to produce a processor that HaL will use in its own product, and which it may sell as well as silicon. Fujitsu will certainly sell the processor as a part. "The specific microprocessor design will be marketed by Fujitsu in the Far East," says Goldberg, "and it will be available to Fujitsu in other areas."

Leather Jackets and Hot Rods

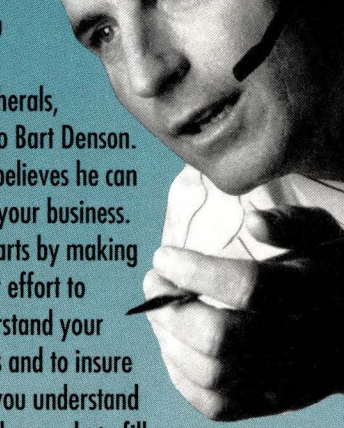
LSI is another long-term vendor of SPARC processors—as, in fact, it is of the MIPS processor, having licensed both early in the game. Now the company thinks that any lack of performance on the part of SPARC is more than compensated for by the size of its market. "Now is the time when they [SPARClike vendors] are going to make money," says Prem Nath, LSI's director of marketing for the SPARC product division. "In 1992, all the vendors will have competitive, 40-MHz systems."

LSI has, though, seen a high-performance SPARC project come to naught—in the form of the much-anticipated Lightning, which was supposed to be a joint effort along with Hyundai and Metaflow. For reasons that remain unclear, the Lightning effort fell apart last year. However, Hyundai and Metaflow have regrouped and are now working on Lightning's aftermath, Thunder. At the moment, though, no one at either company will say anything about the project. Reports from sources outside the companies say that Thunder is very close to fruition.

Meanwhile, Ross Technology Inc., a part of Cypress Semiconductor involved with SPARC, is itself known to be working on a high-performance, superscalar design, Pinnacle. "We've got our next-generation architecture—which we are not prepared to talk about yet," says Joe Nichols, the company's director of marketing. "But it is clear that SPARC is scalable."

He suspects that the real news for SPARC may actually be in its multi-

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processing facilities. "What we have, in production, is multiprocessing," he says. "A lot of other processors can't say that. The MIPS guys haven't got it yet. And I don't see multiprocessing coming from HP." Ross and Cypress provide the processors that go into Sun's own multiprocessor servers.

And, of course, there are many other SPARC vendors, and more coming. One of the newest of them is Tera Microsystems Inc. Tera's chip sets have laid claim to the low end of the mar-

ket—as, say, Cypress has chosen to lay claim to the multiprocessing side of the business. Tera combines its own silicon along with that of others (notably Weitek Corp.) to provide highly integrated, low-cost SPARC processors. The company says that its products now offer the cheapest and most direct path to building a SPARCstation 2 clone.

Cap and Gown

SPARC thus finds itself suspended between two states. Its critics say it is

cursed with certain immaturities. Its partisans agree but say this is a temporary condition and that the processor will grow up soon enough.

For the moment, let us suppose that the partisans have got it right, and that—very soon—Super-SPARC and systems based on it will ship. If so, where does SPARC go then? Some observers believe that if SPARC survives its adolescence, it will then skip upward to another level of being entirely. "I think," says LSI's Nath, "that SPARC will go straight to gallium arsenide, rather than ECL."

But that is a minority view. SPARC International's Duncan, for instance, says he doesn't see a gallium arsenide SPARC anytime real soon. "I don't think that for the foreseeable future you'll see gallium arsenide at the price you can throw into mass-produced desktops...for the foreseeable future, and for me that's five years or so, there's plenty of room for improvement in the fundamental technology."

Still, there's another change coming—less dramatic, perhaps, but more certain, and sooner. "We are working on the next generation of the SPARC instruction set," says Sun's David Ditzel. And, say some observers, it may be that those coming changes in instruction sets will be infinitely more important than anything hardware can manage. →

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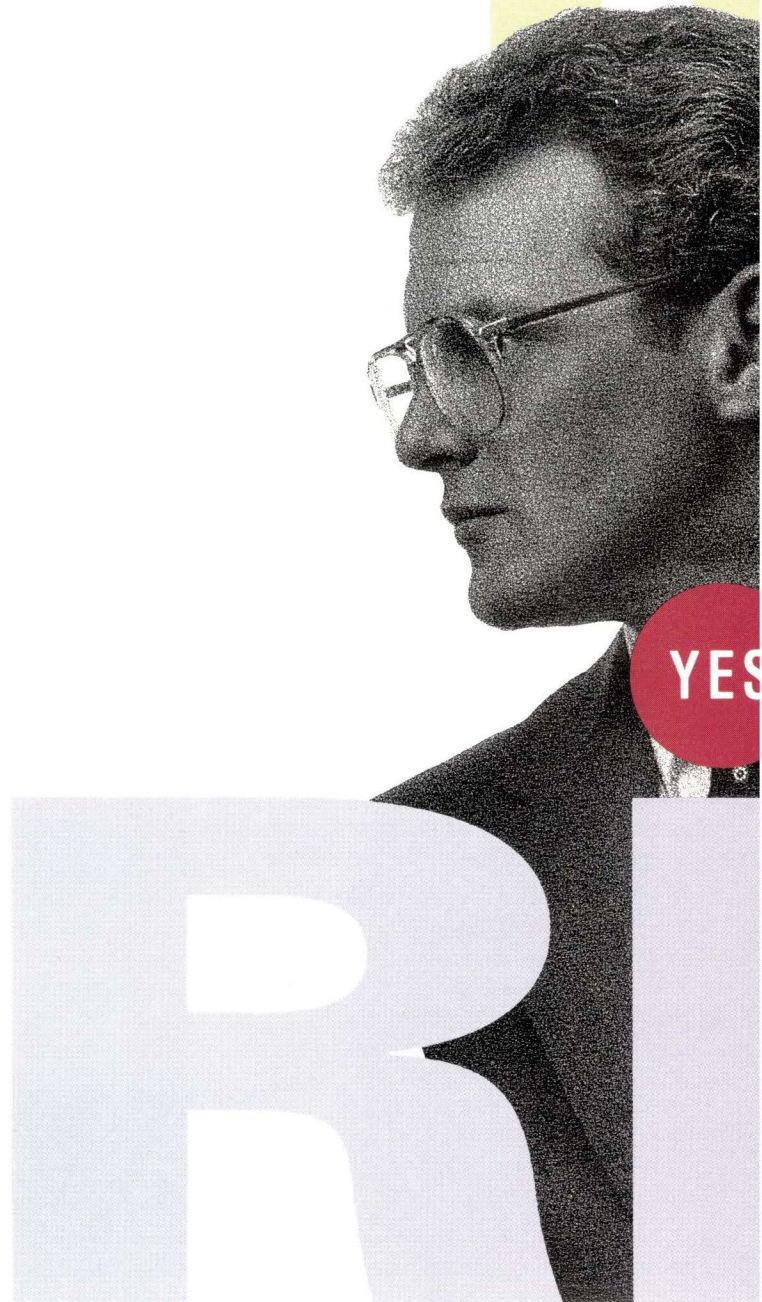
NEWSPRINT

by Paul Hammond, SRS Imaging

Most printers are designed to operate in a PC environment. Because PCs typically have limited memory, the printer must have the intelligence to handle most of the process. Using this approach, the PC—usually a low- to medium-speed machine—sends a file down an even slower serial line. The printer controls the movement of images through its raster buffers, adds fonts and completes other tasks. Add it all up, it spells slow. Worse, printer memory limitations often restrict resolution to the 200- to 300-dpi range.

In order to coax more speed from the printer, designers add capabilities that utilize the characteristics of a specific PC or operating system. Software interfaces must be prepared if a different host is used. Price and complexity shoot up; speed crawls up. In a network, a PC needs an interface for each printer in the system, or the interfaces must be somewhere in the system. It's a mess.

(continued on Page 64)



photograph by Carol Lee/Stock Bo

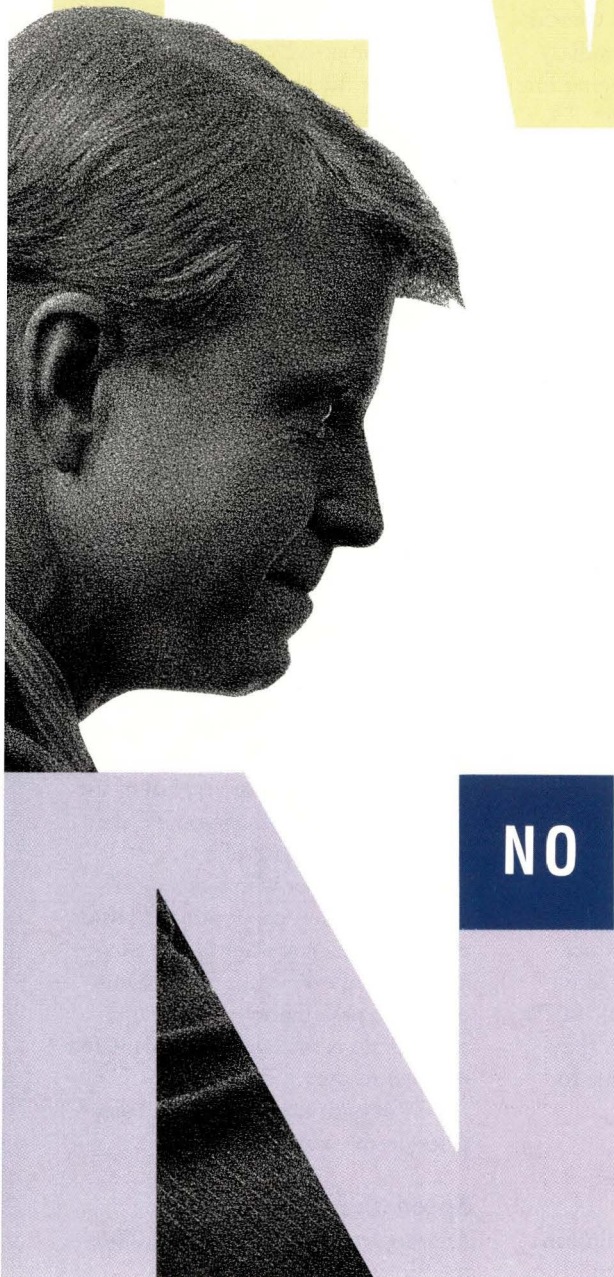
NEWS

by Dan Eakins, MiLAN Technology

More than one strategy exists for making high-quality, fast and affordable printing available for users on UNIX networks. Few fully packaged printing applications exist, however. The most notable of these complete packages is Sun Microsystems Inc.'s NeWSprint. Sun's total package includes a repackaged Xerox Corp. print engine, SBus adapter, cables and one copy of NeWSprint software. This package lists at \$2,695 and is a fantastic value if you are looking for a PostScript-quality, 17-ppm (the rated speed of the Sun SPARCprinter), network printing resource and have an extra Sun SPARCstation 2 that can be used to drive the printer.

In its present form, however, NeWSprint does not yet constitute the open printing environment for the '90s.

(continued on Page 69)



(continued from Page 62)

The Workstation Model

Sun Microsystems Inc. released NeWSprint in 1990 and last year released NeWSprint 2.0. It is a software product that uses the workstation to handle virtually every print function except the job of putting the ink on the paper. The power of the workstation means speeds many times greater than the PC model for printing. Multitasking gets the job done in the background, while the user goes on to a new task—without meaningful degradation of the performance on the workstation. The workstation uses the high-speed lines, and best of all, the printer doesn't need a large, expensive controller.

Finally, the 1200L, in conjunction with its expanded imaging capability, uses the SCSI interface, so data transfer occurs at 5 million characters per second, compared with the 1,900-3,800 characters per second in a standard serial interface. The usual bad news, the price, turns out to be easy to take—\$11,995. That's about \$5,000 less than comparable machines built on the PC model.

"We're opening up the printing market in a way that will bring more choices to the end user," says Charles Andres of SunPics, a Sun subsidiary focusing on printing and imaging for computer systems. Andres adds, "A user can purchase a 28-MIPS workstation as a server and a printer for

handled by NeWSprint 2.0's front-end software, called PreLimn. Once installed, PreLimn takes over as soon as the traditional UNIX command (`lpr`) is issued by the host. This eliminates one of the biggest headaches connected to installations of new software—changes to application programs. The other UNIX spool and print commands, `lpc`, `lprm` and `lpd`, still operate, too. However, PreLimn adds a new command, `pl`. If `lpr` is selected, the correct filters will be invoked; in effect a `pl` is automatically invoked, but users have the choice of issuing either command, `lpr` or `pl`.

So what is the difference between issuing a `pl` and an `lpr`? When a `pl` is invoked from an `lpr`, PreLimn identifies the file type and searches directories for the default filters. Once it has located the filters, it creates a command line file. The data and command files are written to disk. When the job reaches the front of the queue, the line-printer daemon passes the job back to PreLimn. PreLimn constructs a list of filters and processes the data file. At this point, PreLimn passes the job to the other part of NeWSprint 2.0, the Raster Image Processor (RIP). The RIP adds fonts and finishes the job.

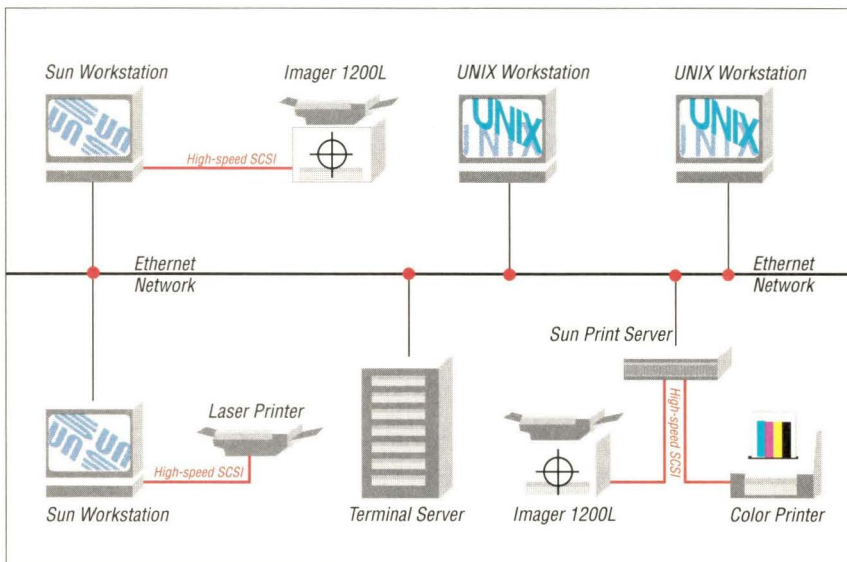
Issuing `pl` directly offers greater flexibility. Rather than use the default filters and options for a document, you specify the filter or options. Digitized company logos are typical of the additions possible when you use the `pl` command instead of `lpr`.

Consider a user who sends most output to a plain paper printer. However, the user may want to put a logo at the top of every page of the handouts for a presentation. All the user needs to do is include the filename for the logo to the `pl` command.

And in both cases, all of this takes place on the workstation.

Speed and Multitasking

Another feature of NeWSprint 2.0 is the file type flexibility. Adobe's PostScript is virtually an industry standard, and PreLimn tears through PostScript files. In fact, the only difference between PostScript on the PC



Workstations connected to the SRS Imager 1200L automatically become network print servers. A SCSI interface provides a high-speed link to the network.

Sun markets the SPARCprinter, a low-end, 300/400-dpi printer designed for NeWSprint. Now other vendors are seizing opportunities. Applications calling for large paper sizes, graphics, plotters and color are addressed by new products.

A good example is SRS Imaging's Imager 1200L printer. It is a laser printer that offers 11-by-17-inch (B size) plots at a speed of 12 pages per minute. It offers a 600-dpi image, close to the quality needed for phototypesetting and well within the range necessary for final copy on technical

less than some printers. And since printing is typically only a 4- to 6-MIPS task, on a Sun 12- to 28-MIPS workstation, it can be done in the background while you continue to use your workstation."

NeWSprint 2.0 Printing Model

NeWSprint 2.0 has two main functions. The first is to identify and convert the file for printing. Next, it performs the rasterization of the image before it is sent to the printer.

Identification and conversion are

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and PostScript with NeWSprint 2.0 is image processing speed. NeWSprint 2.0 is much faster. PreLimn includes a utility that replaces Adobe's TransScript; again, the only meaningful difference—improved performance. As a result, your PostScript printer is easily accessible. Andres of SunPics explains another important point. "Since NeWSprint 2.0 is software, if a Level Three or Four PostScript is released, users will be able to add that additional PostScript functionality to any printer that supports NeWSprint without any hardware upgrade required."

PreLimn is also smart enough to process ASCII, Sun Raster, tek, otfroff or ditroff files without missing a beat. Finally, the aliasing feature allows PreLimn to print your C, FORTRAN, text or shell files. PreLimn takes care of the translation to PostScript and uses information on the system to figure out printer characteristics. The result: The user doesn't need to worry about the target

printer. If it's a PostScript printer, fine. If not, PreLimn will see that the job is printed correctly.

Network Environment

All this sounds simple enough. And it's easy to use NeWSprint 2.0 in a network environment. Let's again consider the SRS Imager 1200L as our example, this time of a printer using NeWSprint 2.0 in a network. SRS bundles each Imager 1200L with Sun's NeWSprint 2.0 software, which enables the host workstation to become a network print server. As a result, all users on a UNIX network are transparently linked to the printer, just as if they were directly linked, according to Thomas Cocotis, SRS's president.

Transparent. Nice word, but what really goes on when NeWSprint 2.0 is in a network?

Start by constructing a simple network for purposes of illustration. Hook up two workstations, one for a user and one to operate as print server. The operations are the same

regardless of the number of user workstations. The identification of file type and the location of the filters are handled on the user's machine. This is passed to the spooler, lpd, which resides on the server. When the job is at the front of the queue, the lpd spooler will check its database of available printers and their characteristics when preparing a job, then pass the job back to the user's workstation for the addition of the filters. The filters are added and the job is sent back to the server as a shell script, npscomm. The server will then run the RIP portion of NeWSprint 2.0. If any interfaces are necessary, these are on the server. NeWSprint 2.0 takes over once the lpr or pl is issued, so it is transparent to the user. If the user prefers a personal printer instead of the default on the network, this is specified.

Fonts

NeWSprint 2.0 is bundled with 57 brand-name, scalable, outline fonts made using Sun's F3 font format.

SunPics recently introduced NeWSprint XP—a newer, faster, better version of NeWSprint that helps workgroup professionals speed up the time it takes to print large-format, PostScript-based documents.

NeWSprint XP speeds up the performance of various output devices (in this case, image setters, high-resolution laser printers and large-format plotters). NeWSprint XP also makes it possible to print files from any computer on the network—including Macintosh, IBM and IBM-compatible PCs, workstations and minicomputers.

All the key features of NeWSprint 2.0, including PC/Macintosh interoperability and Type 1 font support, are available in NeWSprint XP software. In addition, NeWSprint XP software will be able to take advantage of internationalized offerings from SunPics, including localizable, scal-

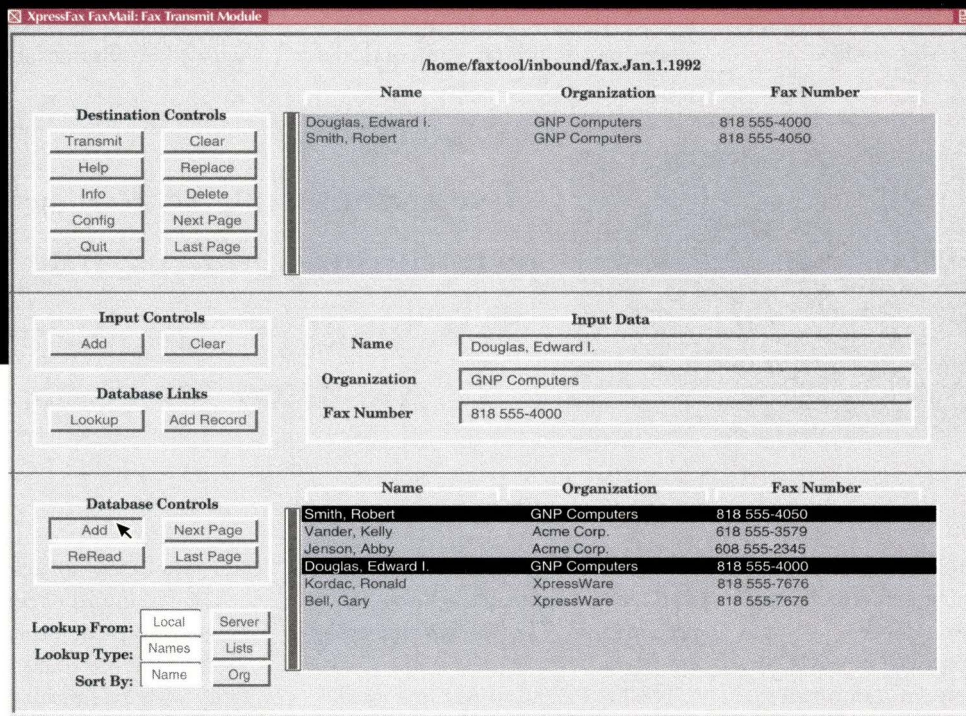
able foreign language fonts in F3 outline format. For example, NeWSprint XP software combined with Nihongo NeWSprint allows Japanese scalable fonts from Morisawa and Co. to be output on high-resolution devices.

One of the first adopters of NeWSprint XP technology will be SRS Imaging, which has agreed to license the new technology and incorporate it in upcoming products. SRS will distribute the software with its 900-dpi Imager 1200L XP, the first high-resolution laser printer to support this new, high-performance publishing software.

The SRS Imager 1200L XP will produce high-quality, 900-dpi PostScript language output on a wide range of paper sizes, including standard 8 1/2 by 11 inches and 11 by 17 inches. Its SCSI interface and print handler software will continue to provide the high-speed data transfer necessary for producing scanned and raster images, technical drawings, publications and books—no additional cards required.

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These fonts are "hinted." Hinting is the use of extra dots to fill out curves and angles of serifs (the little tails) on letters. Hinting maintains high-quality images, even at smaller point sizes. You aren't limited to the 57, either. NeWSprint 2.0 is compatible with more than 1,200 additional fonts from suppliers that include Linotype, Monotype, URW, Bigelow & Holmes and Autologic. And NeWSprint 2.0 will print Adobe Type 1 fonts embedded in imported files from Macs and PCs.

cal interface and DeskSet tools, a user can print documents by dragging a file icon with a mouse and dropping it onto a print icon.

In today's high-tech environment the programmer is often forgotten—at least until something goes wrong. But with NeWSprint 2.0 the programmer has the developers' kit as a standard feature of the package. It offers, among other things, source-code examples of printer handlers and descriptor files. There are also utilities to smooth the

session have an unsatisfactory display, such as he or she may find using a 1200-baud dial-up modem?

Not likely. In most cases, except perhaps for very large engineering drawings, or color printing, there is no degradation of performance whatsoever. SunPics' Andres said the company had run a number of tests in 1990 on a relatively small 16-MIPS workstation. Even when four to five sessions were running concurrently with a NeWSprint job, the degrada-



Even when four to five sessions were running concurrently with a NeWSprint job, the degradation was barely noticeable.

Downloading fonts is one of the most time-consuming processes in the PC model of printing. With NeWSprint 2.0, fonts can be centrally located on the network. Performance comparisons between the two approaches are meaningless. Downloading alone can take minutes in the PC world; the whole process requires only seconds on a workstation.

Windows and WYSIWYG

NeWSprint 2.0 uses Sun's NeWS technology, a window environment for SPARC systems. However, it will operate under any window environment running on a SPARC system, such as SunView and MIT X.

NeWS operating under OpenWindows offers special benefits for users. To begin, it is a true, common WYSIWYG (what you see is what you get) display. The display on your terminal is exactly the same as the printed image, including fonts. This feature is designed to help Sun move into the electronic publishing and office automation markets.

Through Sun's Open Look graphi-

addition of new printers to your network. The documentation is a 200-page manual, *The NeWSprint Developer's Guide*.

The SRS 1200L is just one third-party option. Other printer companies supported by NeWSprint interfaces include the heavyweights: among them, Epson America Inc., Hewlett-Packard Co. and Seiko Instruments USA, Inc. In addition, several other printer vendors have signed on. With NeWSprint, you have your choice of personal ink-jet printers, plotters, typesetting equipment, high-speed color printers, or wide-bed plotters—all on the same network, all initiated with the same set of commands. Andres offers HP as an example. "HPPCL files can pass straight through NeWSprint 2.0, due to its native mode capabilities."

Multitasking

How much degradation is there when NeWSprint 2.0 is running on one session, while the user goes on to another session on the same workstation? Does the user on the different

tion was barely noticeable.

The PC model of printing is dead. In order to protect user investment, NeWSprint 2.0 offers greater connectivity with PCs such as Apple's Mac, but the workstation approach is too fast not to dominate in the years to come. A printer like the SRS Imager 1200L not only offers speed in processing, but also the ability to use the high-speed SCSI interface for data transfer. NeWSprint 2.0 delivers flexibility. It can handle virtually any of the common file types. It can use any printer on your network. The cost of such a solution is lower, because it leverages the power of the workstation. You use the power you already own in your workstation; you don't have to buy it in a printer. ◀▶

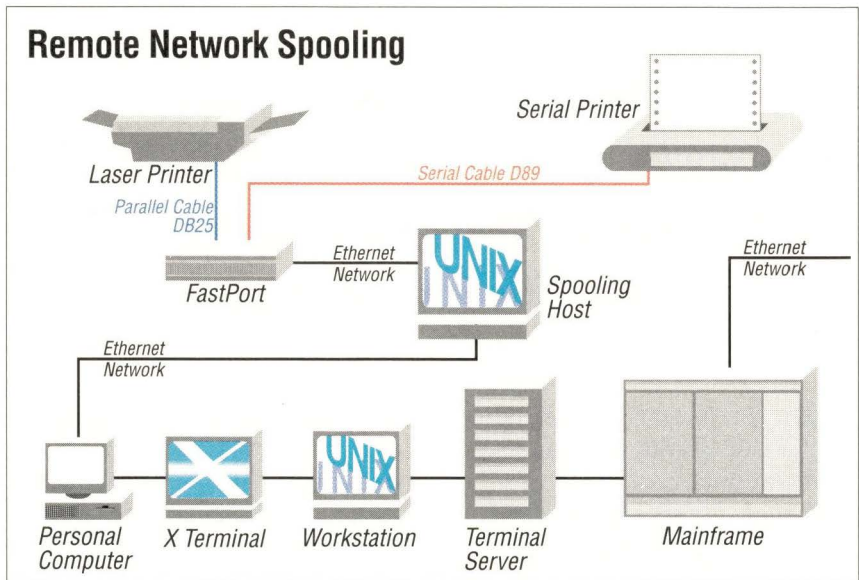
Paul Hammond is vice president of sales and marketing for SRS Imaging, the Irvine, CA-based supplier of workstation printers. Hammond has more than 10 years of experience in the UNIX market in Europe and the United States.

(continued from Page 63)

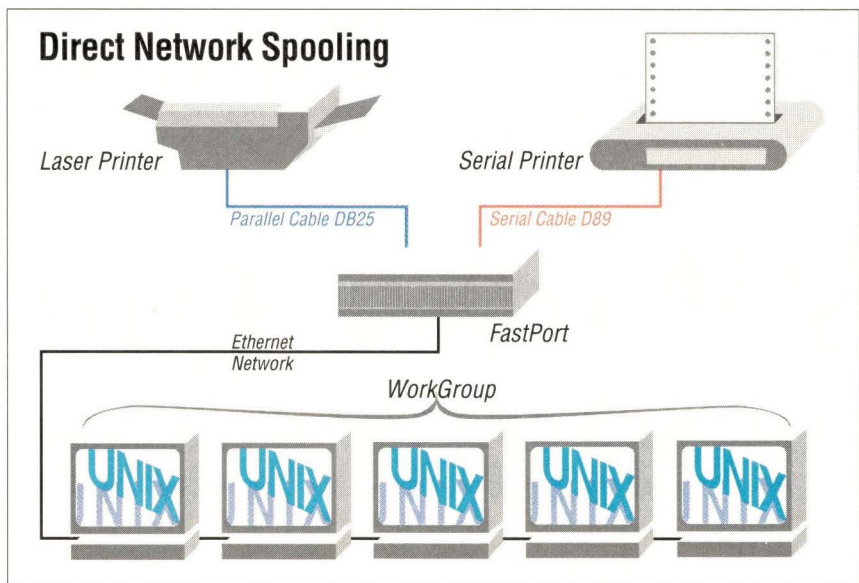
A complete print system must address four basic components adequately to be an effective environment. It must deal with 1) presentation of text and graphics, 2) translation into a print language, 3) communication of the data to the printer, and 4) production of a printed page. When the components of NeWSprint are analyzed in each of these areas, NeWSprint's contributions appear to be only in the areas of presentation and compilation. Sun has not changed the model of distributed printing but has lived within the constraints of the centralized computing environment from which they emerged. NeWSprint does not address some of the problems in distributed printing such as the location independence of printers, heterogeneity of printers and workstations and the shortcomings of remote spooling as seen with `lpr/lpd`.

With FastPort, for example, MiLAN Technology is able to compensate for the lack of fast, distributed printers in the UNIX environment. By implementing direct network spooling, as opposed to traditional remote spooling, MiLAN is making it possible for fast and inexpensive PostScript printers to be put on a TCP/IP network and accessed directly by a workstation's native spooler, thereby eliminating the need for the remote spooler. When this is combined with WYSIWYG text and graphics applications and distributed PostScript compilers that provide translation, a portable distributed printing environment is created that rivals that of NeWSprint.

To get WYSIWYG, the computer must display the bits of information on the screen in the same language that they will be printed from. This was the aim of Adobe Systems Inc.'s display PostScript, which is featured by many desktop publishing applications. When images from an application using display PostScript are printed, they are already described in the PostScript language that a PostScript printer will use. PostScript printers feature interpreters that take PostScript language descriptions and



Direct network spooling (below) eliminates the need for a remote `lpd` spooler. Products such as MiLAN's FastPort provide a TCP/IP interface for the printer so that workstations can spool print jobs directly to the printer.



translate them into the raster scans that are used by the print engine to physically produce the printed page.

Remote vs. Direct Spooling

All the traditional strategies that have emerged for network printing with BSD UNIX systems are built under the Berkeley line printer daemon (`lpr/lpd`), since this is the only widely available spooling system for the most popular versions of UNIX. This method makes printers accessible to other users on the network as a

remote printer. What isn't normally known is that there is significant overhead associated with remote spooling in the traditional way. This includes such systems as Sun's NeWSprint.

`lpd` allows you to spool either to your own printer directly attached to your computer or a printer attached remotely to another computer. When remote spooling in this fashion, the entire job is sent to the other computer, entered in the queue and then printed as if it were a directly connected printer when the printing resources

NeWSprint software is only available in binary form for SPARC OS, and the video controllers are only available for the SBus.

are free. By doing this, the ability to employ local filtering and local control of the print queue is lost.

What users desire and what direct network spooling allows is the ability to take advantage of local packages and configurations without accessing a remote host. The age of distributed computing allows desktop UNIX computers to spool directly through a high-speed Ethernet connection to the printer. Direct network spooling makes printing on UNIX networks a remarkably straightforward and flexible process. MiLAN's FastPort employs filters for installation on each workstation that interfaces to the spooler on that

workstation and allows printing to be accomplished without accessing a remote host. All computers should share the compute-intensive task of converting the data into a PostScript format, and printers should perform the task of rasterizing these files.

NeWSprint: An Open System?

Sun developed NeWS (Network Extendible Windowing System), which NeWSprint uses as a compatible language to Adobe Systems' PostScript imaging language. NeWS allows text and graphics to be displayed and printed in the same fashion as the PostScript language. But

NeWSprint is truly WYSIWYG only insofar as displayed images can be compiled in the NeWS compiler. To date this has meant that you have to be using X11/NeWS as your windowing system, since it is the only windowing system that displays under NeWS. The acceptance of MIT's X windowing system by the UNIX community created a situation in which commercial, academic and other users are actively developing and using other windowing systems such as X11R4 with Motif. These users cannot take advantage of NeWSprint's WYSIWYG functionality unless their application supports the NeWSprint compiler.

NeWSprint is different from most other printing systems in that Sun has placed a PostScript-compatible compiler on a workstation and not in the printer. By embracing NeWSprint, you embrace the robustness of this compiler. Sun's language and fonts are largely compatible with Adobe's own language and fonts, yet Sun claims that NeWS is only a dialect of PostScript. Sun aims only to be compatible with Adobe, and there are many areas in

**If it ever goes down,
another computer?**



which they do things differently.

Sun has made NeWSprint open for developers to develop the needed fonts, drivers and filters to make NeWSprint compatible with a large number of printers and applications. And since they do not support all of Adobe's technology, one must suspect that their only intentions are to support PostScript insofar as it carries forward Sun's definition of open printing, that is, NeWS.

NeWSprint appears to be an inexpensive solution at \$2,695. However, when you consider the price of the SPARCstation 2 computer and extra memory that Sun recommends be used to drive the printer, NeWSprint could end up costing as much as \$15,000. Sun says that by using the resources of your workstation to print, you will save money because you do not have to pay a printer manufacturer for the printer controller. However, with NeWSprint you end up paying Sun for the memory, microprocessor, disk and monitor, whether you want to or not. After all, not many users have an extra 25-MIPS workstation floating around

that can be used as a print server.

Since UNIX is multitasking, this computer can be used for other functions, but it will be forced to move to wherever the shared printer is moved, and if an organization is actively using printers, this computer will virtually become a very expensive print server. NeWSprint requires configurations that either embrace remote spooling in the traditional fashion or make for very expensive distributed printing.

Even if you are ready to dedicate one of your high-speed UNIX workstations to take over half of the shared SPARCprinter's functions, your hands are tied and you must buy a computer that has a SPARC microprocessor. NeWSprint software is only available in binary form for SPARC OS, and the video controllers are only available for the SBUS.

Open Printing as such leaves a lot to be desired for those Digital Equipment Corp., Hewlett-Packard Co., IBM Corp. and Sun 68000-based system users, not to mention those Solaris 2.0 users who will buy SunOS to run on their 486 PCs. Although

other UNIX computers that support Lpd will be able to print to the SPARCprinter, they will not be able to take advantage of the WYSIWYG functionality and other advanced features of NeWSprint unless their applications support the SPARCprinter.

It will be tough to find one of the other Open Systems vendors offering Open Look with X11/NeWS on their own platforms even though AT&T ships these in the SVR4 sources. In the future, it will be interesting to see if SunPics will license the NeWSprint compiler to run on architectures other than SPARC and whether it will allow other companies to develop SPARCprinter controllers for different buses like Turbochannel and the PC/AT.

Another more flexible strategy for WYSIWYG PostScript Network-based printing on a high-speed print engine is possible. MiLAN's FastPort allows direct spooling through a high-speed TCP/IP connection to a network-connected PostScript printer. Using these in conjunction with software from Adobe and WYSIWYG applications, a complete environment is formed that

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excels NeWSprint's. In addition, it will function with all BSD-based systems, many System V implementations from the major manufacturers such as AT&T, HP and IBM, as well as any Sun system, including the older 68000-based machines. Since software is available in source form from almost every vendor mentioned, this solution is by and large portable to any UNIX computer.

Print Server: Efficient Data Communication

By placing a printer directly on a TCP/IP network by way of a print server, all the workstations have a direct 10-Mb/s path to the printer. This gives the printer a status on the network equal to the networked workstations. A UNIX print server consists of at least one parallel or serial printer port, an Ethernet interface, microprocessor and memory. It is a small and inexpensive dedicated computer that provides translations of TCP/IP-encoded data and sends them directly to the printer.

For instance, the MiLAN FastPort features all three of the most popular Ethernet cabling types, one serial port and one parallel port for \$899. Host software is supplied in binary form for one of 12 different systems on a floppy disk for free. A single binary copy is licensable for as many users as needed since MiLAN encourages every computer to spool itself. Source code is available for a slight additional fee. The FastPort can send sustained data transfers through the Parallel port at speeds approaching 1 Mb/s, and as such it can stay ahead of the fastest print engines on the market. The 80186 CPU's sole task is to run TCP/IP code translation, so it can transfer data at a faster rate than a workstation-based parallel port.

Adobe TranScript: Translation

Sun was not the first company to put a PostScript-style compiler on a UNIX computer. In 1985 Adobe released TranScript, which has been widely used for years in the UNIX community to put files in a PostScript format and aid their printing on a PostScript printer. TranScript is avail-

able in source and binary form and for single-user and site licensing. One binary copy sells for \$495, source is available for \$1,795 and a source site license can be bought for \$2,950. It can be compiled to run on a variety of BSD and System V computers and is even sold on an OEM basis through many manufacturers such as NeXT Computer Inc., Apple Computer Inc., IBM and Solbourne Computer Systems Inc. In fact, one of the reasons that Adobe has sold 25,000 licenses is

that prior to selling NeWSprint, Sun sold and supported TranScript.

TranScript is very similar to NeWSprint and is its senior by more than five years. When Sun created NeWSprint, it built almost all of TranScript's functionality into it. NeWSprint's PreLimn is roughly equivalent to TranScript translation functions. TranScript allows files that are not in a PostScript form to be translated into them and then ships them off to the printer. It interfaces to

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the UNIX spooler and allows native PostScript printing to be done from UNIX utilities like `vi` while making sure to insert banner pages correctly and additional logos to the print job. NeWSprint and TranScript both ship with executable filters that translate ASCII to PostScript, `ditroff` to PostScript, `troff (C/A/T)` to PostScript and Tektronix 4014 files to PostScript. While Sun provides special handlers for certain printers and environments to make printing easier, TranScript is easy to install and use. It can have special filters and shell scripts written for it quite easily since it is available in source form.

High-Speed PostScript Printer

The speed of remote spooling under `lpd` was not an issue 10 years ago when most computer rooms had line printer engines that were slower than the fastest sustained serial data transfers through minicomputers. However, with laser printer engines that can be driven at speeds exceeding 20 ppm,

bottlenecking through slow parallel and serial connections means that there is no easy way to achieve fast printing in a UNIX environment when spooling in the traditional way. A class of printers is now entering the market with 17-ppm print engines, fast graphics microprocessors, true PostScript compatibility and high-speed parallel interfaces.

One example of such a printer is the HP HP113i, which can be bought without PostScript for under \$4,000. It features large paper trays, the most advanced Canon engine, and a superfast parallel port that can be driven in its normal mode at 70 KB/s, which is more than five times faster than most of its competitors. Although the printer features Ethernet connectivity by buying interface controllers that fit in the printer, HP has not yet released a controller for TCP/IP, only Novell Inc. NetWare. By simply attaching a MiLAN FastPort to the parallel port and buying Adobe PostScript for it, you will have a very reliable, superfast TCP/IP Ethernet-based PostScript

printer for around \$7,000.

By combining Adobe's TransScript, a WYSIWYG application like Frame from Frame Technology Corp., a FastPort UNIX print server and one of the superfast printers on the market today, you can easily buy a solution with the same level of performance as NeWSprint for less than \$10,000. This solution will allow you to implement distributed printing in a much more flexible manner than is possible with remote spooling. It will also allow users to implement a custom environment over a period of time while not sacrificing the hardware that is already owned, such as older PostScript printers and workstations. ➔

Dan Eakins cofounded MiLAN Technology, Sunnyvale, CA, in 1990 to provide the UNIX networked user with fast, efficient, affordable network solutions. Eakins, who holds a BA from St. John's College in Annapolis, MD, currently serves as the company's vice president of sales and marketing.



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Workgroup Page Printers (12-24 ppm)

Company Model	Print speed (ppm)	Engine	Emulations	Interfaces	Resolution (dpi)	NEWSprint compatible	PostScript	Print method	Duty cycle (pgs./mo.)	Special features	Price
Acom Computer Inc. , 2250 Obispo Ave., Long Beach, CA 90806. Circle 200											
LX4817	17	Canon	IBM 5219, 3812-1, 3816-1, HP LaserJet II (PCL 4&5)	parallel, serial, LAN	300	yes	opt.	laser	50K	(2) 250 sheet input trays, 1,000-sheet input, duplex printing, envelope feeder	\$5,995
LX4820	20	C.ltoh	IBM 5219, 3812-1, 3816-1, HP LaserJet II (PCL 4&5)	parallel, serial, LAN	300	yes	no	electronic beam	100K	(2) 250 sheet input trays, 1,000-sheet input, duplex printing	\$5,995
LX3824	24	Kentek	IBM 5219, 3812-1, 3816-1, HP LaserJet II (PCL 4&5)	parallel, serial, LAN	300	yes	no	LED	160K	(2) 250 sheet input trays, 1,200-sheet input, duplex printing, 1,400-sheet output, stacker	\$9,995
Advanced Technologies International , 355 Sinclair-Frontage Road, Milpitas, CA 95035. Circle 201											
LC-6815	15	Fuji-Xerox	AutoCAD ADI, HP PCL 4, HP-GL, Epson FX-80, Diablo 630, line printer, Tektronix 4014	parallel, RS-232 serial	300	yes	opt.	laser	20K	11x17 paper handling, compact desktop size, 3 paper trays, multiple graphics emulations, CCITT Group III/IV	\$5,695
1570 (DWY)	15	Ricoh	AutoCAD ADI, HP PCL 4, HP-GL, Epson FX-80, Diablo 630, line printer, Tektronix 4014	parallel, RS-232 serial	300	yes	opt.	laser	25K	letter and legal paper trays, labels or card stock, CCITT Group III/IV	\$6,995
LC-6820	20	Ricoh	AutoCAD ADI, HP PCL 4, HP-GL, Epson FX-80, Diablo 630, line printer, Tektronix 4014	parallel, RS-232 serial	300	yes	opt.	laser	70K	11x17 paper handling, 2 input trays, 2 output trays, offset jogger, face-down stacking, CCITT Group III/IV	\$15,995
ALPS America , 3553 North First St., San Jose, CA 95134. Circle 202											
LSX1600	16	MKE	HP LaserJet II	parallel, serial	300	no	opt.	laser	50K	integrated paper trays, envelope feeder	\$3,295
AMT Inc. , 765 Flynn Road, Camarillo, CA 93012. Circle 203											
Tracjet Laser	16	Pentax	HP PCL 4, IBM ProPrinter	parallel, serial	300	no	no	laser	50K	tractor feed (uses paper, labels, card stock)	\$4,695
American Computer Hardware Corp. , 2205 South Wright St., Santa Ana, CA 92705. Circle 204											
LZR 1230	12	Toshiba	HP LaserJet Plus, Diablo 630, Epson FX-80	parallel, RS-232C serial	300	no	no	laser	25K	multi-sheet feeder, jogger, envelope feeder	—
LZR 1260 Series	12	Toshiba	HP LaserJet Plus	parallel, RS-232C/422 serial, AppleTalk	300	no	yes	laser	25K	multi-sheet feeder, jogger, envelope feeder	—
LZR 1560	15	Xerox-Fuji	HP LaserJet IIP	parallel, RS-232C/422, serial, LocalTalk	300, 400	no	yes	laser	20K	1-3 paper trays, 250-sheet output trays, multi-sheet feeder	—
LZR 1650	16	Mita	HP LaserJet IID	parallel, RS-232C/422 serial	300	no	no	laser	30K	envelope feeder, high capacity input replaces lower tray w/ 2,500-sheet feeder	—
LZR 2450, LZR 2450D	24	Kentek	HP LaserJet IID, DEC LN03+, Diablo 630ECS	parallel, RS-232 serial	300	no	no	laser	80K	high capacity sheet feeder, high capacity output stacker, second 3 1/2-inch floppy drive	—

Workgroup Page Printers

Company Model	Print speed (ppm)	Engine	Emulations	Interfaces	Resolution (dpi)	New/Sprint compatible	PostScript	Print method	Duty cycle (pgs./mo.)	Special features	Price
BGL Technology Corp., 451 Constitution Ave., Camarillo, CA 93012. Circle 205											
Mark 9115	15	Fuji	HP LaserJet Series II, HP-GL (7475, 7550, 7580, 7585), DEC LN03+, Tektronix 4010/4014, Versatec, CalComp 906/907, Magnum Code, Bar Codes, Sixel Graphics, Z ⁺ emulation	parallel, RS-232C/422A serial, AppleTalk, Ethernet, HPIB, Versatec, Dataproducts, IEEE-488	300, 400	yes	yes	laser	25K	11x17 paper handling, 1-3 input trays, envelope feeder, 2 output trays, 12-18 MB RAM, 20-MHz/80386 plus an Intel 80960 RISC coprocessor, 50 MB drive, auto-emulation sensing, simultaneous protocol support	\$7,995
Mark 9120	20	Ricoh	HP LaserJet II, HP-GL (7475, 7550, 7580, 7585), DEC LN03+, Tektronix 4010/4014, Versatec, CalComp 906/907, Magnum Code, Bar Codes, Sixel Graphics, Z ⁺ emulation	parallel, RS-232C/422A serial, AppleTalk, Ethernet, HPIB, Versatec, Dataproducts, IEEE-488	300, 400, 480	yes	yes	laser	80K	11x17 paper handling, 1-3 input trays, 3 output trays, envelope feeder, 20-32 MB RAM, 20-MHz/80386 plus an Intel 80960 RISC coprocessor, 50 MB drive, auto-emulation sensing, simultaneous protocol support	\$16,075
Data General Corp., 4400 Computer Dr., Westboro, MA 01580. Circle 206											
6771	16	—	HP LaserJet II	parallel	300	no	no	laser	25K	expandable memory	\$3,499
6772	16	—	HP LaserJet II	parallel	300	no	yes	laser	25K	expandable memory	\$4,499
6773	16	—	HP LaserJet II	parallel	300	no	yes	laser	25K	expandable memory	\$3,999
Data Systems Hardware, 22560 Glenn Drive, Ste. 112, Sterling, VA 22170. Circle 207											
L15PS	15	Fujitsu	HP	parallel, serial, Appletalk, SCSI	400	no	yes	laser	30K	11x17 paper handling, 3 input trays	\$6,995
Dataproducts Corp., 6219 DeSoto Ave., Woodland Hills, CA 91367. Circle 208											
LZR1560	15	Fuji-Xerox	HP	parallel, serial, Appletalk, SCSI	300, 400	no	yes	laser	30K	11x17 paper handling	\$5,695
LZR2455D	24	Kentek	HP	parallel, serial	300	no	yes	LED	120K	duplex printing	\$16,995
Digital Design Inc., 8400 Baymeadows Way, Jacksonville, FL 32256. Circle 209											
656	15	Ricoh	HP LaserJet II	parallel, serial	300	no	no	laser	25K	MICR printing, letter and legal paper trays	—
Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571. Circle 210											
DEC Laser 3200	13	Xerox	HP PCL 4	parallel, serial	300	no	opt.	laser	35K	duplex printing, multiple paper-size handling, envelope feeder	\$4,799
DEC Laser 3250	13	Xerox	HP PCL 4	parallel, serial	300	no	yes	laser	35K	duplex printing, multiple paper-size handling, 2 input trays, envelope feeder	\$6,299
Turbo PrintServer 20	20	Ricoh	HP PCL, Tektronix 4010/4014, ReGIS	DECnet, Ethernet, TCP/IP	300	no	yes	laser	70K	duplex printing, 3 input trays, 2 output trays, offset stacking, accounting, access restrictions	\$19,495
Eastman Kodak Co., 901 Elmgrove Road, Rochester, NY 14653. Circle 211											
Ektaplus 7016 Printer	16	Kodak	HP PCL 4, HP-GL, Epson FX-80, IBM ProPrinter, Diablo 630	parallel, RS-232C serial	300	no	yes	laser	15K	multiple-size paper handling, 500-sheet paper tray, envelope feeder, 7 languages, 17 font cards	\$5,495
Electronic Form Systems, 2395 Midway Road, Carrollton, TX 75006. Circle 212											
3821	15	Ricoh	HP, Epson, NEC, Diablo	parallel	300	no	no	laser	25K	MICR printing	\$6,995
Facit Inc., 400 Commercial St., Manchester, NH 03101-1107. Circle 213											
P5160	16	Sharp	HP	parallel	300	no	opt.	laser	25K	250-sheet tray, envelope feeder, Turbo PostScript, auto-emulation switching	\$2,929
Fujitsu Computer Products of America Inc., 2904 Orchard Pkwy., San Jose, CA 95134. Circle 214											
VM2200	22	Fujitsu	HP LaserJet II, HP-GL, Epson FX-80, IBM ProPrinter, Diablo 630, Qume Sprint, Fujitsu M304X Line Printer	parallel, serial	300	no	no	laser	50K	11x17 paper handling, large-format paper handling	\$9,995

Workgroup Page Printers

Company Model	Print speed (ppm)	Engine	Emulations	Interfaces	Resolution (dpi)	NeWSprint compatible	PostScript	Print method	Duty cycle (pgs./mo.)	Special features	Price
Genicom Corp. , One Genicom Drive, Waynesboro, VA 22980. Circle 215											
7170	17	Toshiba	HP PCL 5, IBM XL24E	parallel, serial	300	no	opt. laser	50K		duplex printing, 1,500-sheet input and output trays, emulation sensing, upgradable memory, multiple paper-size handling, envelope feeder	\$4,495
Hewlett-Packard Co. 19310 Pruneridge Ave., Cupertino, CA 95014. Circle 216											
33491A	17	Canon	HP PCL 5	parallel, serial, Ethernet, LocalTalk, Token Ring	300	yes	opt. laser	50K		(2) 500-sheet paper trays, multiple paper-size handling, envelope feeder	\$5,495
IBI, a division of DH Technology Inc. , 15070 Avenue of Science, San Diego, CA 92128. Circle 217											
1600C	16	Pentax	HP PCL 4, Code V	parallel, serial	300	yes	yes laser	75K		continuous form printing, paper and label sizes from 8 1/2x11	\$7,295
IBM Corp. , 1133 Westchester Ave., White Plains, NY 10604. Circle 218											
3816 01S	24	Kentek		serial	240	no	yes laser	40K	—		\$18,910
3816 01D	24	Kentek		serial	240	no	yes laser	40K		duplex printing	\$26,640
Image Systems Inc. , 2515 McCabe Way, P.O. Box 19743, Irvine, CA 92713-9743. Circle 219											
IS2020	20	Olympus	HP LaserJet II/D, HP PCL 4, Epson FX-850, IBM ProPrinter XL	parallel, RS-232C/422 serial	300	no	no electronic imaging	100K		duplex printing, 1,500-sheet input, 1,500-sheet output	\$5,995
Megaserve	30	Olympus	HP LaserJet II, DEC LN03+, Diablo 630 ECS	parallel, RS-232/422 serial, SCSI, Ethernet	300	yes	opt. Ion Imaging	150K		2,500 sheet input, up to 3,000-sheet output	\$21,995
Megaserve	45	Olympus	HP LaserJet II, DEC LN03+, Diablo 630 ECS	parallel, RS-232/422 serial, SCSI, Ethernet	300	yes	opt. Ion Imaging	250K		2,500-sheet input, up to 3,000-sheet output	\$29,995
Interface Systems Inc. , 5855 Interface Drive, Ann Arbor, MI 48103. Circle 220											
7812	12	Fujitsu	HP LaserJet II, IPDS/AFP, 4028, 3812, 3287	RS-232C serial	300	no	no laser	25K		dual bin, dual host, 61 resident fonts	\$6,950
Intergraph Corp. , One Madison Industrial Park, Huntsville, AL 35807. Circle 221											
ILP2217	22	Panasonic	HP-GL	parallel	400	no	opt. laser	10K	—		\$11,500
Kentek Information Systems , 2945 Wilderness Place, Boulder, CO 80301. Circle 222											
K3	24	Kentek	HP PCL 5, DEC LN03+	parallel, RS-232C/422 serial, Ethernet	300	no	opt. LED	120K		duplex printing, 2 input trays, heavy paper and card, high-capacity input and output, 75 or 500 envelope feeder	—
K4	24	Kentek	HP PCL 5, DEC LN03+	parallel, RS-232C/422 serial, Ethernet	300	no	opt. LED	120K		duplex printing, 2 input trays, heavy paper and card, high-capacity input and output, 75 or 500 envelope feeder	—
Kyocera Electronics Inc. , 100 Randolph Road, Somerset, NJ 08875. Circle 223											
F-3000A	18	Kyocera	HP LaserJet II, Diablo 630, Epson FX-80, IBM ProPrinter, Qume Sprint II, Line Printer	parallel, RS-232C serial	300	no	no laser	50K		2 paper trays, face-up/face-down output	\$4,995
F-5000A	15	Kyocera	HP LaserJet II, HP-GL 7475A, Epson FX-80, Diablo 630, NEC Spinwriter, IBM ProPrinter, Qume Sprint II	parallel, RS-232C serial	300	yes	no laser	40K		3 paper trays, face-up/face-down output	\$7,995

Workgroup Page Printers

Company Model	Print speed (ppm)	Engine	Emulations	Interfaces	Resolution (dpi)	NeWSprint compatible	PostScript	Print method	Duty cycle (pgs./mo.)	Special features	Price
Linotype-Hell Co. , 425 Oser Ave., Hauppauge, NY 11788. Circle 224											
Printer 60	12	Copal		parallel, RS-232 serial, LocalTalk, Ethernet	600	no	yes	laser	10K	multiple paper-size handling	\$21,000
Mita Copystar America , 777 Terrace Ave., Hasbrouck Heights, NJ 07604. Circle 225											
LP-3155	15	Mita	HP LaserJet II, Epson, Diablo 630, IBM ProPrinter	parallel, RS-232C serial	300	no	opt.	laser	20K	user-replaceable imaging unit, envelope feeder	—
NewGen Systems Corp. , 17580 Newhope St., Fountain Valley, CA 92708. Circle 226											
TurboPS/600T	12	Copal	HP LaserJet, HP-GL	parallel, RS-232C serial, SCSI, AppleTalk	600	yes	yes	laser	10K	expandable memory to 48 MB, tower feed 4-bin input feeder, image to plate capability, second 250-sheet tray slot	\$14,995
TurboPS/1200T	12	Copal	HP LaserJet, HP-GL	parallel, RS-232C serial, SCSI, AppleTalk	1,200	yes	yes	laser	10K	expandable memory to 48 MB, tower feed 4-bin input feeder, image to plate capability, second 250-sheet tray slot	\$16,995
Nissho Electronics USA , 17320 Red Hill Ave., Irvine, CA 92714. Circle 227											
LN-2248	20	Minolta	HP-GL, Line Printer	serial, parallel, AppleTalk, Ethernet	480	no	yes	laser	60K	11x17 paper handling, heavy-paper stock applications	\$18,700
Output Technology Corp. , 2310 North Fancher Road, Spokane, WA 99212-1381. Circle 228											
LaserMatrix 1000 Model 5	16	AOC	HP LaserJet III, Epson FX, IBM ProPrinter II	parallel, RS-232C serial	300	no	no	laser	25K	tractor feed	\$5,495
LaserMatrix 1000 Model 6	16	AOC	HP LaserJet III, Epson FX, IBM ProPrinter II	parallel, RS-232C serial	300	no	yes	laser	25K	tractor feed	\$5,995
Pentax Technologies , 100 Technology Drive, Broomfield, CO 80021. Circle 229											
Laserfold 240	16	Pentax	Epson FX-80	parallel, RS-232C serial	240	no	no	laser	15K	continuous-form media	\$3,495
Printronix , P.O. Box 19559, Irvine, CA 92713. Circle 230											
L1016	16	Pentax	HP LaserJet III, IBM ProPrinter, P-Series line printer, IGP	parallel, RS-232/422 serial	300	no	opt.	laser	10K	continuous-form media, built-in floppy drive	\$6,995
L2324	24	Kentek	HP LaserJet IID, DEC LN03+, Tektronix 4010/4014, IGP	parallel, RS-232C/422 serial	300	no	no.	LED	120K	multiple trays, high-capacity feeder/stacker	\$14,495
Printware Inc. , 1385 Mendota Heights Road, St. Paul, MN 55120. Circle 231											
1217 Pro-III	12	Copal	Autologic ICL subset, Printset	parallel, RS-232C serial, AppleTalk	1,200	yes	yes	laser	10K	multiple paper-size handling	\$17,990
QMS Inc. , One Magnum Pass, Mobile, AL 36618. Circle 232											
QMS-PS 1700	17	Canon	HP PCL 4, HP-GL, DEC LN03+	parallel, RS-232C serial, LocalTalk, Ethernet, Token Ring	600	yes	yes	laser	50K	direct Ethernet connection with TCP/IP protocol, spool to RAM, simultaneously active interfaces, auto-emulation switching, Intel 80960 CA/25-MHz RISC processor, duplex printing, CCITT Group IV	\$7,995
QMS-PS 2000	20	Ricoh	HP PCL 4, HP-GL, DEC LN03+	parallel, serial, LocalTalk, Ethernet	300	yes	yes	laser	70K	direct Ethernet connection with TCP/IP protocol, spool to RAM and hard disk, simultaneously active interfaces, auto-emulation switching 25-MHz RISC processor, duplex printing, CCITT Group IV	\$15,995
Qume Corp. , 260 South Milpitas Blvd., Milpitas, CA 95035. Circle 233											
CrystalPrint Express	12	Sanyo	HP LaserJet II	parallel, RS-422 serial, AppleTalk	600	no	yes	laser	10K	2 paper trays, multiple paper-size handling, Weitek RISC microprocessor	\$3,495

Workgroup Page Printers

Company Model	Print speed (ppm)	Engine	Emulations	Interfaces	Resolution (dpi)	NeWSprint compatible	PostScript	Print method	Duty cycle (pgs./mo.)	Special features	Price
Rosetta Technologies , 9417 Princess Palm Ave., Tampa, FL 33619. Circle 234											
RT3216	16	Pentax	HP LaserJet II	parallel, RS-232 serial	300	no	no	laser	50K	continuous-form media	\$4,995
RT4224	24	Kentek	HP LaserJet IID, HP PCL 5, DEC LNO3+	parallel, RS-232/422 serial	300	no	opt.	LED	120K	dual paper trays, emulation switching	\$12,995
RT4324	24	Kentek	HP LaserJet IID, HP PCL 5	parallel, RS-232/422 serial	300	no	opt.	LED	120K	duplex printing	\$17,995
Sharp Electronics Corp. , Sharp Plaza, Mahwah, NJ 07430. Circle 235											
JX-9700	16	Sharp	HP LaserJet II, Epson FX, IBM ProPrinter, IBM Graphics Printer, Diablo 630	parallel, serial	300	no	no	laser	15K	2 paper trays, envelope feeder	\$2,295
Siemens Nixdorf Printing Systems L.P. , 5500 Broken Sound Blvd., Boca Raton, FL 33487. Circle 236											
2030-1	24	Kentek	HP LaserJet IID, HP LaserJet Plus, HP PCL 5, DEC LN03+, AFP/IPDS, 3287, 3812, 3816	parallel, serial RS-232C/422	240	no	yes	LED	120K	duplex printing, 2 paper trays, dual emulations, selectable job offset stacking, multiple-form handling, envelope feeder, 3 1/4-inch floppy drive	\$19,800
2030-2	24	Kentek	AFP/IPDS 3827, 3820, IBM 3825	S370Bus & Tag, EIA/SDLC	240	no	no	LED	150K	remote print manager supported, 2 paper trays, dual emulations, selectable job offset stacking, multiple-form handling, envelope feeder	\$38,042
SRS Imaging , 15 Hammond, Ste. 312, Irvine, CA 92718. Circle 237											
Imager 1200L	12	Copal	HP-GL, HP-GL2, CalComp 907	SCSI	600	yes	yes	laser	10K	11x17 paper handling, multiple paper-size handling	\$11,995
Imager 1200L XP	12	Copal	HP-GL, HP-GL2, CalComp 907	SCSI	900	yes	yes	laser	10K	11x17 paper handling, multiple paper-size handling	—
SunPics , 2550 Garcia Ave., Mountain View, CA 94043. Circle 238											
SPRN-400	12	Xerox	HP-GL, HP-GL2, CalComp 907	SBus	300, 400	yes	yes	laser	5K	multiple paper-size handling, fast raster printing	\$2,695
Synergystex International Inc. , 3065 Nationwide Pkwy., Brunswick, OH 44212. Circle 239											
CF1000	16	Pentax	HP LaserJet II	parallel, RS-232C serial	300	no	no	laser	—	continuous form printing	\$4,995
Talaris Systems Inc. , 6059 Cornerstone Ct. West, San Diego, CA 92121. Circle 240											
1590 Printstation	15	Ricoh	HP PCL, Diablo 630 ECS, DEC LN03+, Tektronix 4014	parallel, serial, SCSI, Ethernet, SNA/BSC	300	yes	no	laser	25K	dual paper trays, 400-sheet output stacker, custom plug-in cartridge slots for custom fonts, forms, and overlays, TCP/IP support	\$7,490
1590-T Printstation	15	Ricoh	HP PCL, Diablo 630, DEC LN03+, Tektronix 4014	parallel, serial, SCSI, Ethernet, SNA/BSC	300	yes	opt.	laser	25K	dual paper trays, 400-sheet output stacker, custom plug-in cartridge slots for custom fonts, forms, and overlays, TCP/IP support	\$8,990
2090-S Printstation	20	Ricoh	HP PCL, Diablo 630 ECS, DEC LN03+, Tektronix 4014	parallel, serial, SCSI, Ethernet, SNA	300	yes	opt.	laser	70K	duplex printing, auto-emulation switching, LP and LPR print commands, multiple paper-size handling, 2 paper trays, TCP/IP support	\$13,990
2090 Printstation	20	Ricoh	HP PCL, Diablo 630, DEC LN03+, Tektronix 4014	parallel, serial, SCSI, Ethernet, SNA	300	yes	opt.	laser	70K	duplex printing, auto-emulation switching, LP and LPR print commands, multiple paper-size handling, 3 paper trays, TCP/IP support	\$18,990
Texas Instruments Inc. , P.O. Box 202230, Austin, TX 78720-2230. Circle 241											
MicroLaser XL	16	Sharp	HP LaserJet II, Epson FX, Diablo 630, IBM ProPrinter	parallel	300	no	opt.	laser	10K	multiple paper-size handling, envelope feeder, label and invoice printing	\$2,399

Workgroup Page Printers

Company Model	Print speed (ppm)	Engine	Emulations	Interfaces	Resolution (dpi)	Newsprint compatible	PostScript	Print method	Duty cycle (pgs./mo.)	Special features	Price
MicroLaser XL Turbo	16	Sharp	HP LaserJet II, Epson FX, Diablo 630, IBM ProPrinter	parallel, RS-232/422 serial, AppleTalk, SCSI	300	no	yes	laser	10K	multiple paper-size handling, envelope feeder, label and invoice printing	\$3,649
Toshiba America Information Systems Inc. , 9740 Irvine Blvd., Irvine, CA 92718. Circle 242											
PageLaser GX400	17	Toshiba	HP PCL 5, IBM XL24	parallel, RS-232 serial, Ethernet, Token Ring	300	yes	opt.	laser	50K	2 input trays, multi-purpose feeder, large capacity feeder and stacker, mail box sorter	\$4,499
Troy, A division of Pierce Co. Inc. , 2331 South Pullman St., Santa Ana, CA 92705. Circle 243											
315 MICR Printer	15	Ricoh	HP LaserJet Plus II, Diablo 630, Epson FX-80, IBM ProPrinter II	parallel	300	no	no	laser	25K	—	\$11,495
Unisys Corp. , P.O. Box 500, Blue Bell, PA 19424-0001. Circle 244											
AP 9215-1	15	Ricoh	HP LaserJet Plus, Epson FX-80, IBM ProPrinter	parallel, serial	300	no	no	laser	25K	multiple trays, 1.5 MB RAM, job-separation mode	\$5,995
XES Inc./Versatec Products , 2710 Walsh Ave., Santa Clara, CA 95051. Circle 245											
Xerox 8810	15	Xerox	HP-GL, HP-GL2, CalComp 906/907, V-80	parallel, RS-232C serial	400	yes	opt.	laser	20K	1-3 input trays, 11x17 paper handling, floppy disk, check plots from CAD/CAM	\$9,995
Xerox Corp. , 800 Long Ridge Road, Stamford, CT 06904-1600. Circle 246											
4213	13	Xerox	HP LaserJet IID, Xerox 4045, IBM 3287, 3812, 5219, 5224, 4224	parallel, RS-232C/422 serial	300	no	opt.	laser	45K	duplex printing, (2) 250-sheet input trays	\$4,795

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X WORLD

The X Information Xchange

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Roy Wiemann

Don't miss the largest and most comprehensive conference and exhibition on the X Window System ever held on the East Coast this April 27-30 in New York. XWorld offers over 40 comprehensive tutorials, lectures, technical sessions, executive briefings, panel discussions, product education seminars, group application classes and more. Whether you are an experienced technical user, an MIS manager, a systems integrator, a

software developer or strictly a beginner, XWorld can provide you with valuable information on how to use the X Window System more effectively and efficiently—no matter what market you're in.

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Conference At A Glance

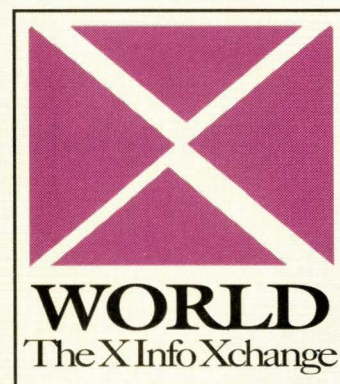
(Partial listing only.)

- Advanced Motif programming—*Dan Heller; Z-Code Software*
- Designing applications for GUI platforms—*Jeff Vogel; Electronic Book Technologies*
- Code walk-through of an Xt application—*Dave Sklar; Electronic Book Technologies*
- Intro to Windows for X programmers—*Anthony Parisi; Belmont Research*
- Programming to the OI Toolkit—*Gary Aitken, Tom LaStrange, Steve Misek; Solbourne*
- Microsoft Windows with X—*Chris Holmes; VisionWare*
- X on the PC—*Peter Shaw; AGE*
- Intro to C++—*David Bern; Software Technology Transfer*
- The Looking Glass Adventure—*Jeff Barr; Visix Software*
- X and color consistency—*Chuck Adams; Tektronix*
- The cost of X—*Judy Estrin; NCD*
- Successful training for newcomers to the X Window Programmers in the 90s—*Byron Druss; Bluestone Consulting*
- Creating Motif-like Window Managers outside the UNIX environment—*Russ Sprunger; Spectragraphics*
- Systems administration to the X window system—*Bruce Hunter; Root Creations*
- PC and X integration—*Steve Auditore; The X Business Group*
- Common APIs to GUIs—*Alain Rappaport; Neuron Data*
- Project life cycle & the X Window—*Brian Keller; ADP*
- MIS meets X—*Steve Mikes; New York Stock Exchange*

Plus:

Mark Snitily & Thomas Roell of SGCS • James L. Peterson of IBM • Jim Fulton of NCD • Mike Harrigan of NCD • Michael Foody of Visual Edge • Bruce Hanson of US West • Rick Thomas of UNIX Systems Labs • Heather Rose of SUN • John Theyung of NYSE • Keith Packard of MIT X Consortium • Tom Pierpoint of TeleSoft • Mark Linton of Silicon Graphics

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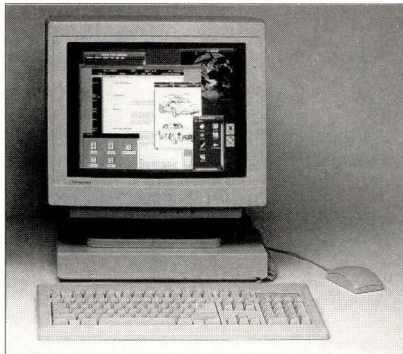


NEW PRODUCTS

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

Tek Shows New X Terminals

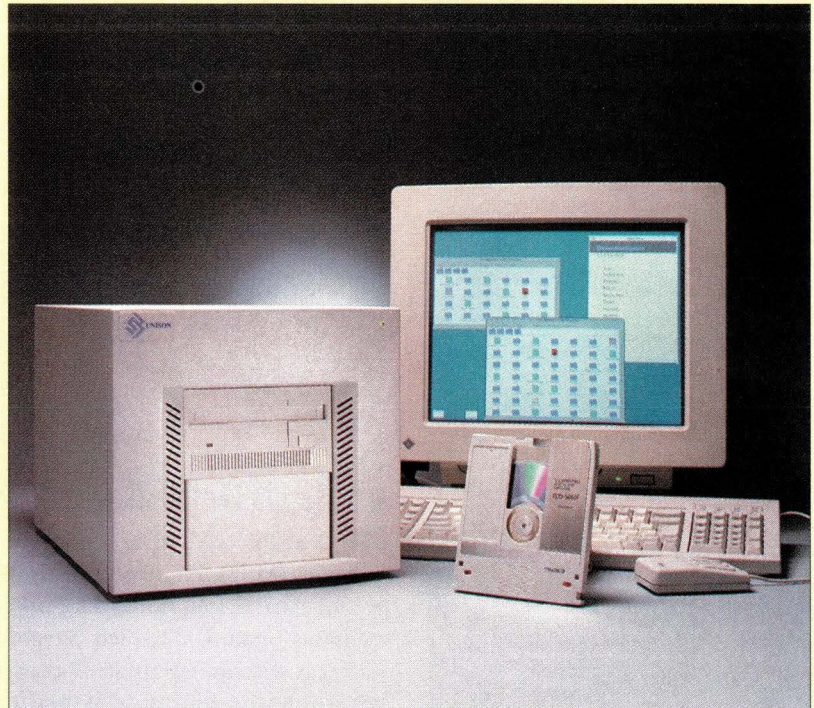
Tektronix has introduced two new series of X terminals, a high-end and a low-end offering. The high end is composed of the XP330 Series: four models based on the MIPS R3000 processor and the Texas Instruments graphics chip, the TI34020 running at 40 MHz. The XP330 series includes the 19-inch XP334 that offers 256 shades of gray and 1,280-by-1,024 resolution, with pricing that begins at \$3,495. The XP336, meanwhile, is a 17-inch display that offers 1,152-by-900 resolution and 256 colors for \$4,750. The XP337 has a 19-inch screen, resolution of 1152 by 900 and 256 colors at \$4,995. Finally, the XP338 has a 19-inch screen, 1,280-by-1,024 resolution and 256 colors at \$5,995.



The low end includes the TekXpress XP12 and XP18, both based on the TI TMS 34020 graphics processor running at 32 MHz. The XP12 has a 19-inch monochrome monitor with 1,280-by-1,024 resolution and a price of \$2,495. The XP18 has a 17-inch color display with 256 colors, 1,152-by-900 resolution and a price of \$3,795.

Tektronix Inc.

Wilsonville Industrial Park
P.O. Box 1000
Wilsonville, OR 97070-1000
Circle 117



Super-Fast Rewritable Optical Drive

Unison Information Systems has unveiled the fastest rewritable optical drive for the Sun marketplace. The Opti/Max, with an average access time of 7.6 milliseconds and read/write transfer rates of 1 Mb/s, is faster than many magnetic disks. The company claims the system is as much as 10 times faster than existing rewritable optical drives.

The 5 1/4-inch Opti/Max is intended for use with SCSI-based UNIX workstations. It features Unison's SCSI-to-SCSI caching controller and an uninterruptible power supply. The system makes use of the standard Sun driver. An additional 600 MB of capacity is available with each optical cartridge.

Prices range from \$5,000 to \$10,000, depending on the subsystem's performance capabilities. Quantity discounts are available.

Unison Information Systems Ltd.

21 Walsh Way
Framingham, MA 01701
Circle 116

Z-Mail Delivered

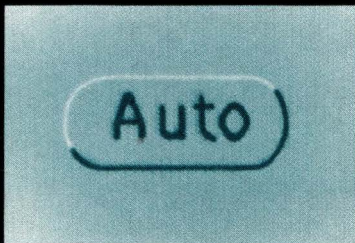
Z-Mail, the email manager that has been a cult favorite in the X Window System community, has been shipped as a new product by a company founded by the man who wrote it, Dan Heller. Z-Mail 2.1 is now available from Z-Code Software. Heller says the 2.1 release offers several enhancements over older versions, including the ability to revise and expand the configurability of X Window System interfaces. Moreover, users can specify fonts, window colors and so forth with interactive dialogs.

In addition, Z-Mail Version 2.1 gives systems administrators new installation options via a network-based license server. The product also provides rule-based mail-management filters, mail sorting and mail searching by text pattern or date. It also supports graphics, fax, voice and video. Pricing is \$295 for a single-user license, \$1,395 for a five-user license and \$2,495 for 10-user license.

Z-Code Software Corp.

23 Summerhill Ct.
San Rafael, CA 94903
Circle 118

The Beginner's Guide To SunOS Disk Drive Installation.

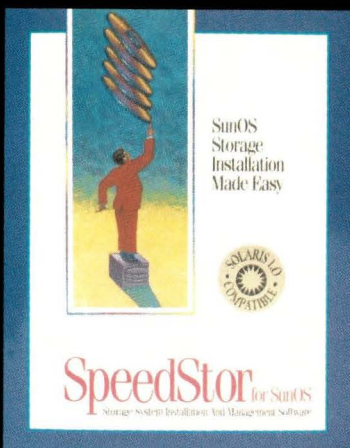


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 STORAGE DIMENSIONS

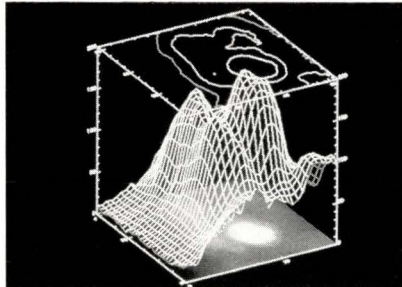
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Circle No. 48 on Inquiry Card

NEW PRODUCTS

Combined Math and Sci-Viz

IMSL has introduced a product that combines its own C/Math/Library with the Interactive Data Language scientific-visualization system from Research Systems Inc. of Boulder,



CO. Called IMSL/IDL, the product provides IMSL's library of roughly 200 mathematical functions. The library contains functions in such categories as linear systems, eigensystem analysis, interpolation and approximation, quadrature, differential equations, transforms, nonlinear equations, optimization, statistics and random-number generation, complex intrinsics and so on.

This library is then linked to RSI's IDL product that then allows the user to rapidly produce graphical representations of the math involved. Data can be displayed in not only standard 2D displays—line plots, scatter plots, bar graphs and so on—but also several 3D representations, ranging from polygons to pixel images. Pricing varies.

IMSL Inc.
14141 Southwest Freeway
Suite 3000
Sugar Land, TX 77478-3498
Circle 119

Tool Purifies Software

An object code debugger that can find memory use problems has been introduced by Pure Software. Called Purify, the product checks C or C++ programs at the instruction level to find problems that are otherwise difficult to discover. It inserts additional checking instructions directly into the object code produced by existing compilers. The instructions then check every memory read and write to find such things as memory leak errors (in which memory is allocated but no

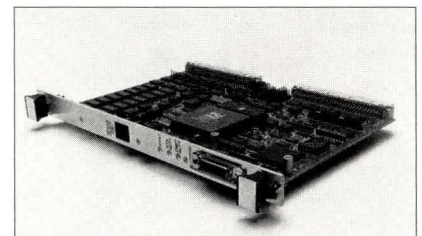
longer accessible to the program) and memory access errors.

The company says that memory errors are among the most common, but the most difficult to discover, causes of otherwise mysterious systems crashes. Purify will check all code, including third-party libraries. It can work with C and C++ code on SPARC-based platforms running SunOS 4.1.1, and it supports the CC, cc and GNU 1.x compilers. Pricing begins at \$2,750 for a single, floating network license.

Pure Software Inc.
2111 Grant Road
Los Altos, CA 94024
Circle 120

Etherplex Multiplexer

Systech has announced an Ethernet multiplexer designed to operate with Ethernet terminal servers. Named Etherplex, the product is meant for computers that use the VMEbus for I/O connections, though the company says an SBus version is planned. Etherplex consists of a VME board and software that communicates with TCP/IP terminal servers without burdening the host systems with interrupts and context switching.



In effect, Etherplex off-loads TCP/IP and Telnet processing from the host entirely. The company says that this results in significantly higher performance for the network. It says that Etherplex maintains an output rate of nearly 4,000 characters per second per user, supporting up to 80 users. The product is based on an Intel i960 and is compatible with the company's Unplug multiplexer. Pricing begins at \$3,995.

Systech Corp.
6465 Nancy Ridge Drive
San Diego, CA 92121
Circle 121

C++ Compiler with Source-level Debugger

A C++ compiler with a source-level debugger has been introduced by Liant Software. Called LPI-C++, the product is a 32-bit compiler meant for commercial applications. It is a complete 2.1 implementation of C++ as described in *The Annotated C++ Reference Manual* by Ellis and Stroustrup. In addition, LPI-C++ comes bundled with the company's CodeWatch debugger.

CodeWatch, which is also available on Liant's other compilers, lets programmers enter and display all names as they appear in the C++ source code, and programmers can evaluate and monitor C++ expressions in the debugger using C++ syntax. Also, CodeWatch has a class-browsing facility that lets programmers review class-member information and class hierarchies. Pricing begins at \$695.

Liant Software Corp.

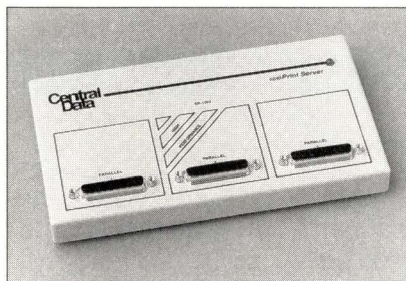
959 Concord St.

Framingham, MA 01701-4613

Circle 122

SCSI Printer Server

Central Data has introduced a product that provides parallel I/O expansion via the SCSI bus. Called the scsiPrinter Server, the product provides three parallel ports. One is DMA-driven and has parallel rates of up to 236 KB/s. The other two operate at 10 KB/s to 15 KB/s. For additional expansion, up to seven scsiPrint Servers may be daisy-chained for a total of up to 21 parallel ports.



The product is packaged in a small metal chassis measuring 8 by 4 1/2 by 1/2 inches. Drivers are available for Sun SPARCstations, as well as several other RISC systems, including the HP-Apollo 9000 and IBM RS/6000.

Pricing begins at \$795.

Central Data Corp.

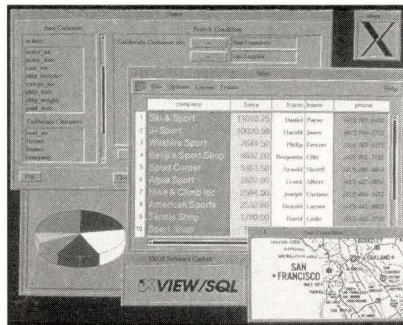
1602 Newton Drive

Champaign, IL 61821-1098

Circle 123

SQL Graphical Tool

A graphical query tool that enables nonprogrammers to manipulate UNIX relational databases has been introduced by iXOS Software. The product, iXVIEW/SQL, provides the user with an easily understood graphical interface while automatically generating SQL queries in response to a number of different inputs. These can include scroll bars, dialog boxes, pull-down menus and so on.



Currently, iXVIEW/SQL supports Oracle and Informix. The company says it can be extensively customized to fit individual workgroups and that it supports many different data types, including but not limited to, text, graphics and scanned images. It runs under OSF/Motif and on SPARC-based systems and the IBM RS/6000, with a minimum of 8 MB of RAM and 10 MB of free hard-disk space. Pricing begins at \$995 for a single-user copy. A five-seat network package is \$4,500; a 10-seat package is \$6,995.

iXOS Software GmbH

1030 West Maude Ave.

Suite 512

Sunnyvale, CA 94086

Circle 124

Spectrograph Software

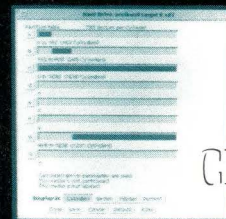
Software that allows a Sun workstation to function as a real-time recording spectrograph has been introduced by Entropic Research. Called the Entropic Recording Spectrograph 2000, the product provides research-

The Power User's Guide To SunOS Disk Drive Management.



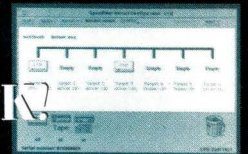
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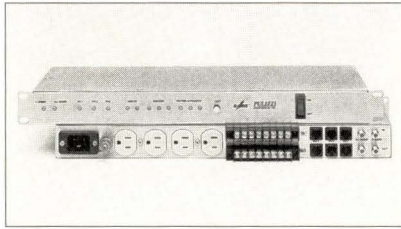
quality signal acquisition and display on SPARC-based workstations. It allows users with the proper coprocessors and peripherals to simultaneously digitize data, store it in UNIX files and produce a variety of real-time graphical displays. The company says its applications include speech and acoustics research, communications channel monitoring, machine and structural vibration analysis, industrial process monitoring and so on.

The product currently supports VMEbus and SBus plug-in coprocessors for Sun workstations. Pricing starts at \$4,990 for an initial run-time license, with package pricing available for kits including DSP plug-in boards.

Entropic Research Laboratory Inc.
600 Pennsylvania Ave. SE
Suite 202
Washington, DC 20003
Circle 125

Power Protection Product

A multiple-line power protector has been introduced by Pulizzi Engineering. The CC 1653 Communication



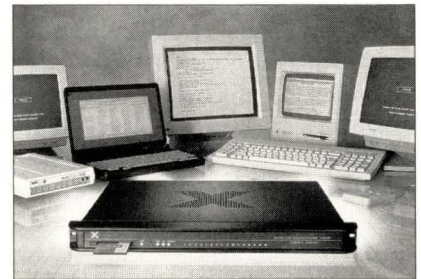
Control System is a power protector designed to withstand spikes and surges as extreme as lightning strikes on AC power, RF and telephone lines. In addition, it provides EMI/RFI suppression on low-frequency circuits, such as telephones, AC power lines, motor drives and position sensors.

The product is packaged in a 19-inch rack-mountable steel enclosure with a height of 1 3/4 inches and a 6-inch depth. NEMA connectors are available for AC lines, RJ45 for phone/data lines, terminals for motor drives and sensor circuits as well as F-type connectors for coaxial cables. Pricing is \$450.

Pulizzi Engineering Inc.
3260 S. Susan St.
Santa Ana, CA 92704
Circle 126

Multiprotocol Terminal Server

Xplex has announced the MAXserver 1600, a 16-port multiprocessor Ethernet communications server. The product's memory can be expanded up to 5 MB with single in-line memory modules. The MAXserver can get its software from a network-based host or via a memory card; the 1600s come with a memory card interface. The machines can, in fact, handle either reprogrammable flash cards or one-time-programmable cards.



The 1600 supports a variety of communications schemes. It supports TCP/IP for UNIX, LAT for DEC systems and, as an option, TN3270 for communication with IBM machines.

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For configuration and network management, the product supports the Simple Network Management Protocol and DEC network management tools.

There are two models. The base configuration with 1 MB of RAM is priced at \$3,195. A high-end configuration with 3 MB of RAM is priced at \$3,395.

Xplex Inc.
330 Codman Hill Road
Boxboro, MA 01719-1708
Circle 127

Under-\$6K Laser Printer

A laser printer using PostScript Level 2 has been introduced by Dataproducts. The LZR 1560 printer accommodates paper sizes of up to 11 by 17 inches and can output at either 300-by-300 dpi or 400-by-400 dpi, even though, the company says, the product does not require the use of 300-by-300-dpi-resolution enhancement methods.

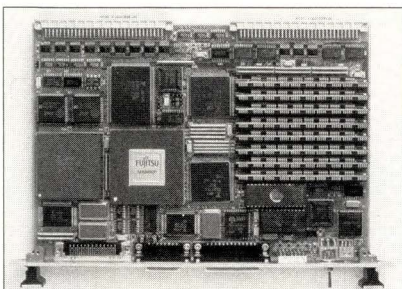
The LZR 1560 can operate at a duty cycle of 30,000 pages per month and can produce 15 pages per minute. The machines come with AppleTalk, RS232, Centronics parallel and SCSI hard drive ports. For a single-paper-tray model, pricing begins at \$5,695; for a double-tray, \$6,495; and for a triple-tray, \$6,995.

Dataproducts Corp.
6219 De Soto Ave.
P.O. Box 746
Woodland Hills, CA 91365-0746
Circle 128

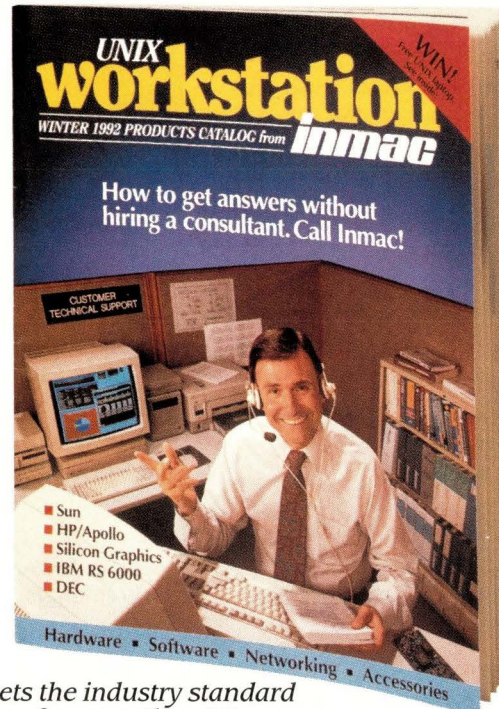
VMEbus SBCs

The availability of the first SPARCstation 2-compatible VMEbus single board computers, utilizing a high-performance MBus internal architecture, was recently announced by Themis Computer.

The SPARCard 2LC features a 40-



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Circle No. 31 on Inquiry Card

MHz SPARC processor—targeting OEM embedded applications with the functionality of a high-end single board computer—and offers twice the performance of a comparably featured Motorola MVME167 68040.

The SPARCard 2SE features two standard SBus peripheral controller slots that can support a variety of SBus cards including graphics and communications modules. Also featured are 16- to 64-MB DRAM and SCSI-2, which are not available on the 2LC.

Both boards are supported with a 64-KB cache, Ethernet, two serial channels and a full IEEE 1014-87 VMEbus interface, as well as extensive SunOS software support. Prices are listed as \$5,995 for the SPARCard 2LC and \$7,995 for the SPARCard 2SE.

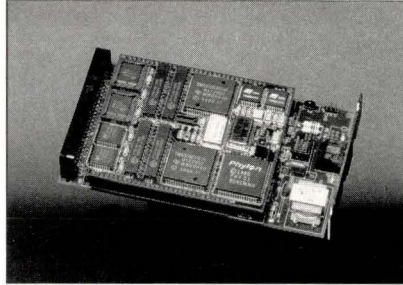
Themis Computer
6681 Owens Drive
Pleasanton, CA 94588
Circle 129

High-Speed SBus Modem

An internal SBus high-speed modem communication board for Sun SBus-

based workstation users has been introduced by Helios Systems.

Incorporating a V.32 bis running at a rate of 14,400 bps, the Helios COM+MODEM allows any Sun work-



station or Sun-compatible user with an available SBus slot to send and receive faxes from within raster, PostScript or ASCII files with a fax resolution of up to 203 by 196 dpi.

Complete hardware and software is competitively priced and available at \$850 per unit. Quantity discounts are available.

Helios Systems
1996 Lundy Ave.
San Jose, CA 95131.
Circle 130

Parallel Make

Aggregate Computing plans to introduce NetMake, a parallel version of the UNIX make utility. Netmake allows software developers to compile individual program modules on separate machines on a computer network.

By sending individual routines to the most appropriate remote machines to be compiled in parallel and then collecting the results on one machine that performs the linking process, Net-Make increases the speed of computing tasks, improves productivity and work quality and makes efficient use of all network resources. With Net-Make, developers can use networks of machines as a single, aggregate computing resource.

Aggregate Computing's product will be available on Sun-3 and Sun-4 platforms in March, with support for additional platforms to follow.

Aggregate Computing Inc.
5217 Wayzata Blvd.
Suite 125
Minneapolis, MN 55416
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Island Graphics Presents

Island Graphics has introduced IslandPresents, an easy-to-use WYSIWYG presentation and business-graphics package for UNIX workstation users. Also included in the package are new modules, IslandChart and IslandTable.

The main module, IslandPresents, includes Outliner, Slide Editor and Organizer views. The program provides color 35mm slide output to selected film recorders and output to overhead transparencies. Many word-processing features such as spell-check, search and replace, footnotes, hyphenation and import/export features may be utilized. Text can be assigned any of 35 PostScript fonts and from one to 72 point sizes in a series of styles.

IslandChart lets users create bar charts, pie charts, line charts and many other color business graphic tools. Users can import data in Wingz, Lotus 1-2-3 and WordPerfect file formats. IslandChart comes with professionally designed chart formats, which are modifiable and easily customized.

IslandTable is a table editor that

allows users to create full-color WYSIWYG tables incorporating high-quality text and graphics. Tables can be pasted and imported into IslandWrite and IslandDraw111111.

This product will be available for Open Look in Q1 '92 and an OSF/Motif version for HP workstations will ship in Q2 '92. Pricing for IslandPresents, including all four modules, is \$995. IslandChart will be available separately for \$495.

Island Graphics Corp.
4000 Civic Center Drive
San Rafael, CA 94903-7413
Circle 132

Memory Upgrades

New 16-MB memory modules for Sun SPARCstation IPX and ELC workstations have been announced by Camintonn/Z-RAM. These compatible memory modules cost-effectively upgrade the Sun workstations to their maximum capacity of 64 MB.

Also released for Silicon Graphics' newest 4D/RPC Indigo workstation are both an 8-MB and a 32-MB memory kit. Both kits are compatible with

SGI's personal Iris workstation models 4D/30 and 4D/35 and offer a maximum system capacity of 128 MB. Other memory products designed for Silicon Graphics include 8- and 32-MB memory kits for more than 13 Power Series Iris workstation models. Pricing for a Sun 16-MB memory module is \$1,580. A Silicon Graphics 8-MB memory kit is \$800; the 32-MB kit is \$3,200.

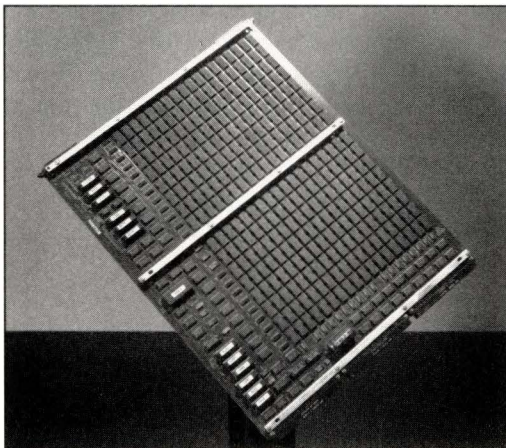
Camintonn/Z-RAM
22 Morgan
Irvine, CA 92718-2022
Circle 133

Visual Color

Visual Technology introduced the TX600C, a color display station utilizing a full implementation of the X Window System. This new model is available as either a complete system or as a base only, offering integrators, resellers and end users the ability to customize the TX600C.

Featuring a 32-bit 68030 25-MHz X server processor, coupled with a 32-bit TI 34020 40-MHz graphics processor and 6 MB of memory, the TX600C is

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designed with the features and performance level needed for display-intensive tasks such as CAD/CAM, geographical information systems, mapping and medical imaging, as well as desktop publishing.

The complete system, called the TX600C-19, is a plug-and-play solution that includes the color-based, 19-inch, 1,280-by-1,024, high-resolution monitor; keyboard; and mouse. Pricing for the TX600C-19 is \$5,865.

Visual Technology Inc.
120 Flanders Road
Westboro, MA 01581
Circle 134

Data Acquisition

Strawberry Tree has released a device that enables workstation users to directly acquire scientific data in real time. This Ethernet-based device, the I/O Station 464, is designed for use in applications such as laboratory data collection and industrial-process control, where scientific workstations are becoming prevalent.



With a data-acquisition device on a network, the user can easily access data generated by an experiment or production process. This allows the processing power of the workstation to perform various analyses at high speed. Another attribute of this prod-

uct is that multiple users can access data, allowing easier coordination in project-related applications. Remote data acquisition is possible during hazardous experiments.

The I/O Station 464 accepts plug-in modules with inputs for measuring analog and digital signals, outputs for control, accuracy to 16 bits and speeds to 1 million samples per second. Price is \$3,995.

Strawberry Tree Inc.
160 South Wolfe Road
Sunnyvale, CA 94086
Circle 135

Young Minds With New Ideas

Young Minds has announced the newest release of the complete X11R5 and GNU software on CD-ROM. UNIX users can now compile software binaries directly off CD-ROM disk from 340 MB of UNIX source code. Included are full core and contributed sources for X11R5 and complete GNU Project materials from the Free Software Foundation.

All of the GNU and X11R5 source code and text files have been full-text indexed, allowing for convenient Boolean and phrase searching with Young Minds' Viewtool. This CD-ROM retrieval software has easy-to-use Open Look and Motif interfaces that replace the need to `grep`. Viewtool is available for the Sun-3, Sun-4 and SPARCstations; IBM RS/6000; DG Aviiion; and DEC Ultrix. The price for the disk is \$49.95.

Young Minds Inc.
1910 Orange Tree Lane
Suite 300
Redlands, CA 92374
Circle 136

RGB Video Scan Converter

RGB/Videolink has released the 1600U video scan converter featuring an optional RS-232 port for remote control from a computer. The converter transforms high-resolution computer graphics to a television format in real time. This permits recording of computer graphics on any video-tape

recorder as well as connection to video projectors, teleconferencing systems and composite monitors.

The 1600U measures the horizontal and vertical frequencies of the input signal and sets up the parameters for the sharpest picture, correct aspect ratio and size of the output image. There is a direct interface to video projectors and other display equipment accepting signals up to 32 kHz. The 1600U can map any number of input lines to any number of output lines, allowing the ideal screen resolution of all images.

The converter also features a zoom function to display the entire screen or window and can also be used to



manipulate computer images with aspect ratios that differ from those of the NTSC or PAL screen.

This model automatically synchronizes to all computer displays with horizontal scan rates from 20 to 90 kHz, including PCs, Mac IIs and workstations from Sun, DEC, HP/Apollo, Silicon Graphics and others. Both interlaced and non-interlaced inputs are accepted. Price is \$19,495.

RGB Spectrum
2550 Ninth St.
Berkeley, CA 94710
Circle 137

Artecon + Micropolis = 2-GB Drive

As a result of a joint alliance with Micropolis, Artecon has introduced the largest capacity disk drive available for Sun workstations.

The company claims the new 2-GB drive, while increasing capacity and performance, is the lowest cost-per-megabyte in the industry. Prices start \$3,595.

Artecon Inc.
2460 Impala Drive
Carlsbad, CA 92008-7236
Circle 138

Mercury Tests X Window System-based Software

Mercury Interactive announced XRunner, advanced automated application testing for X Window System software. XRunner generates programmable test scripts, automates test execution and records test results.

XRunner allows the developer to generate test "scripts" directly from any X Window System-based application. While it records a human operator's mouse and keyboard inputs, XRunner monitors the application's screen output and automatically produces test scripts in a C-like programming language called test script language (TSL). Because these generated test scripts are fully programmable, test engineers can edit recorded scripts, code tests of their own or combine both approaches, all in TSL.

Software developers will notice a savings due to lower QA testing costs, faster time to market and enhanced product quality. XRunner currently brings computer-aided software testing (CAST) to Sun SPARCstations running the X Window System. X-Runner sup-

ports both Motif and Open Look. Versions supporting the HP 9000/700, DEC's DECstation and IBM's RS/6000 will be available soon. XRunner is available in two configurations: XRunner/D provides full development and automated execution support; XRunner/E comes with test execution support only. A basic XRunner configuration, priced at \$35,000, includes 2 XRunner/D and three XRunner/E floating licenses.

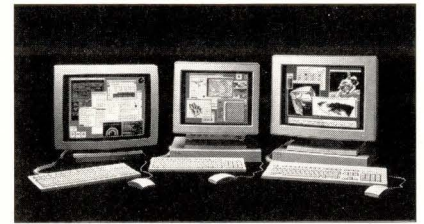
Mercury Interactive Corp.

3333 Octavius Drive
Santa Clara, CA 95054
Circle 139

RISC-based X Terminals Debut

Three high-resolution RISC-based X terminals, including what the company claims is the first X terminal to use the R3000 MIPS Computer Systems chip, are now available from Network Computing Devices.

The family consists of the NCD19r, a monochrome unit based on the R3000; the NCD17r, a color unit based on the 88100; and the NCD19g, a gray-scale unit employing the 88100. All three



models sport resolutions of 1,280 by 1,024 pixels and employ NCD's X11R4 software, which is available either as a PROM set or as downloadable code. The terminals run NCDwm, NCD's Motif-compatible window manager, and can operate with Open Look and XView.

The NCD19r, priced at \$2,895, replaces the NCD19. The new model provides two times the power of the NCD19, yet uses a monitor with 15% smaller volume. The NCD17r supplements the NCD19c, introduced in July 1991, and uses a more compact Sony Trinitron monitor. It sells for \$5,395. And the 19g, the company's first gray-scale unit, sells for \$4,495.

Network Computing Devices Inc.
359 North Bernardo Ave.
Mountain View, CA 94043
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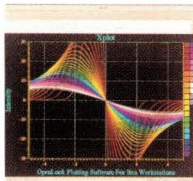
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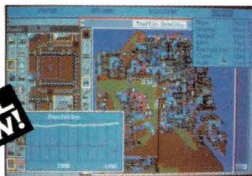
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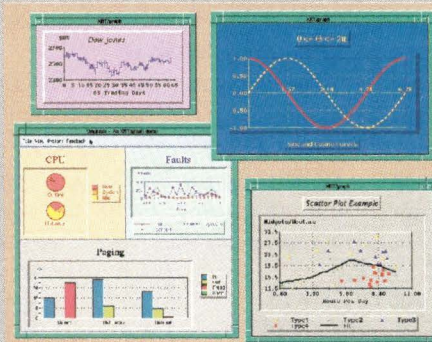
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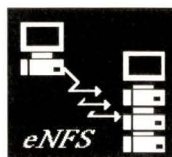
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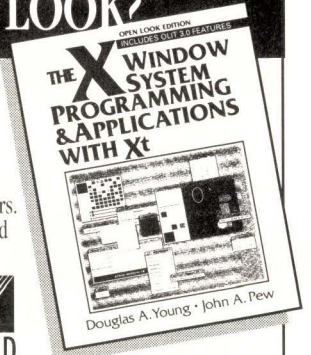
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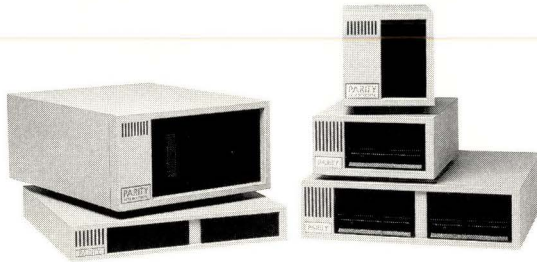
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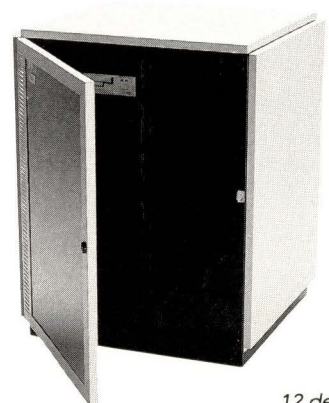
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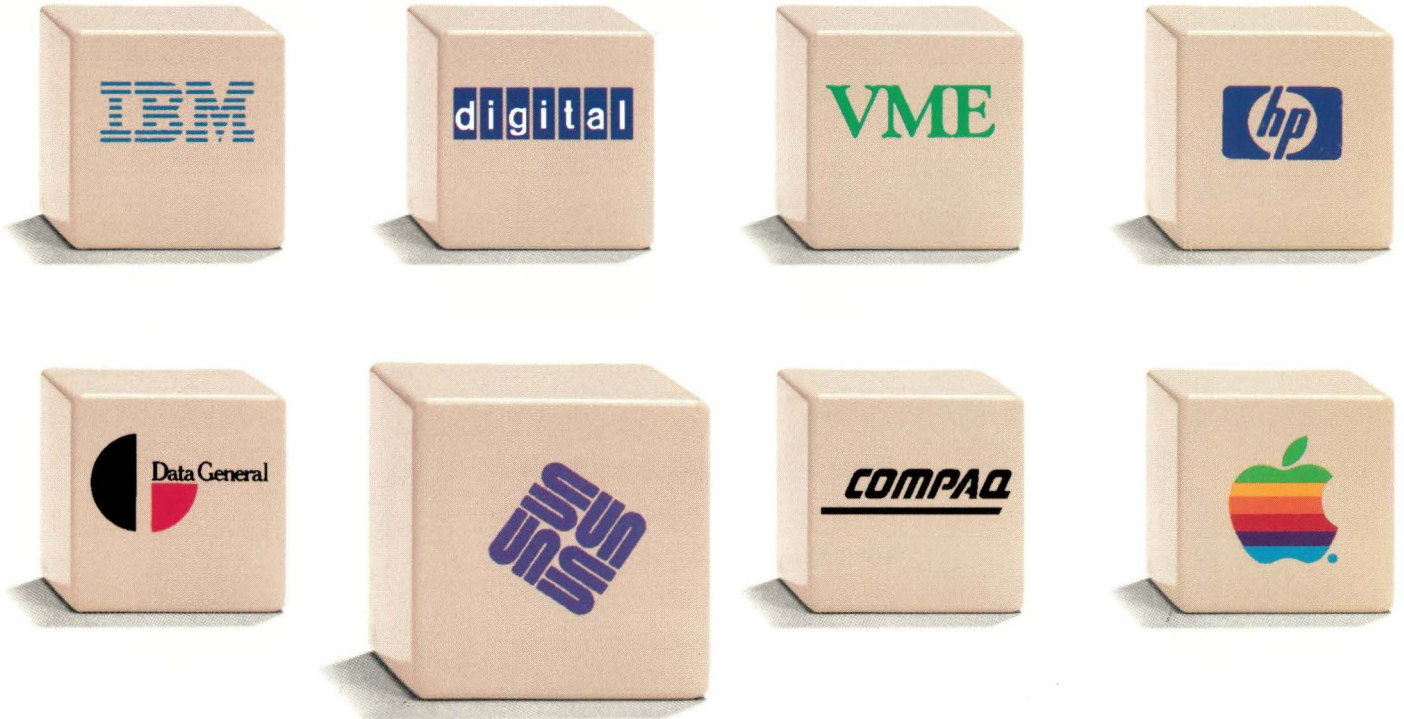
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