SUNEXPERT

An Independent Forum for Open Systems

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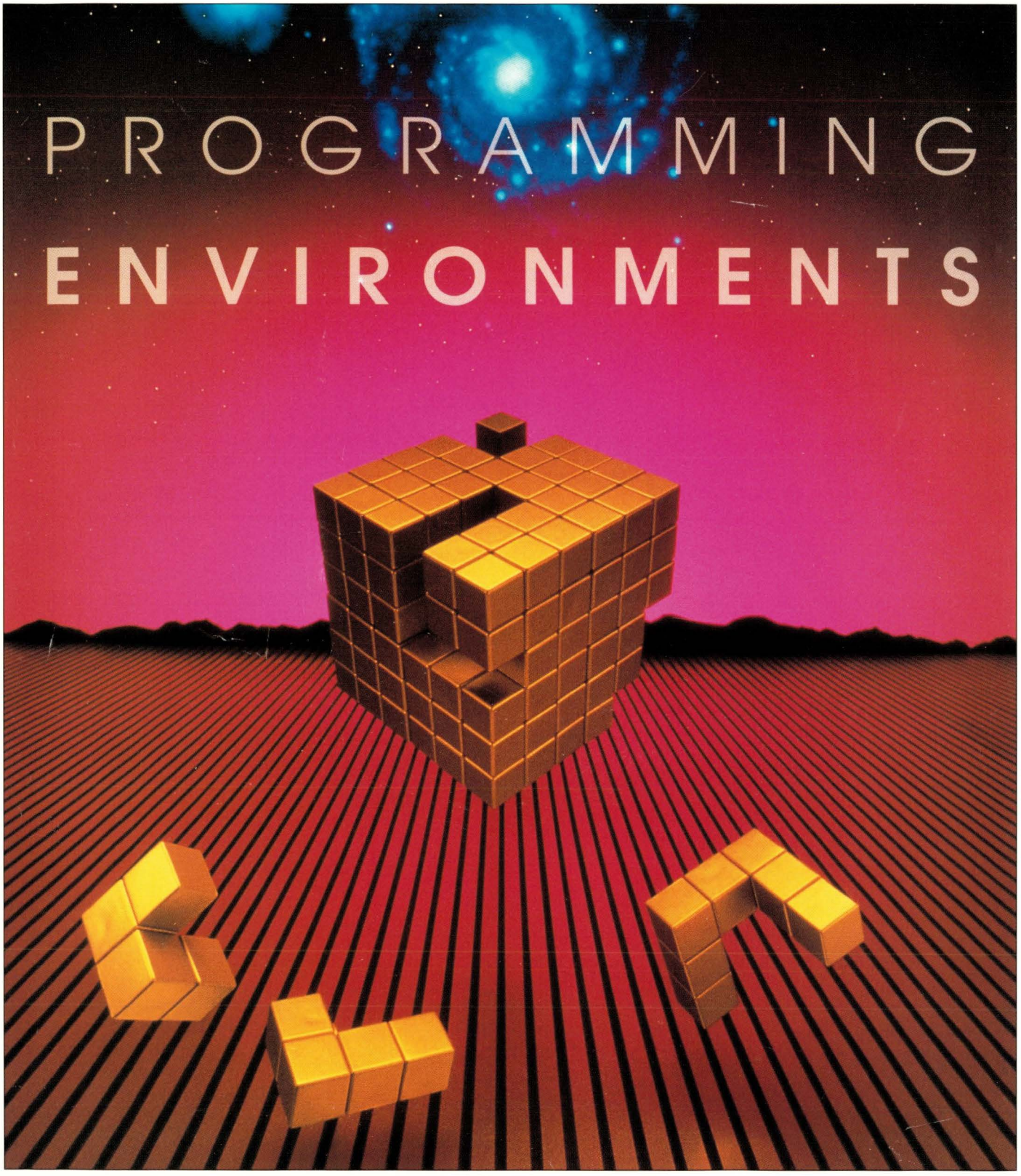

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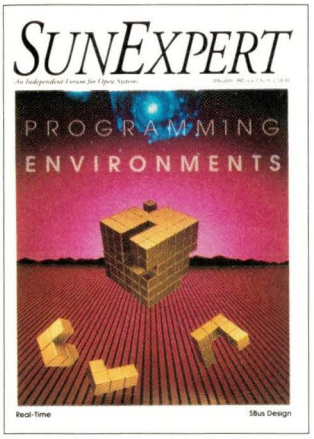
CONTENTS

JANUARY 1992 VOLUME 3 NUMBER 1



Cover Photograph
by Chris Alan Wilton

FEATURES

NEWS

COLUMNS

DEPARTMENTS

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

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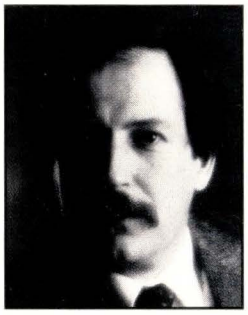
Material for publication should be sent to the attention of: Doug Pryor at the above address or electronically mailed to dpryor@expert.com. Letters sent to the publication become the property of the publication and are assumed to be intended for publication and may be used so. *SUNEXPERT* Magazine is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

Editorial

Fanzine for UNIX

"The tips and tricks I have found in *SunExpert* make me wonder what I have been missing all these years," says a note attached to a subscription request to our circulation department. The writer, a recent convert to UNIX who borrowed a a magazine from a friend, shows the enthusiasm and sense of adventure we try to engender with every issue. Despite our misgivings or skepticism about this or that industry development, we are earnestly committed to the UNIX–SunOS, in particular–and workstation markets. "What a concept–a fanzine for UNIX folks," just about says it all. Just take a look at this issue.



Our lead feature explores programming environments. Mary Jo Foley discusses the who, what, when and where of an emerging trend toward all-in-one systems made up of compilers, editors, debuggers, browsers, analyzers and, in a few cases, management tools.

SunExpert enthusiastically welcomes S. Lee Henry to our line-up of exceptional columnists. This month she begins what we hope will be a long and fruitful relationship with the magazine in her role as system-administration guru. Her January column is the first of a two-part exploration of moving print jobs from queue to queue automatically–a cagey, time-saving trick for those of us on nets with multiple print resources.

Doug Pryor

Doug Pryor

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JANUARY 1992 VOL. 3 NUM. 1

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BPA

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Features	Subsystem Type	Artecon [1]	Brand A[2]	Brand B[3]
594 MB & 650 MB ISO Support	EOD & EOJ	Yes	No	No
Mount & unmount by any user on any mount point	EOD & EOJ	Yes	No	Yes [4]
1 GByte EOD Support	EOD	Yes	No	No
Transfer rate (average)	EOD	10 Mbits/sec [5]	7.4 Mbits/sec	7.2 Mbits/sec
Open Windows™ & command line software interface	EOD & EOJ	Yes	No	No
Software driver included free with hardware	EOD & EOJ	Yes	No	Yes
Cost for 650 MB Single EOD (Including software driver & cables)	EOD	$4,995	$4,990 [6]	$6,995 [7]
Cost for 36 GB Jukebox (Including software driver & cables)	EOJ	$39,995	$51,945	$74,900 [7]

[1] Based on the latest vendor specifications dated September 1, 1991 (specifications subject to change without notice).
[2] Based on the latest vendor specifications dated October 1991 (specifications subject to change without notice).
[3] Based on the latest vendor specifications dated 4/90 (specifications subject to change without notice).
[4] Only allows users to mount into their home directories.
[5] With Maxoptix, Tahiti 2™.
[6] Includes adaptor kits consisting of the software driver, cable and documentation. Adaptor list price is $995.00.
[7] Includes host adaptor card.

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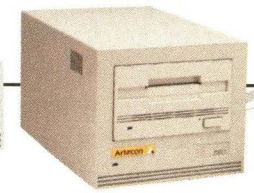

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Erasable Optical Subsystem - $4,995

DSU1-300P2 - 1GByte 5.25"
Erasable Optical Subsystem - $6,995

DSU1-300J1 - 6.5 GByte
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NEWS

SPARCalikes: It's Not Over Till It's Over

With notably few exceptions, it's been a fairly quiet year on the SPARC compatible/clone–a.k.a. SPARCalike–front. There have been more casualties than successes, and far fewer shipments than new product announcements.

But, if at first you don't succeed.... And try, try again is exactly what a number of the existing SPARCalike vendors, as well as some new players, plan on doing in 1992. Unfortunately for the participants (and users too), the SPARCalike distribution channels haven't expanded and remain untried, for the most part.

First, the familiar faces: DataTech Enterprises of Taiwan, via its City of Industry, CA-based DTK Computer Inc. subsidiary, has added two new models to its DTK Station family. Supplementing the DTK Station 1+ and DTK Station VME are the DTK Station 2 and DTK Station 2 VME. The DTK Station 2 is based on the LSI Logic Corp./Sun Microsystems Inc. 28-MIPS, 5-MFLOPS, 40-MHz CPU. The DTK Station 2 offers 8 MB of main memory, a 207-MB internal hard drive, three internal SBus slots and Solaris 1.0 as standard. The DTK Station 2 VME is based on the 40-MHz Cypress Semiconductor Inc. CPU. It includes 16 MB of main memory, a 207-MB internal hard drive, three internal 6U VMEbus expansion slots and Solaris 1.0.

DTK says it plans to ship the DTK Station 2 during the second quarter of this year; list price will reportedly be in the $6,300 range. The DTK Station 2 VME should ship during Q1, according to the company.

DTK is also one of the five companies that has gone public as a licensee of the Tera Microsystems 40-MHz microCORE chipset. It has shown a prototype of its Tera-based machine, but no word yet on pricing or delivery.

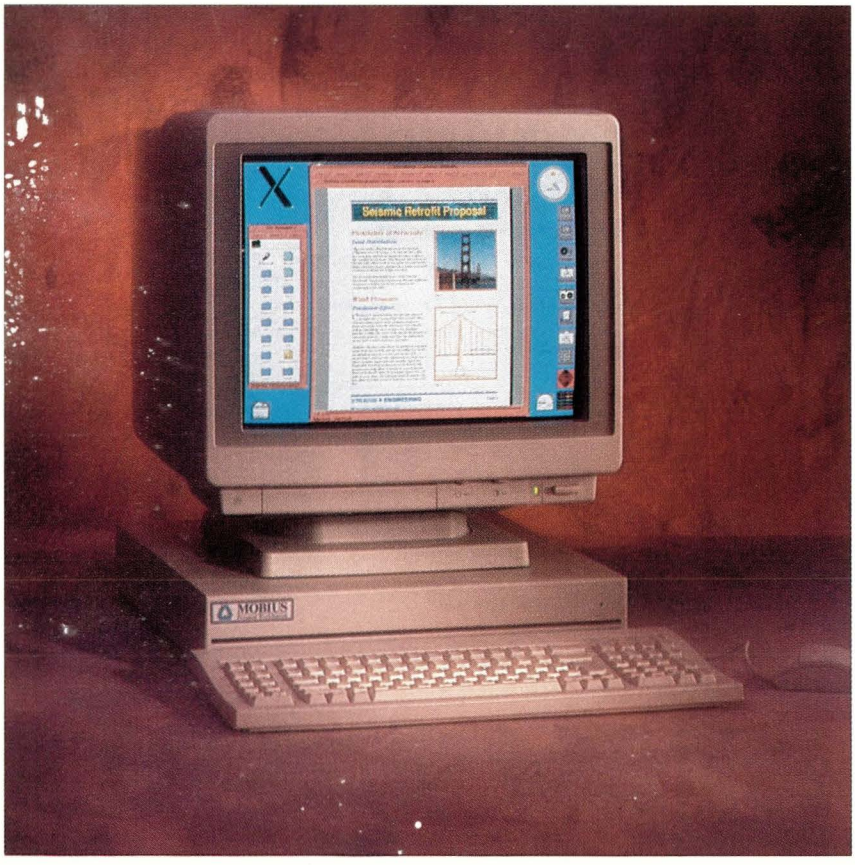
Another Taiwanese PC-clone powerhouse, Twinhead International Corp., has finally demonstrated its long-awaited Twinstation. The machine is built around a 31-MIPS, 4.2-MFLOPS, 40-MHz CPU. A standard configuration is a model equipped with a 17-inch color monitor, 210 MB of hard disk, 16 MB of memory and a Sun GX-compatible graphics accelerator. The Twinstation ships with an MBus connector for its processor module. The company says this will allow it to feature higher-speed CPUs, and even multiprocessing capabilities, in future models. There's no word on pricing or when the Milpitas, CA-based Twinhead Co. subsidiary will ship machines.

RDI Computer Corp., San Diego, CA, continues to roll out new products as fast as it can announce them. At the end of October, the company unveiled its 25-MHz RDI Solution personal workstation. The Mac-like, all-in-one machine incorporates three internal media bays. One of them is a 5 1/4-inch bay, allowing users to add optical drives, a streaming-tape backup unit or removable hard-disk drive. The machine also offers two SBus slots and an external monitor option.

The RDI Solution includes an internal 120-MB hard drive and an 1,024-by-768-pixel non-interlaced color display. The machine can support Sun's SPARCstation 1+ and 2 motherboards. Retail price is expected to start under $5,000. Shipments are slated to begin this month. And already, RDI is talking about its *next* new product, a machine built around Sun's IPX board.

On the newcomer front, there's Mobius Computer Corp., Pleasanton, CA. At the end of last year, Mobius announced its Mirage series of "SPARC-based, Mixed Media

Mobius Computer Corp.'s Mirage: a NeXT-like SPARCalike for the rest of us.



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Active Backplane™ Online Removability	Yes	No	No
Automatic kernel configuration software	Yes	No	Yes [4]
Simultaneous SCSI & IPI device support	Yes [4]	No	Yes
Individual power supply for each slot	Yes	Yes	Yes
Shock mounted drives [5]	Yes	Yes	No
External ID select	Yes	No	Yes
Pizza Box & IPC/X zero-footprint enclosures	$2,595	$3,425	$5,600
Supports CD ROM, EOD, 4mm, 8mm, 1/4" devices	$13,585	$14,485	$19,300
Single 430 MB, 3.5" Removable SCSI Disk-desktop	$26,275	N/A	$35,900
Two 1.3 GB, 5.25" Removable SCSI Disks-desktop			
Four 1.3 GB, 5.25" Removable SCSI Disks-desktop			

[1] Based on the latest vendor specifications dated September 1, 1991 (specifications subject to change without notice).
[2] Based on the latest vendor specifications dated May 15, 1991 (specifications subject to change without notice).
[3] Based on the latest vendor specifications dated 10/91 (specifications subject to change without notice).
[4] 5.25" removables only.
[5] Applies to DataVault series only.

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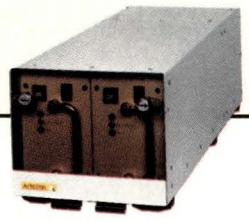

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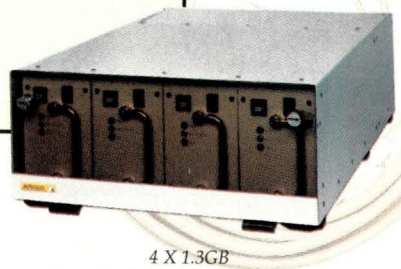

4 X 1.3GB Four Slot Data Vault with 5.2GByte, Removable Disk

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fourth quarter of 1991. Both include 17-inch color monitors with 1,152-by-900-pixel resolution. Both also come standard with two internal and one external SCSI ports and a built-in audio port. The VS-2000 includes Solaris 1.0, a graphics card, 207-MB SCSI hard disk and 8 MB of host memory.

Even though Vertos advertises that all of its products are manufactured in the United States, the company is backed by two Taiwanese investors, the PC cloner Elite Group Computer Systems and another to-be-named vendor with a U.S. manufacturing capability. The VS-1000 was in beta testing at press time; the VS-2000 was under internal evaluation. A SPARC-based notebook could be in the company's future.–*mjf*

Vicom Takes Over Sun Imaging Hardware

Sun Microsystems Inc. has passed the service, sales and support of its VX and MVX visualization accelerators to a third party. As of January 1, the Fremont, CA-based Vicom Systems Inc. acquired complete responsibility for the two products, which are Intel Corp. i860-based devices meant to give Sun workstations increased graphics and imaging performance.

Vicom will provide Sun royalties for sales of the products. The technical staff at Sun which had been responsible for the VX and MVX will be transferred to other projects–"mostly," says a Sun spokesperson, "in multimedia."

The agreement is in no way a surprise. Sun has been saying for some months that it was unhappy being in the high-performance, low-volume market the VX and MVX represented (see *SunExpert*, October 1991, Page 50). Vicom, which already remarketed the two devices, has been hinting with some vigor that it would be delighted to take the VX and MVX off Sun's hands (see *SunExpert*, November 1991, Page 58).

The transfer of the products to Vicom is also in keeping with Vicom's own corporate history. The company has acquired much of its product line from several different sources. In 1989, it purchased the image and graphics divisions of Gould, and in 1990, it purchased the Image Computer Business of Pixar. It has also made much of its own on-going relationship with Sun–it became Sun's exclusive reseller of visualization accelerators in 1991–and its intent to provide image-processing hardware to the Sun after-market.–*mjt*

Sun Resellers Get Email

To improve timeliness and reduce costs of communications between sales and its resellers, Sun Microsystems Inc. has migrated much of its relevant reseller-related information from paper to electronic mail, using TCP/IP and UUCP (UNIX-to-UNIX-CoPy)-based services from Performance Systems International (PSI) Inc. of Reston, VA.

"As of about a year ago, we found that sending hard-copy information

Vertos Technologies Inc.'s VS family incorporates Tera's SPARC processor.

Professional UNIX workstations." The company is positioning the Mirage family as NeXT Inc.-like machines, in part, by bundling Clarity Software Inc.'s Rapport Mixed Media productivity and communications software with each system.

The first member of the series is the Mobius Mirage IPS. The 25-MHz, 15.8-MIPS system comes with a 17-inch color flat-screen display. The IPS includes Solaris 1.0, 8 MB of RAM, 3 SBus slots, room for three internal drives and five built-in I/O ports, including a sound port. The system is priced at $4,990, diskless; a diskfull system starts at $6,990. Systems are available today and can be purchased directly from Mobius, or from an authorized Mobius business partner.

Another recent entrant into the SPARCalike business is Sparktrum Microsystems Inc. Sparktrum is a nine-month old company headquartered in San Jose, CA, that is reportedly a joint venture between two Taiwanese firms, Conquer Electronics and another as-yet-unidentified company.

Based on the Tera 40-MHz chipset, the Sparktrum SK400 color workstation delivers 21 MIPS and 6.15 MFLOPS. Through the addition of the Sparktrum SKB100 interface card, users can configure their systems with up to four SBus boards. Other models announced by the company include the SK402 entry-level color workstation, and SK401 monochrome workstation. Sparktrum plans to sell its machines directly and through high-end PC VARs. Shipments were expected to begin late in the fourth quarter of 1991. The company is hinting that a Tera-based SPARC notebook could be forthcoming.

Yet another Tera licensee, three-month-old Vertos Technologies Inc. of Fremont, CA, has taken the SPARCalike plunge. Vertos launched its SPARCstation 1+-compatible VS-1000 and SPARCstation 2-compatible VS-2000 systems during the

Match Game Revisited

Remember that innocuous little game we ran in last month's issue? The one where we asked you to perform the "simple" task of matching products and people with their sources, following Sun Microsystems Inc.'s corporate reorganization? We promised you answers in this issue. What follows is our best shot.

First, however, we need to add a brief note of explanation (or, perhaps more accurately, a disclaimer). When we originally developed The Game, we–and seemingly, quite a number of others–were under the impression that each new Sun business unit would be selling its own products and services directly to end users, as well as indirectly to OEMs and VARs. (After all, isn't this what you do if you're a separate profit-and-loss center?)

Since that time, we have been told by Alex Osadzinski, director of business development for Sun Labs, as well as head of software strategy for Sun Microsystems Computer Corp. (SMCC), that the individual business units will *not* sell to end users at all, even though they *will* sell to OEMs and VARs. Instead, according to Osadzinski, end-user sales of all products from all Sun business units will be handled by SMCC and SunExpress.

If you are an existing Sun customer, the answer to The Game is quite simple–all arrows lead to SMCC and/or SunExpress. But if you are a new customer, the picture becomes a bit more complicated. The answer(s) to The Game for new customers are supplied to the left. *–mjf*

Other Open Systems News

Digital Equipment Corp.

DEC made one of its mega-announcements last fourth quarter, rolling out new Network Application Support (NAS) software, new VAXes, a new software-licensing scheme and a host of new NAS services. Among the announcements were: NAS 200 and 300 for VMS and Ultrix servers, software that provides basic networking, file and data sharing among applications on PCs, Macs and/or workstations using TCP/IP, OSI, SQL, NFS and DCE; VAX 6000 Model 610 and VAX 4000 Model 550, both of which are top TPC Benchmark A performers; a new version of VMS (5.5); and other VMS-related networking products, including a transaction router, new low-cost VAXcluster systems and "multidatacenter" VAXcluster systems.

DEC unveiled its @aGlance Program, designed to integrate desktop applications, such as Lotus Development Corp.'s 1-2-3 with process-manufacturing-control applications. @aGlance is based on DEC's Application Control Architecture (ACA) services, which are part of its Network Application Support (NAS) architecture. DEC has been working with a number of process-control ven-

MATCH GAME

Answer Key:

A.	1, 3, 5, 12
B.	15
C.	2, 3, 18
D.	2, 3, 9, 13, 18
E.	19
F.	3, 12, 20
G.	1, 3
H.	8
I.	3, 6, 12
J.	10, 12
K.	5, 12
L.	1, 2, 3
M.	3, 8
N.	7
O.	14
P.	3, 4
Q.	17
R.	16
S.	1, 3
T.	14

dors that are using the @aGlance toolkit. The vendors were slated to demonstrate the capabilities of the product late last year. Four desktop applications that now sport @aGlance interfaces also were expected to debut. These were 1-2-3, Applied Info Systems' Xess spreadsheet, V.I. Corp.'s DataViews graphical editor and BBN's RS/1 statistical-analysis package. Platforms supported by @aGlance include VMS, Ultrix, MS-DOS and SunOS.

Hewlett-Packard Co.

HP has unveiled a 14-inch version of its color X-terminal. The HP 700/RX Model 14Ci uses HP's optimized version of the X Window System X11R4, and can deliver more than 52,000 Xstones of performance. The terminal can be used with the HP 9000 Series 800 of PA-RISC-based systems and servers.

Mantix Inc. has made available its Cascade program-management software on the HP Apollo 9000 Series 700 workstations. The package allows users in engineering, manufacturing, defense and telecommunications companies to generate management reports showing resource and schedule information extracted from an Oracle Corp. Oracle database system. The package also provides users with performance-analysis tools.

IBM Corp.

The National AIX-RS/6000 User Group has announced it will provide hotline support, an electronic bulletin-board system, a technical conference and training services for its members. The group also decided to change its name to the International AIX User Group (IAUG), reflecting its new, international focus. Individual membership dues are $50, annually, with student and group discounts available. For more, contact: IAUG, 9050 Capital of Texas Highway North, Ste. 300, Austin, TX 78759. Phone is (512) 795-2016; fax is (512) 343-9650; and email address is `uunet!pencom!psitx!molitor`.

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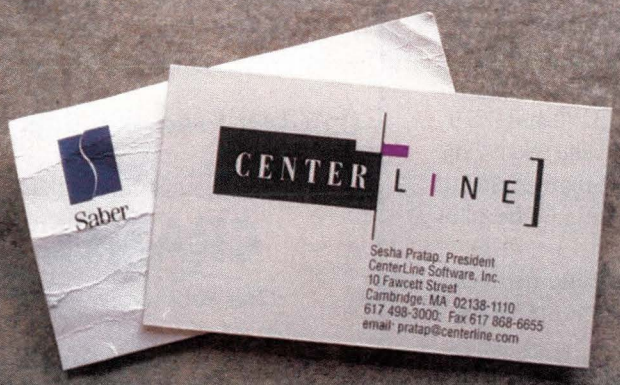

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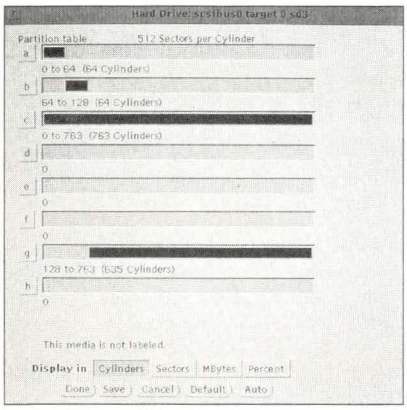


Storage Dimensions' SpeedStor

uct also provides management of SCSI hard drives using screen icons and object-oriented diagnostics. SpeedStor also saves customers money, by allowing them to use generic drives, rather than those prepared for installation by a third party. Storage Dimensions is headquartered in San Jose, CA. The product is being distributed by the Qualix Group, San Mateo, CA.

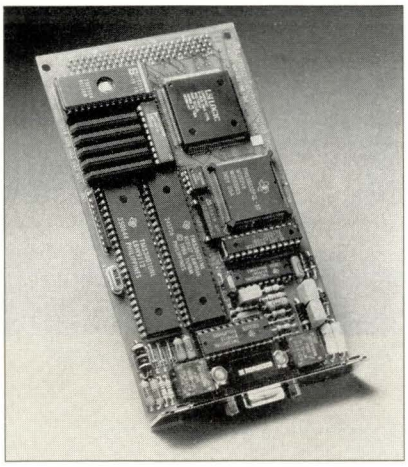
• Watch this year for a new NFS benchmark to be issued by the **Systems Performance Evaluation Cooperative (SPEC)**. Calling their specification "the first vendor-neutral standard NFS benchmark program for measuring file-server performance and capacity in heterogeneous networks," the LADDIS Group submitted the LADDIS benchmark to SPEC last summer. The spec is based loosely on Legato's 1989 nhfsstone benchmark. The benchmark software, written in C, is being ported to all of the platforms of all of the SPEC members. LADDIS stands for Legato Systems, Auspex Systems, Data General Corp., Digital Equipment Corp., Interphase Corp. and Sun Microsystems Inc.

• Sunnyvale, CA's **MIPS Computer Systems Inc.** has ported its R3000 microprocessor software-development tools to Sun-4 workstations. The RISCross family of development tools consist of the MIPS C RISCross compiler and System Programmers Package. The programmers package consists of the Sable3000 architecture simulator, the Cache3000 cache-memory simulator and the SPP/e. SPP/e is a development package, complete with debugging monitor, standalone I/O libraries and software and generation utilities for system PROMs. MIPS also is offering the C RISCompiler and Sable3000 simulator on the DEC VAX. MIPS also has announced pricing and 1992 availability of its 50-MHz, 64-bit R4000 processor. Software-developer kits for the R4000 from Microsoft Corp. and the Santa Cruz Operation were expected to be available by the end of last year. And R4000 versions of its RISCross tools are available now.

• A new version of its UNIX back-up-and-restore product, as well as a print spooler for multivendor UNIX networks, have been introduced by **Systems Center Inc.**, Reston, VA. Release 2.0 of Backup.UNET ships with an Open Look interface (that runs on Sun and other workstation vendors' platforms), support for tape jukeboxes and an intelligent device-selection feature for unattended back-up. UNIX product marketing manager Cindy Bolo says the company plans to add Motif support to the product soon. Systems Center's Unitech Software Division unveiled Print.UNET, a product that simplifies print-queue management and optimizes the use of shared printer resources. The product uses a Motif GUI. It allows system administrators to use access control lists to specify which users have access to each print queue for security purposes.

• **Aurora Technologies Inc.'s** SBus Token-Ring Card has begun shipping in volume. The card, which conforms to 802.5, operates at 4 Mb/s. It includes a 128-KB on-board buffer, optimized firmware and driver code and source-routing support that incorporates a local-ring addressing-priority scheme. The product sells for $895, with TCP/IP support included via Tr/IP software. SNA (3270 and 3770 emulation) support for the token-ring card is available from Brixton Systems of Cambridge, MA. Aurora is based in Waltham, MA.

• **Science Applications International Corp. (SAIC)** of San Diego, CA, has acquired **Market Focus Technologies Inc.**, a vendor of rapid-development



Aurora Technologies Inc.'s 4 Mb/s token ring card

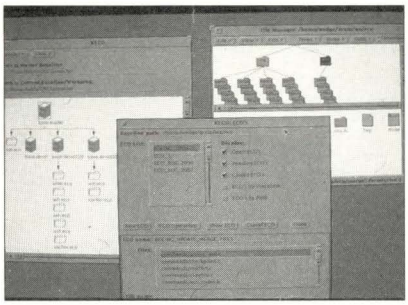
software. Market Focus' key product, Visual Programming Environment, consists of a complete set of application-development tools designed for the programmer and user-interface designer. The product includes a screen-authoring component, a development language and a run-time system for application development.

• **TeamOne Systems Inc.**, Sunnyvale, CA, has released a major new release of its TeamNet concurrent engineering environment for distributed configuration management. TeamNet 3.0 now includes an Open Look-based user interface, as well as improved configuration-management capabilities, a floating-license facility and enhanced NFS client access. The product also boasts improved process-control and file-merge capabilities and an enhanced virtual-copy feature.

• X-terminal vendor **Human Designed Systems** has introduced a new generation of X Window System terminals incorporating Intel Corp. i960 CPUs. The ViewStation FX series achieves performance levels of more than 100,000 Xstones, according to the King of Prussia, PA-based company. The products support both Motif and Open Look user interfaces. Built-in X clients provided with the ViewStation include set-up mode, diagnostics, multiple telnet sessions and VT100 terminal emulations. Screen sizes of 14, 16 and 19 inches are available, with resolutions of 1024-by-768 to 1,280-by-1,024 pixels. HDS recently announced it was awarded the largest X-terminal contract in the industry's history: a 50,000-plus unit sale to Boeing Co.

• Newbury Park, CA-headquartered **Integrix Inc.** has upgraded two of its SBus-based color frame buffers, while simultaneously cutting their prices. The SFB 200 now sports a screen-refresh rate of 76 Hz at a resolution of 1,280-by-1,024 pixels and currently lists for $995. The SFB 220V, equipped with a standard VGA connector, offers resolutions of 1,024-by-

TeamOne Systems Inc.'s Open Look version of TeamNet 3.0



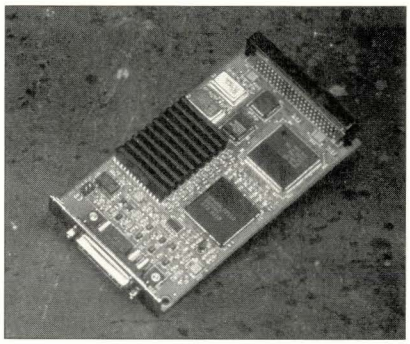
768 pixels, which allows customers to use 14-inch super VGA PC monitors. Integrix no longer offers a Sun connector and cable with this product. List price is $695.

• **Qualix Group Inc.** has introduced a set of numerical computation C++ class libraries, known as M++, and a C++ interface to XView, called Xv++. M++ is a standardized array-language extension to C++, which uses standard computation algorithms, such as LINPAC and EISPAC. Unlike other dynamic array libraries for C++, the company says, M++ supports arrays of up to four dimensions. Xv++, meanwhile, provides a full C++ API to the XView Open Look toolkit. Software distributor Qualix says that it is in negotiations with various vendors to carry their C++ compilers, debuggers and class browsers. The San Mateo, CA-based company also is seeking more class libraries to bring to market.

• Release 2 of the Accel/SQL database-independent toolset is now available from Sacramento, CA's **Unify Corp.** The new version supports the ANSI Level 2 DML and ANSI SQL 2 DDL standards. The product includes support of text and binary data types, support of arrays and complete internationalization. Release 2 for Sybase SQL Server had been installed at several beta sites at press time. Release 2 for other databases–Oracle, Informix and Unify's own Unify 2000–are expected soon.

• More database news: **Progress Software Corp.**, Bedford, MA, has unveiled the latest version of its application-development environment. The environment now supports LAN-based software developers. New features include a Progress NLM Server, allowing users to run DBMS systems on the Novell NetWare 3.11 File Server, while using other services; Windows 3.0 compliance; and support for new PC-to-UNIX connectivity packages.

• **Applix Inc.**, in one fell swoop, has changed the name of its product and announced an upgrade. Release 2.0 of Asterix, now called Aster*x, sports several new GUI and application enhancements. GUI enhancements



Integrix Inc.'s color frame buffer

include the tailorable bar tool ExpressLine, keyboard mnemonics, a pop-up special characters keyboard and a preferences editor. The office-integration software supports 16 international dictionaries and eight international thesauri. Users can rotate and scale text and choose from 125 colors and new paint options. Spreadsheet customers can manipulate data with 46 new, built-in functions. And Aster*x 2.0 Mail customers can use a new, on-line tutorial. Westboro, MA-based Applix has added more built-in filters and more than 200 extension language facility (ELF) macros to the product.

• **Brixton Systems Inc.** has enhanced its BrxPPP Point-to-Point Protocol software and its Brx3270 terminal emulator. The Cambridge, MA, company has added support for T1 routing cards to BrxPPP. And it has extended compatibility for Brx3270 to include new IBM display terminals and the Motif and Open Look GUIs.

• **UniForum** and **EurOpen** have announced the formation of the World Forum of Open Systems Users, in the process combining their activities. "The Forum will serve as an international umbrella organization for all national user groups dedicated to the promotion of Open Systems," according to the two parties. At present, EurOpen will continue to represent Europe, in cooperation with UniForum affiliates in Europe that aren't members of EurOpen. UniForum and its North American affiliates initially will represent North America. And various other national associations will represent the rest of the world.

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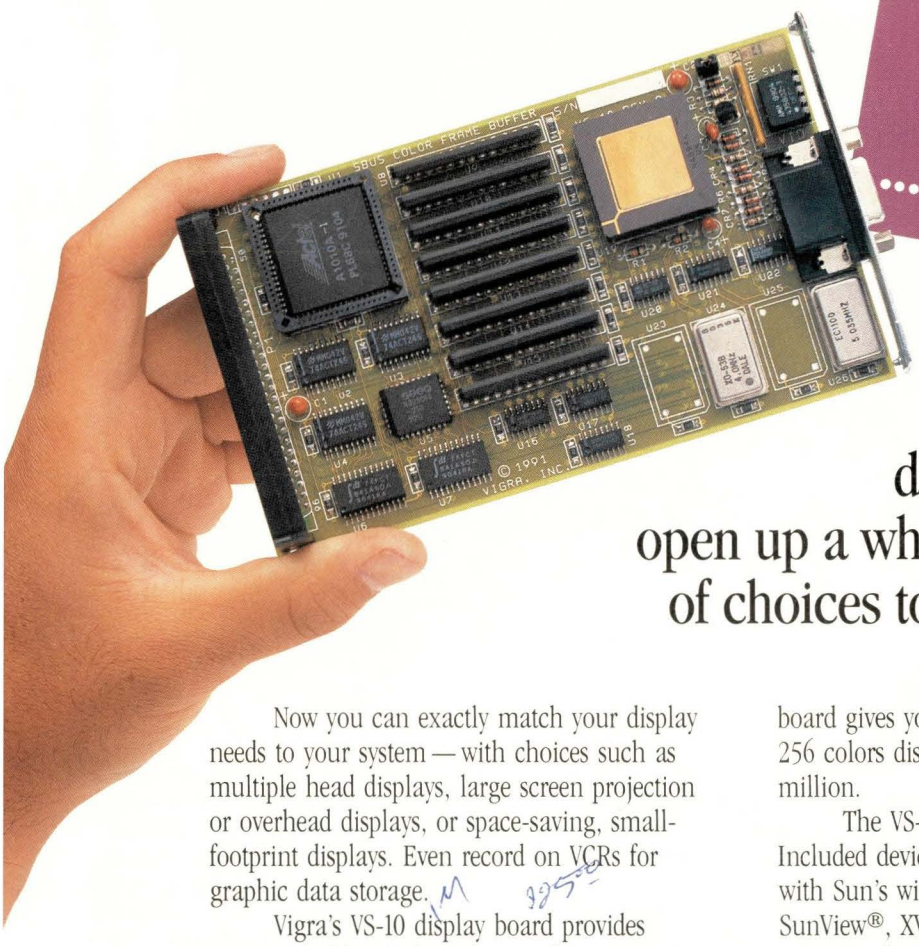

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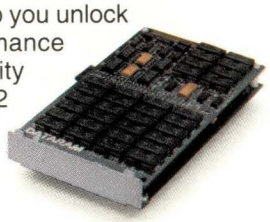

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Ask Mr. Protocol

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Wide-Area Services, or, Software By the Tankerload

by MICHAEL O'BRIEN

"I saved the world last Tuesday. It's your turn this week."
–A Network Services Provider

"Do you have an appointment?"
–A Non-Network Services Provider

"I've got a lorry-load of KCOPs waiting outside..."
–Tom Stoppard, *MacKoon's Hamlet, Kohout's Macbeth*

Q: I'm tired of grotting around trying to find out which anonymous FTP server has the software I want. How can I figure out where to look? How do I find out which site has what? There must be a better way!

A: Yep, there must be. And when Mr. Protocol figures out what it is, he'll be the first to let you know about it. For now, though, anonymous FTP is about the best thing going. There are more helpful things on the horizon, though, and we'll be getting to them a little later on. These services are the first glimmerings of what the network will look like when it's more thoroughly distributed, so they provide us with a better glimpse of the future than most current services do. First, though, let's take a look at good old anonymous FTP. Mr. Protocol will, as usual, start with a historical perspective, which is not surprising, since he at least gives the impression of being older than most historical events himself.

In the beginning, when the net was so young that it wasn't even called the Internet, FTP was something that was only done between consenting adults. The model of the network, then as now, was that of mutually distrustful systems, so it was necessary to login to a remote system in order to use it.

OW! Um, Mr. Protocol has taken the opportunity to remind me that there were exceptions to this rule. A startling variety of innocent services have traditionally been available with-

Dialoging with archie

```
% archie printf-scanf

  021 Host speedy.cs.uiuc.edu
    Location: /pub/MANCHESTER/july_update/usenet/printf-scanf.st
          File -rw-r-r- 00013654 1991 Jun 20 15:04:00 GMT

printf-scanf.st
  022 Host speedy.cs.uiuc.edu
    Location: /pub/MANCHESTER/flat/printf-scanf.st
          File -rw-r-r- 00013298 1990 Apr 30 00:00:00 GMT

printf-scanf.st
```

that the WAIS system is the first generally available glimpse of the Internet as it will someday appear. WAIS provides the user with a single generalized interface to information of almost any conceivable type, and as an added bonus, does this by use of an ISO protocol, rather than by requiring something so incompatible as to be automatically crossed off by standards-conscious managers everywhere. The protocol used is ANSI Z39.50-1988, describing the Information Retrieval application-layer protocol. What WAIS actually does is provide a common interface allowing search and retrieval of data from all over the Internet.

The Information Retrieval protocol specifies how queries and responses may be sent, but it does not specify the actual usage of the application. WAIS turns out to be much more than just a database interface. In fact, if WAIS were, say, a way of executing RPG II programs over the Internet, Mr. Protocol would doubtless be less amazed, and a great deal less interested. It seems as if people are always attempting to provide the most modern facilities for the most perverse and backward services. In fact, Mr. Protocol feels that many of the most widely advertised products in the "mainframe" computer press are the technical equivalent of laser-sighted, nuclear-powered siege engines.

This certainly does not include WAIS.

The central idea behind WAIS is similar to Prospero: treating the Internet as a sort of extended file system. In this case, though, the problem addressed is that of keeping information up-to-date. In the case of the `archie` server, it is the server's business to keep itself updated with respect to the contents of the various anonymous FTP archive sites around the net, which it does by interrogating each site periodically. It is the user's responsibility, however, to interrogate the `archie` server whenever updated information is wanted. WAIS takes

the view that collections of information should at least potentially be able to update themselves actively, so that the user can pose a query once, yet be able to see updated information each time he or she looks at the folder containing the query response.

WAIS queries are currently handled by keyword search, so questions can be phrased as English questions, or simply as lists of words having to do with the subject being queried. Additionally, when a document is discovered that the user finds to be a good match to his query, that document may be given as an example: "Find more documents like this one!"

What a user stores in the WAIS system then is not a view of a file system or a network, but a question, or a series of questions, which may be answered many times, in many ways. This facility of abstraction away from the details of network implementation is, Mr. Protocol feels, the best prediction yet of the future of network usage. More attention will be paid to the resulting information than to the protocol used to get it, at least by the user. Administrators, of course, will have to make sure that everything runs smoothly behind the scenes. Though he may not appear in public quite so regularly, it will be a long time before Mr. Protocol is out of a job. ➸

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`.

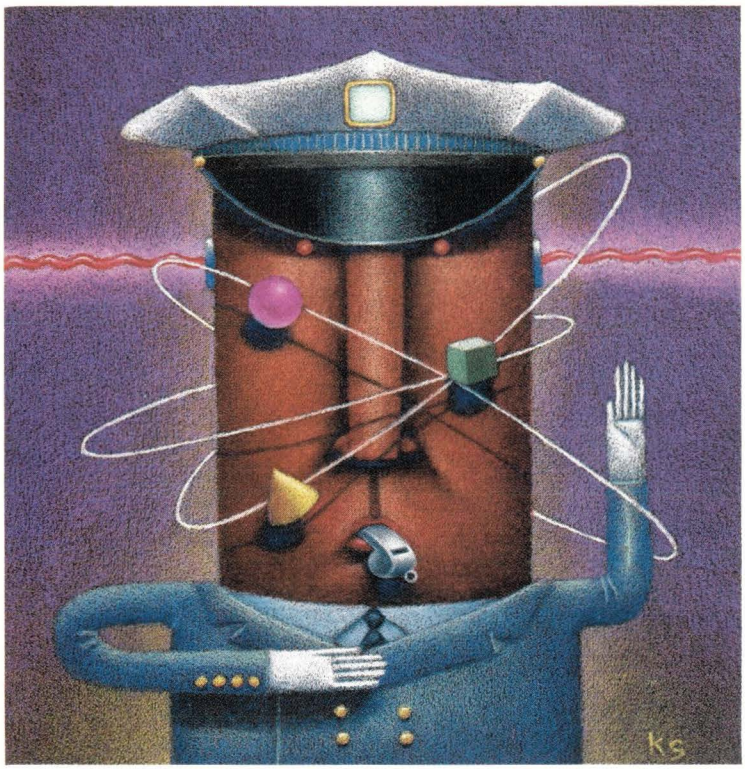


ILLUSTRATION BY KEITH GRAVES

SCCS Revisited

by PETER COLLINSON, Hillside Systems

Judging from the email response, there has been considerable interest in my article on SCCS (see *SunExpert*, October 1991, Page 34). This article builds on that information. I present my personal set of SCCS tools and use these to push forward your knowledge of SCCS. My scripts are undoubtly driven by my needs and ideas on controlling source. Please understand that I am not saying "this is the way to do it" but "this is the way I do it." Use these ideas to develop your own tools.

The Story So Far...

SCCS is a suite of programs used to manage source. When a source file is under the control of SCCS, it goes through a well-defined sequence of operations. First, it is entered into the SCCS system by being made into a history file. The history file is named by taking the original file name and prepending `s.` to it. As a result, we often refer to the history file as the *s.file*.

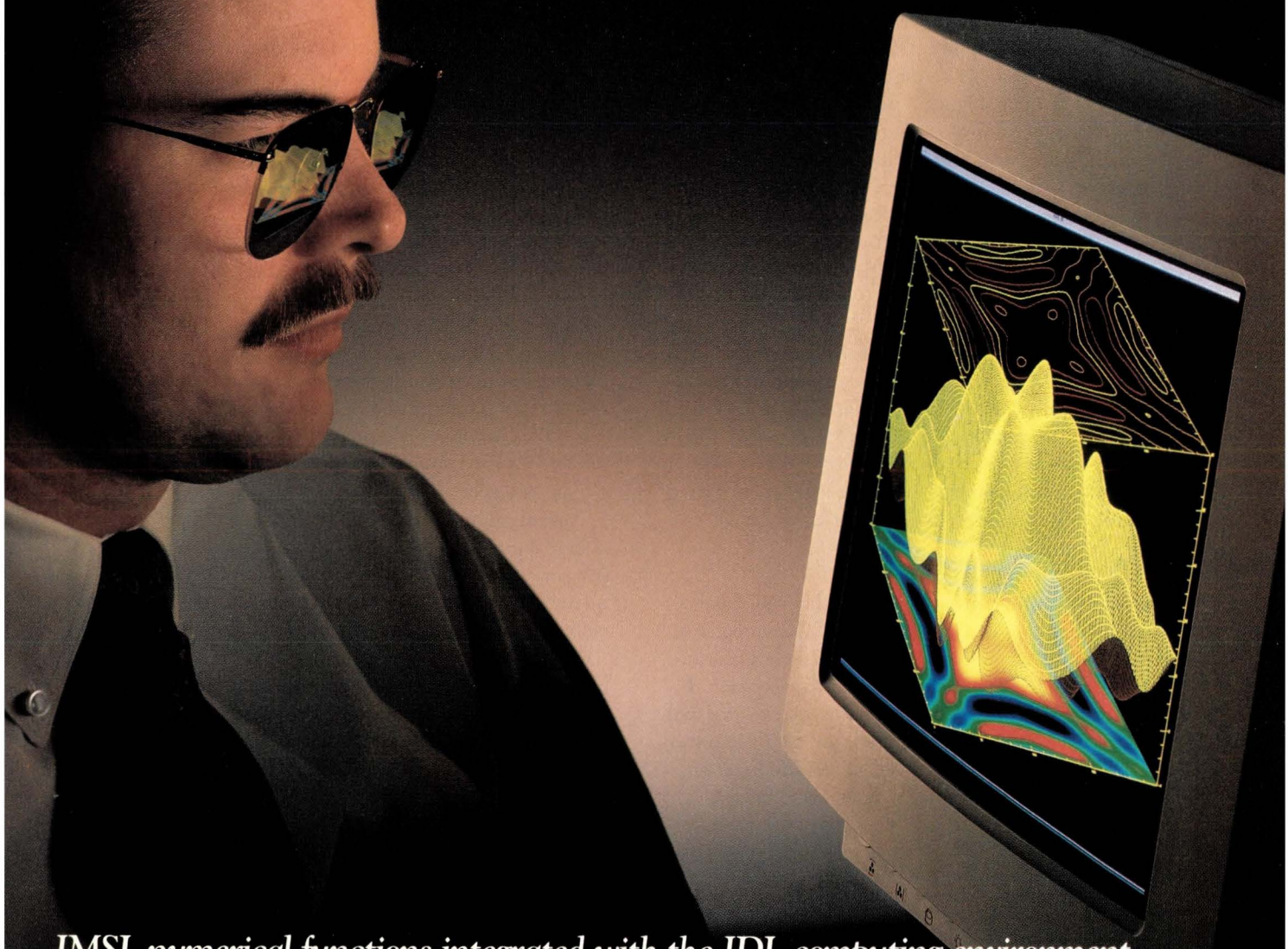
The *s.file* contains the source and some administrative information. The information gives the identity of the creator, the time that the file was entered into the system and other optional annotation. Once the *s.file* exists, you can delete the old top copy in the sure knowledge that you can recreate it. Every time a change is made to an *s.file*, only the differences between the new and the old version are stored on the file. By knowing all the differences, every version of the file can be recreated.

You do not use the *s.file* directly. The *s.file* should never be edited. Instead you get a version of the source in *file* from the *s.file* and use that. The source can be obtained in two forms. You can get the source file in "top-copy" form. Here the source file is read-only and should not be altered. The source file may contain keywords that are expanded when the file is obtained in top-copy form.

Alternatively, you can get the source for editing. A file is made with the write-permission bits turned on. Any keywords will be unexpanded. To prevent simultaneous change, a lock file is created so that only one person may edit the source at a time.

Once editing is done, you can create a new version of the

Introducing Mathematics You Can See



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file by making a *delta*. The `delta` command will obtain the differences between the new source and the last version stored in the *s.file*. The differences are written onto the *s.file*.

You can obtain any version of the file by specifying a version number. In SCCS jargon, the file version number is known as the SID, the SCCS ID, of the file. Usually, the SID is a decimal number, like 2.7. This is release 2, version 7 of the file. Each delta operation will increase the last digit of the number. You, the human, need to take steps to increase the first digit.

When using programs from the SCCS suite, you can use the raw commands like `delta`. Preferably you will call these commands using Eric Allman's control program, `sccs`. The program is installed as standard on SunOS. On other platforms you may need to get hold of the source from `uunet`. Look on `~ftp/bsd-sources/usr.bin/sccs`. There are several files.

The advantage of the `sccs` program is that it stores all the SCCS control files in a sub-directory called `SCCS`. The current directory only contains working files. These can be recreated from the history files. The SCCS directory separates file storage from working areas. Also, it protects the history files from potentially destructive inadvertent `rm` commands. It stores the editing lock file, the *p.file*.

Now Read On...

The `sccs` program is given arguments that will make it call one command from a set of standard SCCS programs. It also has some built-in operators that combine several standard SCCS commands into one more useful operation. I still find that the resulting command is lengthy to type and tend to put a small subset of well used commands into shell scripts. These days I mostly use shell aliases and functions, but it's reasonable to present the commands as scripts.

The first one is called `snew`:

```
#!/bin/sh
# snew
exec /usr/ucb/sccs create "$@"
```

See? That wasn't too painful was it? You can invoke this by typing

```
% snew newfile.c
```

which is a small win over the longer `sccs` command:

```
$ sccs create newfile.c
```

It was a bigger help when the `create` command didn't exist and you had to type something more arcane.

There are perhaps two bits of magic in the script that are worth discussion. First, the entire `sccs` command is preceded by an `exec` statement. To understand this, let's pretend that the `exec` is not present and start again from the beginning. When users invoke `snew`, they will obtain a new shell to interpret the commands. This shell will start reading the `snew` file and discard the first two comment lines. It will find the `sccs` command (without the `exec` remember) and will `fork`, starting a new process. The new process will use the `exec` system call to run the `sccs` command. We now have two processes running: the newly started `sccs` command doing the work and the interpreter shell waiting for the `sccs` command to stop.

The shell is not really needed, since it will simply exit when the `sccs` command finishes. We can eliminate the unneeded shell by the `exec` statement. Starting the command line with `exec` makes the interpreter shell run the named command *in the current shell* without forking. It uses the `exec` system call to start the `sccs` command in place of the running shell. We now have a single process: the `sccs` command doing the work. There is also an added bonus that any status the `sccs` command returns will be passed directly back to the calling shell.

Second, let's look at the argument to the `sccs` command. You should think of the `"$@"` argument as a textual replacement operation. The arguments to the `snew` script replace the `"$@"` on the command line just *before* the `sccs` command is called. Every argument that the user has typed is passed into the `sccs` command *as if* the user had typed the `sccs` command.

This may sound like no big deal. However, there are potential problems in shells when passing arguments into subcommands if the arguments can contain spaces and quoted characters. Such arguments *can* be passed so that the embedded spaces are used as delimiters. This way, one argument to the script may become two or several separate arguments to a command the script calls. Sometimes this is wanted. We don't want this now. We need the arguments to be passed into the `snew` command as the user typed them, preserving the argument structure and contents. The `"$@"` construction deals correctly with these problems.

SCCS Scripts

The `snew` command was the first command that I created. This was swiftly followed by a private version of `get`:

```
#!/bin/sh
# get
exec /usr/ucb/sccs get "$@"
```

Calling this with just a file argument will get the top copy of the SCCS file. You can get other versions by typing:

```
$ get -r3.4 prog.c
```

This gets revision 3.4 of the file `prog.c` replacing the current top-copy version. The command complains if the file is locked for editing. If you want to keep the current top copy of a file and look at some other version, the `-p` flag is useful. This generates the data on the standard output channel of `get`:

```
% get -r3.4 -p prog.c > 3.4prog.c
```

creating an additional version of the file.

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Notice that I now have two different commands called `get`: the SCCS primitive and the new shell script. No matter, the shell script will appear first in search paths.

My set of basic commands are almost complete. There are two more. The first gets a file for editing:

```
#!/bin/sh
# co
exec /usr/ucb/sccs edit "$@"
```

used like:

```
$ co prog.c
1.3
new delta 1.4
5 lines
```

to get an editable copy of the program above. The last version was 1.3 and we are now creating version 1.4. Incidentally, there are five lines of source.

After we have made some changes, we can put the file back into the system using:

```
#!/bin/sh
# ci
exec /usr/ucb/sccs delget "$@"
```

This puts a file back into the system, making a delta. It then gets the new version out again as a top copy.

```
$ ci prog.c
comments? Add a new line
1.4                 delta
1 inserted
0 deleted
5 unchanged
1.4                 get
6 lines
```

This command will ask you to type in some text to annotate the file. You should type in a reason for the change. The reason *should* be a little more helpful than my example. The remaining stuff is printed by the two separate commands that are run as the `delget` action. I show this in italics. The `delta` command asks for the information, tells you the version it is dealing with, and prints some statistics on line changes. The `get` command prints the version number and a line count.

By now aficionados of RCS are screaming. Yes, RCS uses the commands `ci` and `co` for these operations. When I first saw RCS, I liked the notion of "checking in" and "checking out" a file so I stole the names. It means that you cannot use my names for these scripts if you use both RCS and SCCS. You *can* add some shell code to do selection based on the knowledge that SCCS stores files in an `SCCS` directory while RCS uses a directory named `RCS`. You can simply rename my commands. I do not use RCS, so I don't care.

A Better ci?

In reality, I expand the `ci` script somewhat because I prefer to have the ability to add more than one line of commentary in an easier way than is the norm. The `delta` command demands that you add a backslash at the end of each commentary line when there is more text to follow:

```
% ci prog.c
comment? one line\
comment? last line
1.3
etc.
```

I just keep forgetting the backslash and the command rushes away working with `delta` and `get` before I can shout "stop, you idiot" or other complimentary remarks. I prefer to have the script ask me for additional lines of commentary and end input by typing return by itself.

```
% ci prog.c
Comment? one line
Comment? last line
Comment?
1.4
etc.
```

This is reasonably easy. My revised script is:

```
#!/bin/sh
# ci
trap 'exit 1' 1 2 3 15
echo -n 'Comment? '
read comm
test "$comm" != "" &&
while echo -n 'Comment? '
    read line
do
    test "$line" = "" && break
    comm="$comm"'
'"$line"
done
exec /usr/ucb/sccs delget -y"$comm" "$@"
```

The aim is to pass the commentary by using the `y` option. The text to be used as commentary is contained in the shell variable `comm` that is built up in the script.

The first line of the new `ci` ensures that an interrupt character (Control-C on my machine) will abort the operations if you decide not to check the text in. The next two lines print the string `Comment?` and take some input from the user, on the same text line. System V users may prefer to put a `\c` at the end of the `echo` command to achieve this effect. Users of `ksh` can put the prompt into the `read` command.

The first `test` line checks whether the data that the user typed is simply a newline. In this case, the user is supplying no information. Naughty, but that's their prerogative.

The double ampersand at the end of the line is the conditional execution operator. If the `test` command succeeds,

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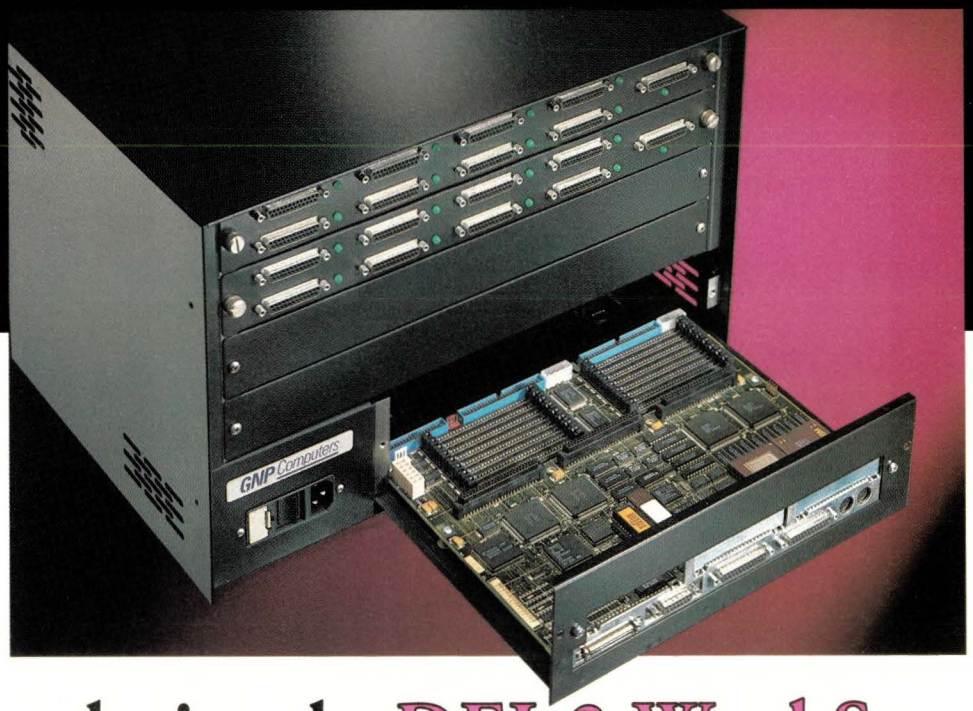

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then the next command is executed. When the `test` fails, the `&&` operator is deemed to have failed and the next command, the `while`, is not executed. So, if the user only types a newline, the `test` fails and the whole `while` statement up to the `done` is not executed.

If there is some data, the `while` loop is entered and will ask for further lines of text until the user just replies with a newline. During execution of the loop, the data for the `sccs` command is built up in the `comm` variable. Notice how newlines are added into the data.

The revised command encourages you to add explanatory commentary to the delta.

I find this revised command a huge win over the default. It encourages you to add significant text commentary about why the delta was made. Suddenly, it's easy to use the delta commentary properly, giving reasonable explanations of changes rather than terse and often meaningless single line statements.

Backtracking

In addition to the basic set of four commands, there are two commands that can manipulate the *s.file*. First, it's useful to be able to backtrack to the last known text. This will throw away all the changes you have made since you typed the `co` command.

```
#!/bin/sh
# unedit
exec /usr/ucb/sccs unedit "$@"
```

This is another trivial script making use of a feature of the `sccs` program. Let's say that you are editing version 1.5 of some code in our file called `prog.c`. It's 2 a.m. and you decide that all the stuff that you have done since the last top copy is junk. Well, you could say

```
$ unedit prog.c
    prog.c: removed
1.4
6 lines
```

and will be rewarded by seeing that the code is thrown away. The revision number reverts back to the previous one. Finally, a `get` command is done to obtain a top copy of the file.

Beware of using `unedit`; it can throw away things that you would have preferred to keep in the cool light of the dawn. In cases of doubt, save the text and backtrack using SCCS. First, check that file in:

```
$ ci prog.c
Comment? Not sure about this
Comment? junking it
Comment?
1.5
etc
```

We simply check all the junk in, making version 1.5. Now we can do the sneaky bit.

```
$ co -x1.5 prog.c
Excluded:
1.5
1.5
new delta 1.6
6 lines
```

The `-x1.5` argument to the `co` command says "get the file out for editing but *exclude* revision 1.5." It's possible to specify more than one delta for exclusion. The command tells you what exclusions are in force. Actually, the effect is to generate a copy of version 1.4 for editing. Now we

```
$ ci prog.c
Comment? Omits 1.5
Comment? same as 1.4
Comment?
1.6
etc
```

The broken version (1.5) is cut out from the development cycle, but it is still accessible should it be needed. The delta commentary shows clearly what has happened since we have made a place holder saying that the two versions are identical.

More Backtracking

Another useful command for backtracking is `fix`. You can use it in situations where you have created a delta but must make some minor change. The tiny change doesn't deserve a whole SID to itself. What you really wish is that you had not made the delta in the first place. The `fix` command allows you to revert to where you were before you typed `ci`:

```
#!/bin/sh
# fix
exec /usr/ucb/sccs fix "$@"
```

You need to supply it with the SID of the top version. It will only *work* on the top version and the appropriate `-r`

option is mandatory. The sequence of commands goes like:

```
$ ci prog.c
Comment? Final version
1.7
etc
$ cc -o prog -O prog.c
"prog.c", line 5: syntax error at
    or near variable name "printf"
$ fix -r1.7 prog.c
1.7
6 lines
1.6
new delta 1.7
```

We now have the file back as if the delta 1.7 had never been made. The file can be edited to fix the missing semicolon and the delta operation redone. We will have lost the delta commentary. Also, we have lost a little bit of the audit trail of the file. This may be a bad thing.

With `fix` and `unedit`, it is possible to step backwards through an SCCS file unwinding and deleting all the deltas that have been made. Don't do this; use the technique above that excludes deltas. Each delta should be a single logical change to the set of files that make up the program. If you follow this maxim, each change is valuable even if you are not currently using the code. Sometimes it can be useful to illustrate to other (much later) coders that you have explored some development path and found a dead-end. This saves everyone time. Sometimes old bits of code can suddenly become useful, and reverting to a previous version of the code can save more time.

I guess that the message of this article is that SCCS is a set of tools that should be made to work in a way that suits your environment. I think that my personal set has saved me hours over the years. It's always worthwhile investing time to get the tools right.

Further Reading

If you need more background and introductory material on SCCS, then you should seek out my article on SCCS (*SunExpert,* October 1991, Page 34).

The manual pages on your system provide a terse guide to the SCCS suite. There is a manual page for the `sccs` program and all the other related pages are named `sccs-`*something*, like `sccs-get`. Sun has some documentation on SCCS.

Eric Allman, the author of the `sccs` control program has a paper in the Berkeley 4.3BSD manual set. It's document 14 in the "UNIX Programmer's Manual Supplementary Documents 1" with the yellow spine. ⊸

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

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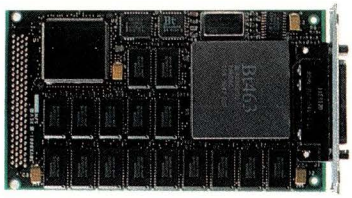

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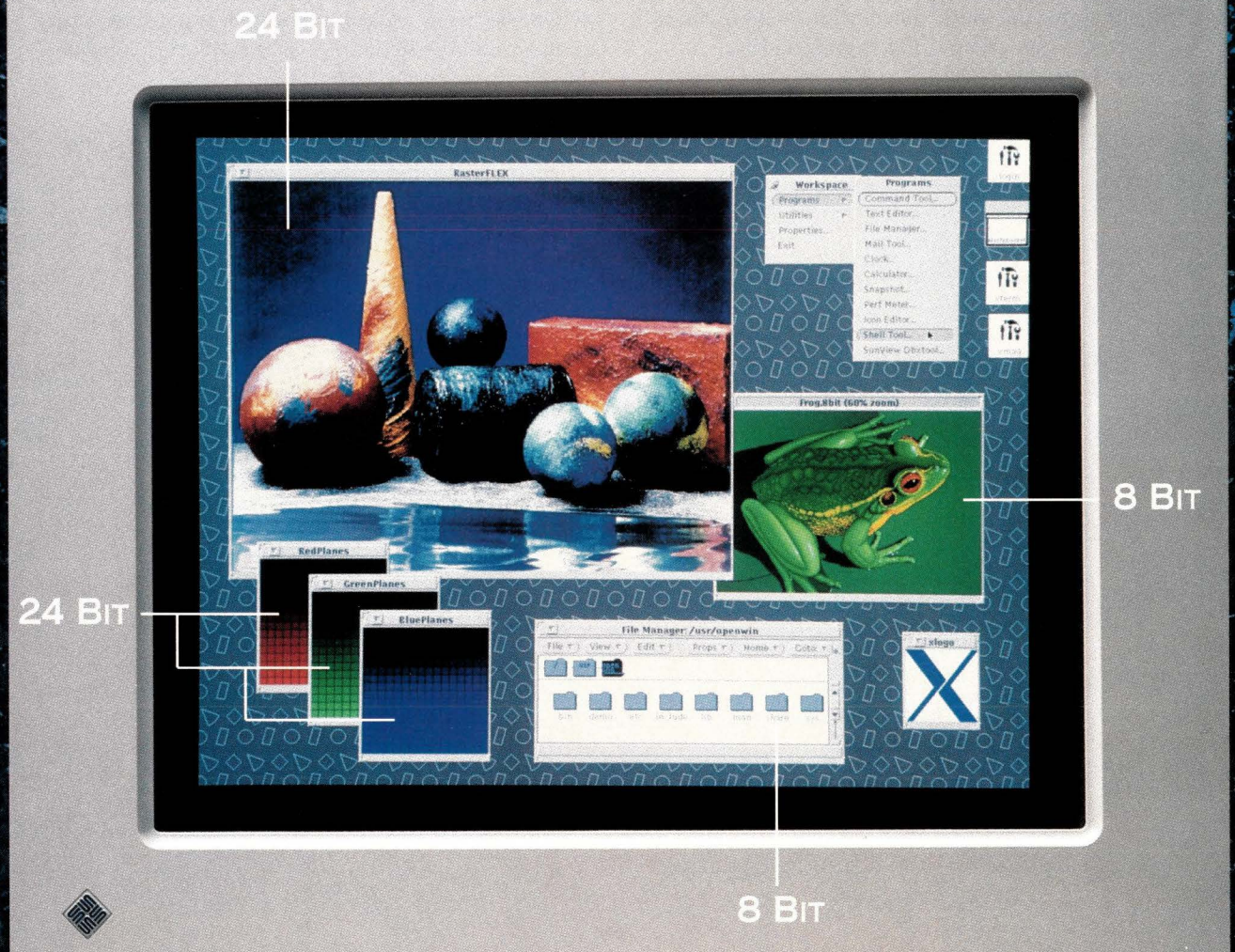

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I/Opener

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This Column May be Illegal

by RICHARD MORIN, Technical Editor

As you might suspect, I do a lot of writing. "I/Opener" is the biggie, but I also write articles for other publications, letters to assorted editors, system and user documentation, training materials and, of course, code.

Code is different from prose, to be sure. The most tolerant compiler or interpreter makes the strictest editor look indolent by comparison. The computer, in turn, is much less impressed by hand-waving than the typical human. In summary, code must actually do something, correctly and reliably.

The development process is remarkably similar, however. The same neurons (more or less), hands, hardware and software are used for both text and prose. Both require a combination of planning, inventiveness and attention to detail.

Legalities

The legal environment for prose is pretty simple. Plagiarism is a no-no, so give credit for small quotes, and get permission for large ones. Oh yes, don't say bad things about people unless you can prove them and/or like getting sued.

The legal environment for code is rapidly getting more complex, however, and I am more than a little nervous about the direction in which things are going. Let's say I get a contract to develop a system for knarfling wombats. I do some analysis, sketch out a design and jump in.

In coding it up, I borrow from reference works, other code I have seen, etc. As long as I don't copy actual code, I'm pretty safe from any copyright problems. Trade secrets are a bit dicier, but minor predations are generally not an issue. The overall design, in any case, is my own, and I supply a substantial amount of my own ideas in the development process.

I get it working, deliver it to the customer and go on to other projects. Unfortunately, I'm still not in the clear. Mammoth Corp. has built a program to greeble warbishes. It uses a nifty searching algorithm, which the corporate lawyers have decided to patent. Two years after I deliver my product, a software patent is issued. Three years after that, I get a nastygram in the mail, saying that my knarfling system violates the patent, and I owe somebody big bucks.

Could I have found out about the proposed patent? No. Pending patents are not public information in the United States. Besides, how would I know what to look for? In any event, I wouldn't have had the resources to fight the claim, any more than I have them now to defend the case.

Perhaps I should have patented it myself. I thought the algorithm was nifty, too, but then I think many of my hacks are nifty. It certainly didn't seem like a fundamental advancement in the art of computer science. And, again, I don't have the resources.

Hence, I am left high and dry, exposed to legal attack for a problem I could not reasonably avoid. If prior

applications of the algorithm can be found, or the judge can be convinced that the algorithm is an obvious one, I may win relief from the lawsuit. This is small consolation, however, if the legal expenses of fighting the case bankrupt me.

There is an answer, to be sure, but it only works for large companies. Mastodon Enterprises has more patents than it can count. If and when Mammoth complains about a violation, Mastodon simply trots out its own set of patents. A cross-licensing agreement eventually emerges, and everybody goes away happy.

Unfortunately, I like working for myself, and I don't think the patent system should force everybody into cartels. Further, think of the chilling effect on the free software movement. Carnegie-Mellon and Berkeley can probably hold their own in a patent hassle. I doubt, however, whether the GNU Project, the Icon Project, or any other small-scale freeware effort can afford a messy legal fight. I know I can't; maybe I should get out of the freeware game...

The sad part of all this is that it is completely unnecessary. The software industry is about 50 years old, depending on who's counting. There doesn't seem to be a conspicuous lack of innovation, and the lack of patent protection isn't keeping products off the market. Fundamentally, the combination of copyright and trade secret protections seems to be doing a perfectly adequate job.

Why Patents?

I don't know. The stated purpose of the patent system is the encouragement of innovation. "The Congress shall have power: To promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries." (U.S. Constitution, Article I, Section 8)

Far from promoting "the progress of science and useful arts," software patents may be uniquely able to stifle it. Even if the Patent Office were knowledgeable about software, which it isn't, a substantial number of questionable patents would be bound to get past them. How many lawsuits can this industry afford?

We simply can't afford to waste our time on this sort of trash. There are jobs that need to be done, like cleaning up our past mistakes, avoiding new ones, and trying to keep this spherical lifeboat operable as we proceed. Computer software is going to be very critical to humanity's comfort, if not its survival, over the next century. We can't afford to hobble it by endless networks of lawsuits.

If the clock on your VCR is still blinking 12:00 (thanks, Pixar, for that one), you may not have heard about "look-and-feel" lawsuits. These are less insidious than software copyrights, in that folks know when they are copying the appearance and behavior of another product. Nonetheless, these lawsuits have a serious chance of retarding large parts of the commercial software industry.

Imagine, goes the usual analogy, that the automobile industry had been hit at an early age by "look-and-feel" lawsuits. Some cars would have steering wheels, others would have levers, pedals or what have you.

What if, as this thing develops, one company gets to own spreadsheets, another controls pen-based input systems and a third locks down windowing systems. How many computers do you want to own? More realistically, how high a barrier to entry do you think there should be for improvements on existing ideas?

On my Sun 3, the system grep utility takes 0.17 seconds to search `/usr/dict/words` for the string "foo." The GNU clone takes 0.01 seconds for the same task. Shall we keep the GNU version off our computers to protect AT&T's interface rights? Really!

I think (hope, actually) that this may be a self-limiting phenomenon. If a company prevents everybody from copying its interface, the world will beat a path past its door. Apple may win its action on Windows, and might then decide to take on Motif. It will have a hard time, however, getting any traction on Open Look. The industry might hiccup, but no great catastrophe would ensue. AT&T is very happy to welcome any and all comers to Open Look, and the conversion effort, while annoying, is not a show-stopper.

Prospects

There are things we can do. First, resist corporate pressure to patent any little hack that comes along. Don't lose you job over it, but try to keep your company from abusing the system. In the process, try to raise the consciousness of your colleagues and friends. This madness is going to hurt us all: programmers, vendors, users, etc. If we all see it coming, we may be able to slow it down a bit.

Next, get out your checkbook and write out a check ($42 for employed professionals, $10.50 for students, $22.00 otherwise) to:

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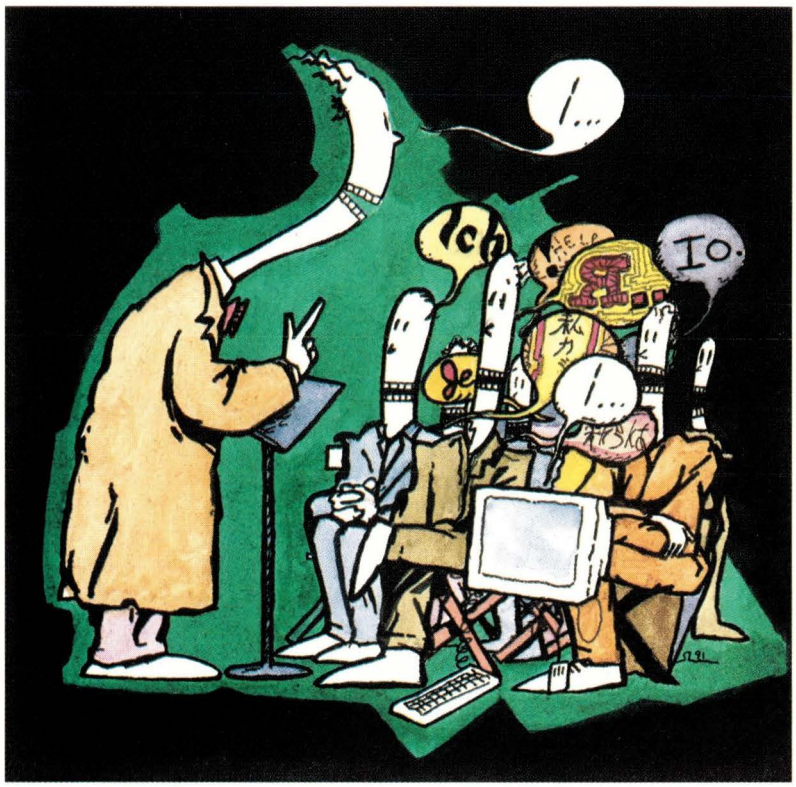
Alternatively, dig out your Spring 1991 issue of *README*, and read the cover article. (You are a Sun User Group member, aren't you? If not, contact them at (617) 232-0514 or `office@sug.org`.

Software development is one of the few fields left where a small firm with a bright idea can still make a difference. Let's keep it that way.

Richard Morin may be reached at Canta Forda 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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Unicode

by PETER H. SALUS

I make no bones about the fact that I am not a fan of what the Unicode Consortium (now Unicode Inc.) has done. I recognize the need for commercial activity here, but such activity has been driven by forces that are really counter to genuine internationalization.

My comments are driven by the appearance of *The Unicode Standard*, Version 1.0, volume 1 (Addison-Wesley, 1991; U.S. $32.95; ISBN 0-201-56788-1), nearly 700 pages, only a few of which are "intentionally left blank." The volume is well-designed, handsomely printed and quite unwieldy. It is 8 1/2 by 11 inches in format and perfect-bound. I cracked the binding my second attempt at weighing the volume open. I was trying to type and look at a central page at the same time. (One of the advantages of things like the much-more-cheaply produced GNU Emacs manual is the plastic circular binding that allows the book to lie flat next to the workstation. The earlier O'Reilly and Associates' books were similarly "user friendly.")

Before getting into Unicode proper, let me enter my usual objection to the Consortium's use of "standard." In my mind, Unicode is about as "standard" as SVR4 or XPG3. It is a consensual or consortial document that hasn't been approved by any standards-approval agency: governmental (e.g., NIST); national (e.g., ANSI or DIN); or international (ISO/IEC JTC1). And while IBM/DEC/Sun/Apple/Microsoft/Adobe, et al., carry a lot of financial weight, the mass of the world's language populations is excluded from this group. Xerox and GO, who are represented on the Unicode Technical Committee, help here, as do members of the University of Toronto's Department of East Asian Studies. But the net result is less than worldwide.

Another problem, insofar as I am concerned, is the overwhelming preponderance of programmers (rather than linguists) involved. I was gratified to see that Lloyd Anderson (of Ecological Linguistics) and the noted Mongolist Wayne Schlepp (Toronto) were listed in the "Acknowledgements," but a larger number of people involved in languages and their scripts

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would have prevented some of the lacunae and inconsistencies that I perceive.

There is a good commercial reason for wanting true internationalization in the computer world. Though nearly all of the software/hardware has a Western flavor to it, the markets are shifting and straight ASCII and English just won't do.

Fifteen years ago, Stanford University published Merritt Ruhlin's survey of languages of the world and their speakers. Top-down, the ordering begins:

Mandarin Chinese
English
Russian
Spanish
Hindi

This totalled 1.2 billion people. More importantly, there are five different character sets involved: Chinese ideograms, Cyrillic, Devanagari, the English (26-letter) version of the Roman alphabet, and the Spanish extension of Roman (with accent marks and with an alphabetization scheme that puts ch, ll, rr in places other than where English puts them). The next two languages on the Stanford list are Bengali and Arabic. They introduce two more character sets, as the Bengali version of Devanagari is different from that of Hindi. The next two are German and Japanese. German brings us yet another variant of Roman (with umlauts and the sz-digraph) and Japanese, two more sets. Without wanting to exhaust everyone, let me point out that number 23 is Korean, with over 34 million speakers. Vietnamese has about 28 million speakers; Swahili about 15 million; Danish about 5 million.

What is so horrid about Unicode (and many other proposals) is how Anglo-centric and chauvinistic they are. Peter Anvin (Northwestern University) in the midst of a net-exchange involving folks in Belgium and Japan, remarked: The Unicode standard specifically states that a particular rendering system does *not* need to be able to replicate every single zany combination."

I can only assume that the combination of accents and tone marks of a language like Vietnamese would be thought a "zany combination." Last November, Marc R. Roussel, of the University of Toronto, asked "Is...any fixed code sufficiently flexible to meet the needs of the community? The answer seems to be 'no,' since linguists of the future (among others) will certainly need combinations we have neither yet seen nor imagined."

While Roussel is right, systems like that of the International Phonetics Association have proven sufficiently flexible over more than a century to enable linguists to transcribe every human language encountered as well as infantile vocalizations and the utterances of the deranged and the damaged.

Paul Bijnens (Leuven, Belgium) asked: "Are those 'non-spacing' characters indeed completely independent?" That is, can a user "float" any accent mark or other diacritic over any character?

Bijnens noted that "not all arbitrary sequences of 16-bit codes were meaningful in Unicode. But, unfortunately, DIS 10646 doesn't allow for any diacritical combinations, either. I thought there was some discussion that not all arbitrary sequences of 16-bit codes are meaningful in Unicode. ...Is it, e.g., meaningful to break any Unicode string in two parts regardless of whether you break between a base character and its nonspacing diacritics, without altering its interpretation? ...Anyway, I see no solution in restricting your 'repertoire' to some limited set of combinations of base plus diacritics as ISO10646 now does, either."

Erik Naggum (Oslo) responded, "This ordering problem does not come up with the accented letters, etc., because everyone can see that they are really simple variants of the basic Latin forms. Anyway, I suspect 'Eurocode' is not even technically feasible. There are too many different letters for eight bits, even when most of the control codes are omitted."

This last is fascinating to me, as Norway is adjacent to Sweden and so near to Germany. I note that the "a" with two dots over it occurs in both languages (Swedish and German), but that it occurs in different places in the alphabetical order.

Despite the commercial push behind Unicode, I have a feeling that it will not become the new "standard." The Japanese and the Koreans have already raised many objections to the Han character representations proposed for volume 2 of Unicode. If we are interested in the non-Western market, we must listen to what the Chinese, the Japanese, the Koreans and the over-a-billion writers of Brahmi-derived and Arabic-derived scripts think is important.

Masataka Ohta (Tokyo Institute of Technology) and Eiiti Wada (University of Tokyo)–whom I have never met–have made a number of interesting and valuable comments that should be heeded rather than flamed-at.

The volume that Addison-Wesley has produced will enable those of us critical of Unicode to focus on what it now says. For the future, I think that I side with Eiiti Wada: "The only way to save the world and Japan from having to work with two codes is to discard Unicode and use [Draft International Standard] 10646, because Unicode is [more recent] than JIS X 0208 which is...still under development [but incorporated into DIS] 10646." I do note that as of now Bengali, Gurmukhi, Gujarati, Oriya, Tamil, Telugu, Kannada, Malayalam and Lao are not covered by DIS 10646, though they are included in Unicode 1.0.

With memory getting cheaper all the time, there ceases to be a problem with a 32-bit representation. ⊸

Peter H. Salus is the executive director of the Sun User Group. He has attended both ISO and P1003/P1201 meetings and expects remission of time in purgatory as a result. Email: peter@sug.org.

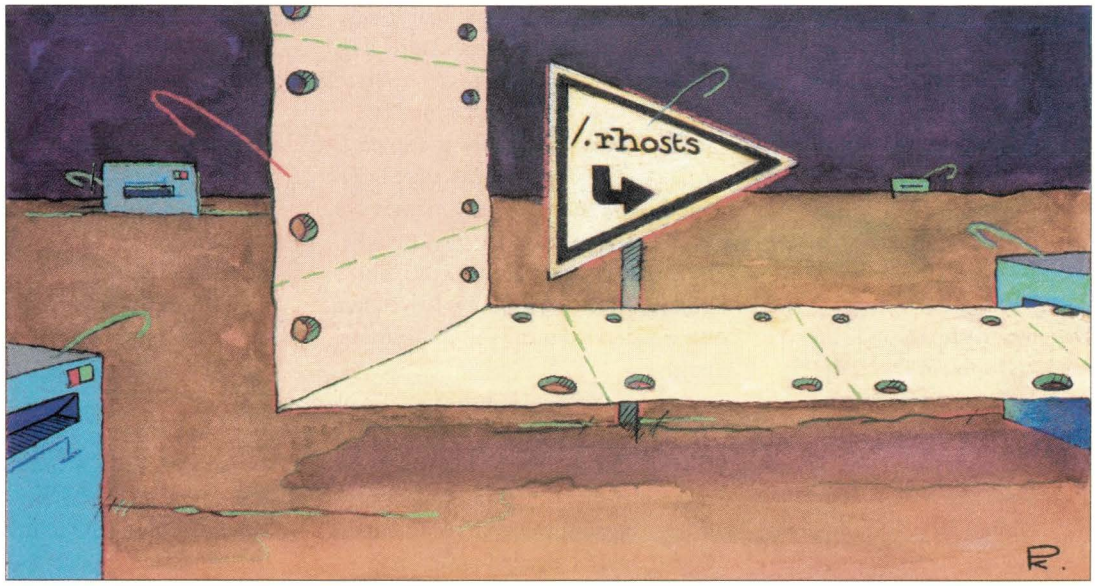

ILLUSTRATION BY PETER KALABOKIS

Rerouting Print Files: Part 1: Using a C Shell Script

by S. LEE HENRY

Just about every system administrator takes to writing shell scripts. By encapsulating a complicated or tedious process in a script (e.g., setting up a user account in our particular environment), we save ourselves a lot of monotony and ensure that we don't forget anything in the process. Script writing is also an opportunity to turn a little of the drudgery of system administration into magic.

Another option for the innovative sysadmin is to turn some of these procedures into XView tools that can be as fun to use and as intuitive as the desktop tools that come with OpenWindows. This takes some skill with the C programming language and familiarity with XView commands, but is not especially difficult. To explore this option, this two-part column details a script and an XView tool for rerouting print jobs from one printer to another. This month, I outline how print queues work and provide a C shell script for rerouting print jobs. Next month, I will provide the C/XView code to build the tool for OpenWindows.

Print Queues

The essential elements involved in queueing print jobs are:

- a directory for holding the queued print jobs,
- the line print daemon, `lpd`, which tends the print queue,
- the lock files which give `lpd` exclusive access to the queue,
- the `printcap` file that describes the printer's capabilities and,
- the control and data portions of the print files themselves.

The spooling directory is specified in the `printcap` file and is set up when you install a printer. For a local printer, the `printcap` file will specify a spool directory with an option like `sd=/usr/spool/Magic` where Magic is the name of the print queue and usually the name of the printer as well. For a remote printer, the directory will contain both the name of the print host and the printer, for example, `rd=wizard\:/var/spool/Magic`.

The daemon `/usr/lib/lpd` is generally started up in

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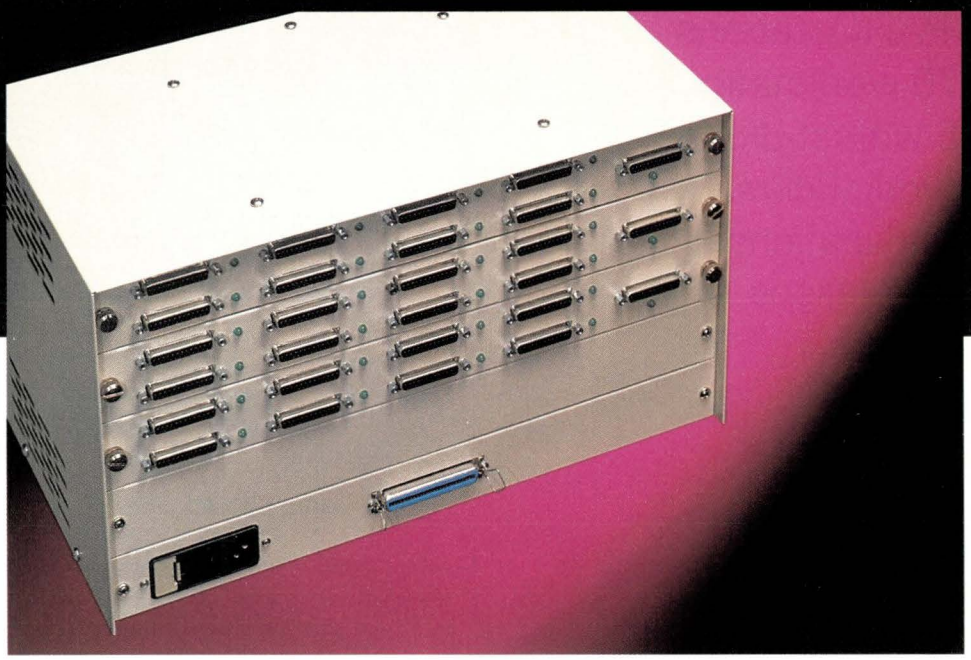

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The file names you will see in your print spool directory will look like this:

```
.seq
cfA000wizard      <-- control file, queue item #0
cfA001wizard      <-- control file, queue item #1
dfA000wizard      <-- data file, queue item #0
dfA001wizard      <-- data file, queue item #1
dfB001wizard      <-- 2nd data file, queue item #1
lock              <-- lock file for current lpd
```

when the print queue looks like this:

```
Magic is ready and printing
Rank  Owner   Job  Files                    Total Size
active slee   0    standard input           130 bytes
1st   slee    1    reroute,reroute.howto    3365 bytes
```

Here's what the file names tell us:

```
dfA000wizard
df                - -data file
   A              - -first file
      0000        - -queue item #0
       wizard     - -host submitting job
```

Figure. Exploring the print queue

`/etc/rc` and runs in the background. It forks another `lpd` whenever `lpr` is used. The forked process services a particular print queue and dies when there are no longer any print files left in the spool directory.

The lock file called `lpd.lock` in `/usr/spool` is created by `lpd` and contains its process ID. The forked `lpd` creates a similar file called lock in the spool directory that it controls; this prevents other daemons from trying to service the queue as well.

The printcap file (`/etc/printcap`) describes the printers and details where they are connected and where print spools are located, etc. For a discussion of the `printcap` file and the use of print filters, see *SunExpert,* August 1991, Page 46.

Print jobs (see figure) are stored in the spool directory as sets of files: data file(s), which are copies of the file(s) being printed or links to them (i.e., if you used the `-s` option with `lpr`) and a control file, which tells the system the names of the file(s), your userid, and the hostname of the system asking for the file(s) to be printed, etc.

There is also a queue sequence file `.seq` that is used to number files sequentially as they are put in the print queue. Files from remote systems are numbered by the host that generated them, so the numbers on a print host will not necessarily be sequential.

The contents of the control file will have lines like `Hwizard` and `Pslee` where `H` is the hostname of the machine where `lpr` was invoked and P is the person printing the file. These and other options are described in the man page for `lpd`.

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Rerouting Print Jobs

OpenWindows' print tool, the `lpc` command, and `lprm` provide ways to control the print queue, but none of these provides a way to move print jobs from one print queue to another. Often, you can simply remove the print job from one queue and print it again on another, but this is not always convenient, especially if you've already shut down the application that generated the file. What you need to do in this case is reroute the file by copying the control and data files associated with a print job and moving them to another print queue. Since just dropping the files into a new directory doesn't get `lpd`'s attention, you might need to do something to get it started. Both the script and the XView tool take care of this by piping a "rerouting" message to `lpr`.

The Script

```
#! /bin/csh
#
#   reroute - - reroute print jobs
#   assumes printer names and spool
#   names are the same
# -------------------- 1
set SRC = ""
while ($SRC = = "")
    echo "  Queued where?:"
    echo " 1 - Magic"
    echo " 2 - Spell"
    echo " 3 - Potion"
    echo " "
    echo -n "Please enter number -> "
    set input = $<
    switch ($input)
        case 1:
            set SRC = "Magic"
            set SRCHOST = "wizard"
            breaksw
        case 2:
            set SRC = "Spell"
            set SRCHOST = "sorcerer"
            breaksw
        case 3:
            set SRC = "Potion"
            set SRCHOST = "witch"
            breaksw
        default:
            echo "Invalid selection"
            echo "Please try again"
            sleep 1
            breaksw
        endsw
end
set DEST = ""
while ($DEST = = "")
    echo "  Transfer to?:"
    echo "      1 - Magic"
    echo "      2 - Spell"
    echo "      3 - Potion"
    echo " "
    echo -n " Please enter number -> "
    set input = $<
    switch ($input)
        case 1:
            set DEST = "Magic"
            set DESTHOST = "wizard"
            breaksw
        case 2:
            set DEST = "Spell"
            set DESTHOST = "sorcerer"
            breaksw
        case 3:
            set DEST = "Potion"
            set DESTHOST = "witch"
            breaksw
        default:
            echo "Invalid selection"
            echo "Please try again"
            sleep 1
            breaksw
        endsw
end
# -------------------- 2
lpq -P$SRC
echo -n "Select a print job (by #) -> "
set input = $<
set padnum = 'echo $input | awk \
    '{print substr("000",1, \
    3-length($1)) $1}''
set FILES = 'rsh $SRCHOST \
    "cd /var/spool/$SRC;ls cf*$padnum*"'
echo -n "Moving print job ."
foreach file ($FILES)
 rcp $SRCHOST":"/var/spool/$SRC/$file \
 $DESTHOST":"/var/spool/$DEST/$file
end
echo -n "."
set FILES = 'rsh $SRCHOST \
    "cd /var/spool/$SRC;ls df*$padnum*"'
echo -n "."
foreach file ($FILES)
 rcp $SRCHOST":"/var/spool/$SRC/$file \
    $DESTHOST":"/var/spool/$DEST/$file
end echo -n "."
set PRINTSTATUS = 'lpq -P$DEST | \
    head -1 | tr '\040' '\072''
echo "."
if ($PRINTSTATUS = = \
'Warning::no:daemon:present') then
    echo "Starting print daemon on $DEST"
    echo REROUTING | lpr -P$DEST -h
endif
sleep 5
echo ""
lpq -P$DEST
echo ""
echo -n "Remove files from old queue? -> "
set input = $<
```

```
if (($input = = "Y") || ($input = = "y"))
then
    rsh $SRCHOST \
    "rm /var/spool/$SRC/cf*$padnum*"
    rsh $SRCHOST \
    "rm /var/spool/$SRC/df*$padnum*"
else
    echo "Not removed from old queue"
endif
```

Notice that in this script we have, the printer and print hosts are hard-coded. The script, although reliable and easy to change, requires upkeep if you switch printers often. You could simply ask the user to enter printer names and devise some way to both make sure they were spelled correctly. You could also use the printer names provided by users to fetch the print host name from the printcap file. The piece of code that you could substitute into our script is shown below.

The Script Part

```
# -------------------- 1
src_printer:
echo -n "Where is your print job now?"
set SRC = $<
set found = ('awk -f get.pnames \
    < /etc/printcap | grep $SRC')
if ($found = = '') then
    echo "$SRC is not a known printer"
    goto src_printer
endif
set SRCHOST = 'echo $found \ |
    awk -f: '{print $2}''
dest_printer:
echo -n " Route to where?"
set DEST = $<
set found = ('awk -f get.pnames \
    < /etc/printcap | grep $DEST')
if ($found = = "") then
    echo "unknown printer $DEST"
    goto dest_printer
endif
set DESTHOST = 'echo $found | \
    awk -f: '{print $2}''
# -------------------- 2
```

The awk Script

```
# call: awk -f get.pnames < /etc/printcap
BEGIN { FS=":"
        n=0
}
{
ch1 = substr($1,1,1)
if (ch1 != "#") {
    if ((ch1 != " ") && (ch1 != "\t")) {
        n = n + 1
        i = index($1,"|")
        if (i * 0) {
                j = i - 1
```

```
                PRINTER = substr($1,1,j)
            }
            else    PRINTER = $1
        }
        else {
            i = index($0,"lp=/dev/")
            if (i * 0)
                print PRINTER ":" "local"
            i = index($0,"rm=")
            if (i * 0) {
                line = substr($0,i,80)
                j = index(line,":") - 4
                HOST = substr(line,4,j)
                print PRINTER ":" HOST
            }
        }
}
}
```

Cautions

If you set up a script like this, you need to be sure that files rerouted from one printer can print on the printer to which they are being rerouted. If, for example, you have a color raster or color PostScript printer, you don't want to send its print jobs to a black and white laser printer (at least not without converting them).

Security Implications

You also need to consider who you want to allow to reroute print jobs. Since the control files in the spool directory are owned by daemon, not even the person submitting the job can transfer the print job (copy both files) directly. The script, therefore, needs to be run by superuser or be owned by superuser and have its "set user ID" bit set, a well-known security hole. Also, since routines like this run across the network, the "trusted host" lists set up through the `/.rhosts` file need to include the hosts which will reroute print jobs. ⊸

S. Lee Henry is a system administrator for a large network of Suns in the federal government and is also president of The Next Page Inc., a tiny consulting firm specializing in systems documentation. Her email address is `slee@expert.com`.

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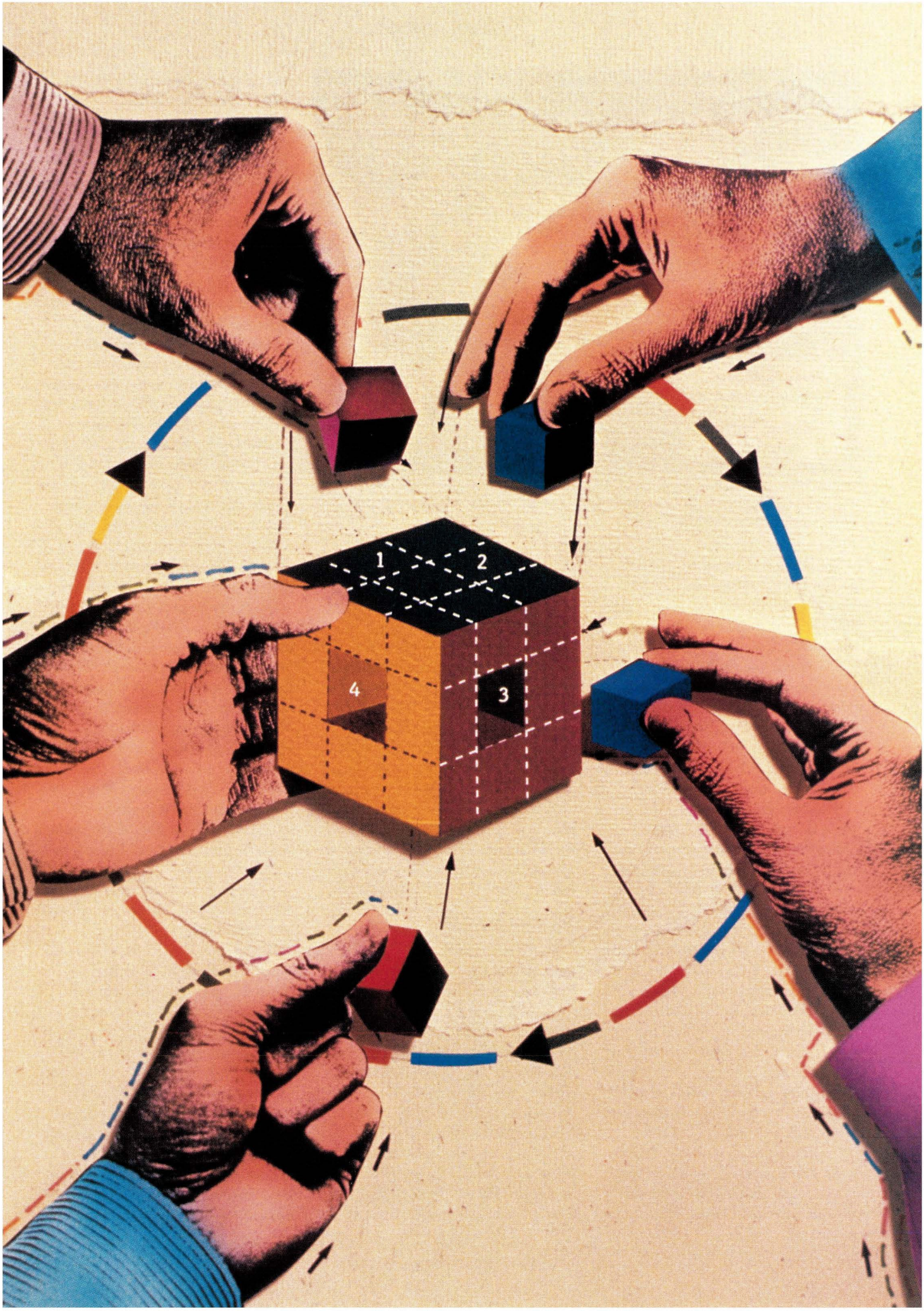
Can We Talk?

Programming environments bring tools–and developers–together to streamline communications.

by MARY JO FOLEY, Senior Editor

If you're a software developer, chances are you live in your debugger, editor and compiler. And chances are these tools all will come from, if they don't already, the same vendor. All-in-one "programming environments"–consisting of compilers, editors, debuggers, browsers, program analyzers, and in some cases, rudimentary management tools–are emerging from third-party software vendors and workstation vendors alike. Besides offering users the convenience of one-stop shopping, programming environments provide the tight, inter-tool integration increasingly needed to fit into The Grand Scheme Of Things, commonly known as the software life cycle.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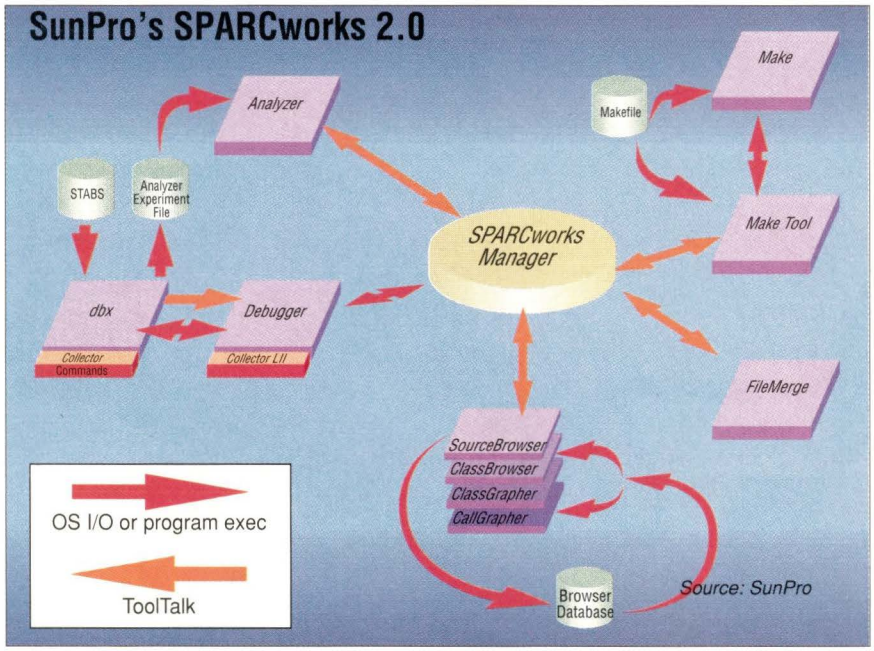


The SPARCworks toolset consists of a debugger, source browser, FileMerge, make and an analyzer–all integrated via the SPARCworks Manager, a session manager; dbx, Sun's debugger; and ToolTalk, Sun's message-broadcast service.

Until recently, in a discussion of programming environments for Sun Microsystems Inc. systems, one of the only names that came readily to mind was Saber Software Inc., now CenterLine Software Inc. But now, there are a number of other vendors invading the native C and C++ SPARC-based development space, including Digital Equipment Corp., Hewlett-Packard Co., Lucid Inc., ParcPlace Systems Inc., ProCase Corp. and Sun's own SunPro business unit. There are a whole slew of other ISVs doing embedded programming environments. Others are doing Ada environments for SPARC (see "But Don't Forget Ada"). In addition, some compiler vendors, like Liant Software Corp., as well as a number of the leading front-end CASE vendors, such as Cadre Technologies Inc. and Interactive Development Environments Inc., are expanding their traditional foci to include debugging, browsing and other programming-environment features.

More programming environments either are or soon will be incorporating frameworks such as DEC's FUSE, HP's SoftBench and SunPro's SPARCworks/ToolTalk as their substrate layer. As a result, the existing crop of products will come to be more similar than they are already from both a functionality and appearance standpoint.

"Everyone's going to have the same data [work] sheet," says Richard Gabriel, chief technical officer for Lucid. Agrees Richard Dellinger, vice president of engineering for ParcPlace: "Ultimately, all of these [environments] will have editors, debuggers and save/store capabilities. The differentiators will become things like speed, and the ability to put the environment on multiple platforms." Ultimately, generic programming environments as we know them today could give way to application-specific development environments (see "The Next Wave").

Tooling With ISV Tools

Traditionally, individual UNIX tools, such as emacs, vi and lint; the Free Software Foundation's GNU C; and UNIX System Laboratories Inc.'s cfront served many C software developers just fine. They weren't elegant, but they worked. But with the emergence of the increasingly complex C++, more developers are balking at the idea of being programming martyrs. They want and need robust and complete sets of tools to make tough jobs a little less hellish. This is why companies like CenterLine have been able to succeed selling utilities that, technically, can be had for free or nearly free.

CenterLine's CodeCenter (formerly Saber-C) and ObjectCenter (Saber-C++) offer a substantial amount of value-added over generic UNIX programming tools. Both environments offer automatic static and run-time error checking; an interactive workspace with an incremental linker; a source-level debugger for source- and object-code debugging; and graphical browsers for code and data visualization.

The interactive workspace and incremental linking capabilities are made possible by the fact that CenterLine develops its environments around interpreters, rather than compilers, according to company president and CEO Sesha Pratap. "Our products have the ability to work with just code fragments," Pratap says, as well as the option of letting users experiment with unfamiliar code and libraries.

CenterLine supports more front-end CASE tools and frameworks than other programming-environment vendors. Under its third-party marketing program, the company is developing links to Cadre's Teamwork/OOD; IDE's Software through Pictures development environment; Rational's Rational Rose engineering tool; object-oriented databases from Objectivity Inc., Ontos, Object Design Inc. and Versant Object Technology; and frameworks from HP, DEC and SunPro. The next versions of both CodeCenter and ObjectCenter will incorporate protocols to support the point-to-point links between CenterLine's and third-party vendors' products, Pratap says.

In October, CenterLine announced a new dot release of ObjectCenter. With 1.1, users can better support large projects and achieve better C++ performance, says product manager of C++ technologies, Torsten Ek. The product now supports shared libraries on Sun platforms and USL's cfront 2.1. Shared library support increases code portability and improves systems performance "due to the delivery of applications with smaller process size and dynamically linked libraries," CenterLine says. And with cfront 2.1,

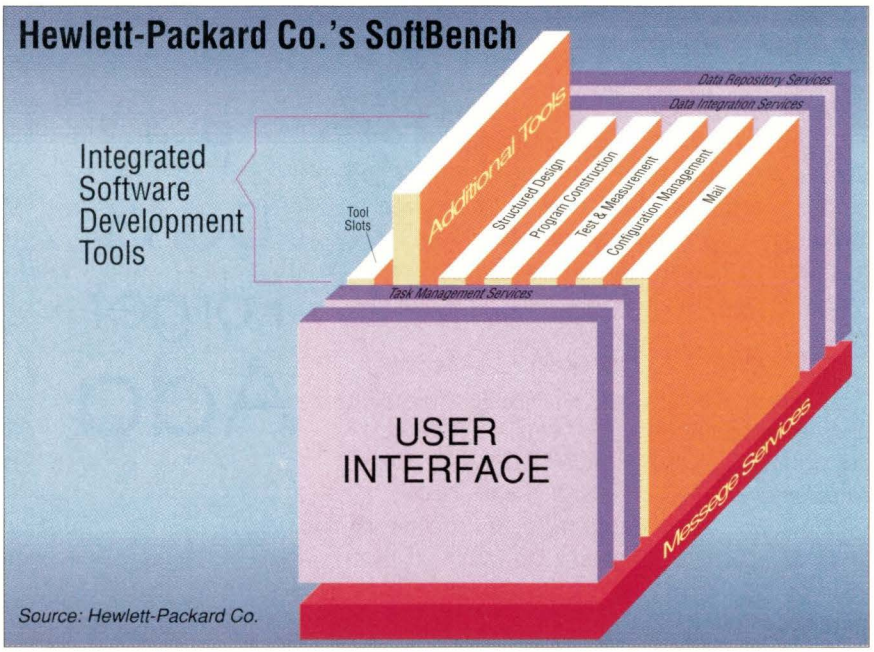
users now have support for new class libraries, including the Solbourne Computer Systems Inc. Object Interface (OI) library for user-interface development and the Standard Library Extensions. Version 1.1 runs on Sun-3s and Sun-4s/SPARC. It lists for $3,995, which includes a year of support and maintenance. (Existing subscribers to the ObjectCenter maintenance plan receive 1.1 for free.)

In July, CenterLine rolled out a new release of CodeCenter–version 3.1. New features include preprocessor support for embedded SQL preprocessors from Oracle Corp., Informix Inc. and vendors of other standard SQL databases; support of dynamic shared libraries on Suns; and support for loading FORTRAN object code. Preprocessor support means that database developers can work directly with their original C source code–even if it contains embedded, non-C statements, like SQL–after it has been run through Oracle's Pro*C, Informix's ESQL/C or other standard preprocessors. As it is doing with ObjectCenter, CenterLine is integrating CodeCenter into HP SoftBench. The company also enhanced the product by adding GNU compiler (gcc) support for Sun, increased support for ANSI C and command line arguments with aliases that allow users to more easily customize their workspaces. Pricing is $2,995, which includes one year of support and maintenance.

In the coming months, CenterLine plans to continue to emphasize its traditional prototyping and debugging strengths, while improving its browsing and building capabilities, says Robert Cramer, vice president of marketing. At the same time, it plans to add features enabling large-project/team-programming support to both of its products. In the longer term, Cramer says, CenterLine plans to expand its testing and maintenance presence.

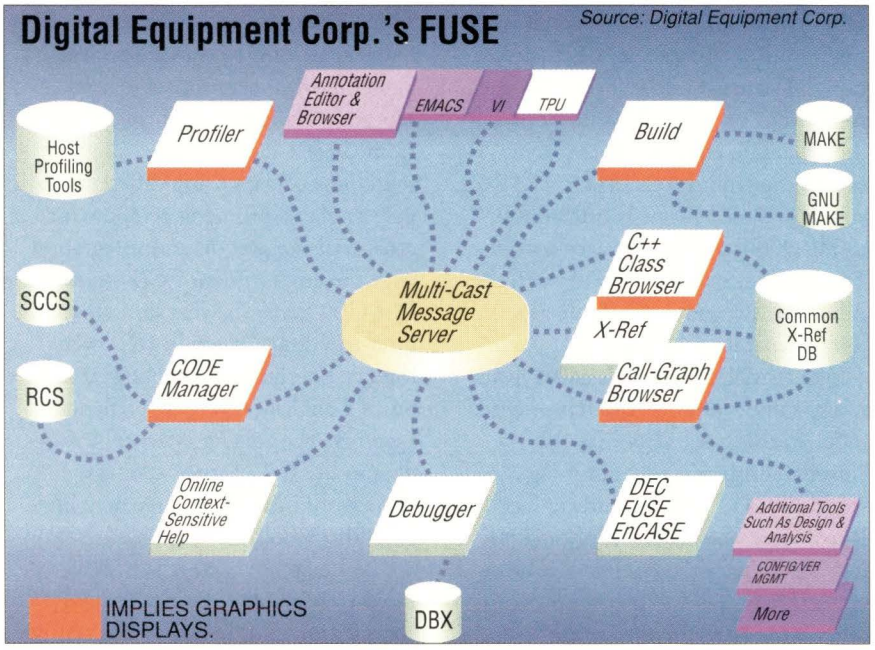
Competing with CenterLine in the C++-for-Sun arena are ParcPlace and Lucid. Besides its Objectworks\C++ environment, ParcPlace also supports a Smalltalk environment for Sun systems, aptly named Objectworks\ Smalltalk.

"We focus on browsing and semantic analysis of a program," says vice president of engineering Dellinger. The ParcPlace C++ environment consists of a C++ source-level debugger, an inheritance browser, a call-relationship browser, a program-structure browser, an error browser, USL's C++ 2.1 and Objectkit\C++, a collection of reusable class libraries. Objectworks\C++, release 2.4, supports team programming and integrates with other UNIX development tools–those from third parties, as well as standard UNIX development tools and utilities (including `yacc++` and `lex++`). The product includes an enhanced debugger that supports peer and light-weight processes, including support for Sun's



SoftBench includes a developer, program builder, editor, debugger, static analyzer and development manager, integrated with a common user interface and task-management, data-integration and data-respository services.

FUSE includes editors, a make utility builder, code manager, cross-referencer, dbx-based debugger, call-graph and class browsers and a profiling tool. The multicast mesage server integrates the individual pieces.



But Don't Forget Ada

"When I first saw Saber-C [now called CodeCenter]," says Bruce Sherman, formerly the vice president of Ada technology vendor, Telesoft, "I thought, 'Wow! This makes C like Ada.'"

While UNIX-oriented programmers probably favor C and C++ over all other languages, Ada refuses to be ignored. The massive language, designed by committee to be all things to all people, and mandated by Federal fiat for most government projects, already contains many of the features that specialized programmers environments now struggle to give C.

The problem is, Ada remains a hard sell.

In terms of technology, several vendors offer complete development environments for Ada. Telesoft, for example, offers RISCada For SPARC, which combines several Ada tools with a graphical environment that allows developers to represent and display their programs as collections of images. "The whole shift we've made," says Telesoft's Sherman, "is to bring the power of Ada together with graphics."

CASE-vendor Interactive Development Environments Inc. agrees. It has recently introduced an Ada Development Environment that includes development tools, an Ada code generator, and a graphics package. "When you are doing large-scale project development," says Adam Frankl, IDE's technical marketing manager, "code isn't enough. You need graphics...to communicate what you're trying to do."

He says that in large projects, involving hundreds of managers and thousands of programmers, sometimes in many different locations, it is much easier to convey a project's intent to everyone concerned via diagrams and icons and text.

Another company combining graphics and Ada is Rational, which has recently introduced Rational Rose, a graphical software-engineering tool for large-scale programming efforts. Rose is a language-independent environment embodying the Booch method of program representation. Rational says it can also be used with projects in C++ and Smalltalk.

For Sun users, though, the best known Ada development environment may be the Verdix Ada Programming Support Environment (VADS) from Verdix Corp. VADS consists of an Ada-oriented user interface, a language sensitive editor and various tools. Sun, in fact, has picked up VADS and remarkets it, along with its own technology. When Sun spun out its language business to the newly created SunPro subsidiary, the

Light-Weight Process Library. List price is $3,000; upgrade price is $800. Objectkit\C++ is an option, priced separately at $500.

Objectworks\Smalltalk, ParcPlace's flagship product, is the more mature of the company's offerings. Release 4.0, unveiled in late 1990, added windowing-system integration, true color, the SmallTalk Portable Imaging Model, incremental garbage collection and support for international applications to the base product. In addition, Objectworks\Smalltalk integrates with numerous databases and other applications. Whereas Objectworks\C++ currently runs on SPARCstations only, the Smalltalk environment runs on everything from PS/2s, Macs, SPARCstations, DECstations and RS/6000s to HP 9000s and Apollo workstations. The product sells for $3,500, with the Advanced Programming Objectkit priced separately at $500.

Like ParcPlace, Lucid is endeavoring to expand beyond its research-oriented roots–in this case, Lisp–into the "more mainstream programming world of C++," in the words of Teddy Rosenberg, vice president of marketing. To do this, the company is bringing its Lisp tools and environment to other languages, the first being C++ (with roll-back support for C).

This month, Lucid is slated to announce its C++ environment, called Energize (code-named Cadillac). The tools that make up the system are the GNU Emacs editor and debugger (modified with Lucid's own protocols), various Lucid browsers and the Lucid C++ compiler (acquired as part of the company's acquisition last year of Peritus International Inc.). In the way that CenterLine's tools are debugger-centered, Lucid's Energize is editor-centered.

Energize aims to provide both data and control integration. A central repository– the ObjectStore OODB from Object Design–stores all representations of data using different, publicly available protocols to allow for cross-tool integration and integration with the environment's C/D server. The C/D Server is what ensures tight inter-tool integration; in fact, even though Energize can be plugged in to Sun's ToolTalk or HP's SoftBench, Lucid is encouraging other tool vendors to use C/D Server, too, as a framework into which they may integrate their tools.

The Lucid environment is structured to be able to do incremental compilation and linking at a very fine level, Rosenberg adds. It also is set up to allow a programmer to navigate through an entire program easily. Energize will ship during the first quarter for SPARC systems and will be ported to other UNIX workstations during 1992, the company says. The product will sell for $3,250 per seat for five-person workgroups; $2,950 per seat for 10-person workgroups; and $4,250 for a single copy.

Meanwhile, back in the C environment arena is Procase Corp. with its SMARTsystem. The product is built around the company's own OODB, called SMARTstore, and consists of five modules for editing, comprehension, analysis, make and debugging.

"We're the only company that provides a true, multiuser environment built on top of a multiuser database," claims George Symons, vice president of marketing. But the real differentiators between SMARTsystem and other programming environments for Sun are the product's built-in interface definition language, called Tailor, and the company's "closed loop" software-development strategy.

Adherence to this strategy means that Procase is attempting to bridge the gaps between software comprehension, development, maintenance and

Ada product went along. It is now marketed by SunPro as SPARCworks/Ada.

And, there are others. Ada vendors continue to bring product to market and to try to sell it. The problem is in finding buyers. Given the current decline in government and military spending, Ada is facing a bit of crisis. "Business has been flat," says Telesoft's Sherman. "It is disappointing."

In general, the Ada technology vendors report sluggish sales, at best. There are, however, a few bright spots. Alsys Inc., for instance, notes that its business continues to show reasonable growth. In fact, says the company's product marketing manager, Edward Falis, "At this point, the main focus of our business is embedded applications." Alsys offers a series of Ada development tools.

Ada happens to be very good for embedded systems development–though, that's partly because so many weapons systems have been developed with the language and programmers know what to expect from it. Programmers are thus starting to turn to it as an alternative to assembly language, particularly since the government has recently tightened up on its requirement that its software be written in Ada. "In the last few years, we've seen a lot of companies bite the bullet and start development in Ada," says Falis.

In fact, Ada has recently made the transition to some relatively specialized processors for embedded applications. For example, Tartan has an Ada development environment for the Texas Instruments digital signal processor (DSP). "The benefits of using Ada on a DSP are tied up in the benefits of Ada in general," notes John Stare, product manager of DSP technology at Tartan. "Don't get me wrong. I like C. But what I've found is that when you have very large projects, you need a language like Ada...which encourages structured programming."

Meanwhile, Ada itself is being upgraded. An industry- wide effort, spearheaded by the U.S. Department of Defense, will shortly yield Ada 9X, the next generation of the language, and one that is object-oriented. "Ada has always supported object-oriented design. Now it will support object-oriented programming," says Dr. Erhard Poledereder, chief scientist for Tartan and chair of the Distinguished Reviewers for the Ada 9X project. The new version of the language will, he says, "have something that is rather familiar to C++ and Eiffel programmers."

But Ada's partisans would really like to see the language move into mainstream computing. To get it there, they're counting on the language's inherent structured programming features, far more than any advantages offered by commercial development environments. "As more and more [developers] find themselves doing large applications," says IDE's Frankl, "they'll turn to Ada." *–mjt*

re-engineering, Symons says. With release 2.0 of SMARTsystem, for example, the company is providing integration between Cadre's Teamwork at the front-end, and Frame Technology Corp.'s FrameMaker at the back-end of the cycle. In the "middle," Procase is providing an add-on metrics package, called SMARTreport, which allows engineers to gain information on the size and complexity of a software-development project–on-line or off-line, using Halstead and McCabe metrics.

SMARTsystem 2.0 is priced at $2,000 per module, or $10,000 for the entire system. Customers with maintenance contracts can be upgraded at no charge. SMARTreport is priced separately for $2,000.

Move Over, Softies

Not content to leave a lucrative and growing market in the hands of ISVs, all of the major workstation hardware vendors have entered the programming-environment fray to one degree or another.

SunPro, the division of Sun responsible for providing tools for the professional developer, unveiled its SPARCworks Professional Series programming-environment plans in September (see "Hereeeeeee's SunTech," December 1991, Page 10). Besides providing compilers for C++, ANSI C, FORTRAN, Pascal and COBOL, SunPro is committed to delivering the surrounding individual and workgroup tools, according to general manager Jon Kannegaard. The SPARCworks toolset consists of a debugger, source browser, FileMerge, make and an analyzer–all integrated via the SPARCworks Manager, a session manager; dbx, Sun's debugger; and Sun's message-broadcast service, ToolTalk.

Prior to SPARCworks' debut, Sun touted its Network Software Environment (NSE) as its programming-environment solution. SunPro calls NSE "the most widely licensed workgroup development product in the marketplace." But user appreciation for the product has been lukewarm, at best. SunPro is promising to make explicit how NSE fits in with SPARCworks, as well as to introduce enhancements to NSE over the coming months.

SPARCworks 1.0 is shipping now. The SPARCompilers are priced at $750 to $1,195 a piece; the SPARCworks environment, at $1,495. SPARCworks 2.0 won't ship before the middle of 1992, following the general release of Solaris 2.0. Version 2.0 will incorporate ToolTalk, offer support for shared libraries, make use of the SVR4 extensible linker format (ELF) and ship with on-line AnswerBook documentation, according to Kannegaard. Pricing will range from $1,750 for SPARCworks Professional C, to $2,195 for SPARCworks Professional FORTRAN.

Whether the programming tools will be available unbundled from the SPARCompilers and/or whether SunPro will port them to other machines remains to be seen. SunPro, with the help of the recently acquired Systems Products division of Interactive Systems Corp., is in the midst of porting versions of its SPARCompilers and SPARCworks to Intel 80X86 platforms running Solaris 2.0.

SunPro is facing some stiff competition from HP and Digital Equipment Corp., both of which have ported their programming environments to SPARC. HP has ported its C and C++ SoftBench environments, as well as its Encapsulator task-and-process-automation tool to the SPARCstation. SoftBench includes a developer, program builder, editor, debugger, static analyzer and development manager. On Sun platforms, SoftBench is meant to be used with SunPro's ANSI

The Next Wave

Today's programming environments are meant to be used by developers in any and every industry. But as class libraries become more robust, they are likely to become less generic. Ultimately, application-specific programming environments could surpass all-purpose C and C++ ones.

Example: Interleaf Inc.'s Development Environment. Interleaf built the environment for resellers and other third-party developers working with the Interleaf 5 professional publishing system. But Interleaf also is positioning the environment as a tool for vendors of other publishing systems.

The Development Environment consists of the Interleaf publishing engine, Interleaf Lisp (the language in which the environment is written) and the developers toolkit. The toolkit includes an embedded Lisp interpreter, as well as an integrated editor, debugger, compiler and other tools. The environment provides dynamic link library support, allowing developers to program in C or C++.

C and C++ SPARCompilers.

Both the C and C++ environments are built on top of HP's CASE framework, also called SoftBench. This framework provides users with inter-tool communication (via the broadcast message server), distributed computing services, a common Motif-based interface and on-line help. Nearly every CASE and development tool vendor already has integrated, or is in the process of integrating, its offerings with the SoftBench framework. And IBM Corp. has licensed SoftBench's broadcast message server technology for use in its own workstation environment, calling it Framework/6000.

HP's C SoftBench for the SPARCstation has been shipping since August 1991. The C++ version is due to ship in February. List price for C Softbench is $2,300; for C++, $6,455.

DEC begins shipping this month its FUSE Version 1.1 environment for Solaris 1.0. Languages supported by the environment include C, C++, FORTRAN and Pascal. Tools comprising FUSE include various editors, a make utility builder, code manager, cross-referencer, dbx-based debugger, call-graph and class browsers and a profiling tool that graphically depicts application bottlenecks. Like SunPro does with ToolTalk and HP does with its broadcast message server, DEC provides messaging tools for integrating applications and UNIX utilities into its programming environment. These are its multicast message server and EnCASE.

What differentiates FUSE from other programming environments is its incorporation of mouse-sensitive graphics, says Chuck Piper, DEC's UNIX CASE product manager. "This means more than Motif with window wrappers," he says. Piper also claims that the template approach adopted by EnCASE allows for "tighter, lower-level integration."

Like SunPro and HP, DEC is signing up third-party tool vendors to integrate with its environment. DEC FUSE sells for $1,800 per user. EnCASE is available for $2,000 per seat. For C++ users, DEC requires the DEC FUSE C++ Support product, which sells for $750 per user.

And For Their Next Act

The coming year is likely to be the most volatile ever for users and vendors of programming environments. This is the year that Solaris 2.0 is slated to debut. At press time, the majority of tool vendors were dreading the chore of moving their products to the new OS. "Solaris 2.0 will be dramatically different," says ParcPlace's Dellinger. "So, our Smalltalk and C++ products will need to be dramatically different."

One of the biggest–and in Dellinger's opinion, "most gratuitious"–changes will result from SunSoft's elimination of sockets in moving to its SVR4-based operating system. But there will be other massive changes tool vendors will need to contend with, namely, SunSoft's incorporation of multiprocessing capabilities into Solaris 2.0 and its making Solaris 2.0 available on Intel-based platforms. Most tool vendors are taking a wait-and-see approach; after all, SunPro hasn't yet released compilers designed to handle multiprocessing or the Intel architecture.

At the same time, at least two of the front-end CASE vendors are extending their product families downward to handle some of the chores traditionally relegated to back-end tools and environments. Interactive Development Environments (IDE), for example, now offers its own C Development Environment. This product includes Software through Pictures, CenterLine's CodeCenter, FrameMaker or Interleaf Inc.'s Interleaf 5, along with its own reverse-engineering and code-generation modules. (IDE is adding ProCase's SMARTsystem to the list of products supported by the environment.) The product incorporates a synchronization facility that helps maintain consistency between designs and code. "We are trying to make it so that designs, code and documentation remain constant," explains Edward Mueller, director of applications marketing for IDE.

IDE's C Development Environment also offers developers a design-generator module, allowing them to create a complete representation of a program or fragment of a program "with the click of a button," Mueller says.

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Cadre, likewise, is extending its concept of the lifecycle to include automatic code-generation, along with its requirements analysis, test, integration and maintenance facilities. Both Teamwork/OOD and Teamwork/C support code generation and linking, says Wesley Hair, senior product manager, "For C++, we provide a front-end graphical editor and then tie this into various programming environments. For C, we've gone a step further. [Teamwork] maintains consistency among the multiple views of the source code. We generate the code and the graphical view." Teamwork/OOD, unveiled in September 1991, consists of an editor, a C++ code-frame generator, a C++ code-capture utility and an operational interface to CenterLine's ObjectCenter.

Front-end CASE vendors aren't the only ones encroaching on the programming-environment world. Compiler companies, typified by Liant, are expanding their traditional focus. In September of last year, Liant introduced its LPI-C++ compiler. (The company also has compilers and environments for C, C-scape, COBOL, FORTRAN and PL/1, among other languages.) LPI-C++ is packaged with CodeWatch, Liant's source-level debugger. "CodeWatch really differentiates our product," claims Don Dudley, vice president of UNIX development. CodeWatch allows developers working in any of Liant's support languages to set breakpoints, action lists and conditional breakpoints. CodeWatch users can define their own macros and access two different user interfaces–X/Motif and another for dumb terminals. According to Dudley, Liant will be rounding out its programming environment in the near term, either by integrating with one of the frameworks provided by workstation-hardware vendors, or by adapting its RM/COBOL environment to its LPI-C++.

USL is even planning to get into the programming-environment act. The organization already offers C and C++ compilers and a graphics toolkit. "With SVR4.1, we want to offer more of a finished development environment," says vice president Donald McGovern, first for C, and then C++. The vehicle for delivering this environment will be UNIX International's desktop environment, release 1.0, which is slated to be available in the middle of 1992 for Intel platforms. (SPARC, MIPS Computer Systems Inc. and Motorola Inc. versions are expected some time in the third quarter.) "Desktop" will include the USL/AT&T-developed C compiler, the OI-based graphics toolkit and a debugger. "At present, we don't plan to unbundle our development tools from the [SVR4] operating system," McGovern says.

And in the much longer term, programming vendors are in hot pursuit of the goal of isolating developers from mundane coding chores. Exemplifying this approach is a start-up, Oberon Software Inc. Oberon's SynchroWorks is an object-oriented software environment that allows users to integrate off-the-shelf application packages, standard file formats, peripheral devices and objects using a consistent graphical interface. More importantly, nonprogrammers can create applications by combining existing packages, newly created objects and the product's user-interface components.

Existing players are on a similar mission. "We're looking for better ways to reuse code and objects," explains Steve Kaufer, vice president of research and technology for CenterLine. "We want to provide abstractions for more programming tasks, more like people do in the database management world. This means more code-generation techniques and groupware tools." In short, Kaufer says, "We want to pull programmers away from programming." ⊸

The Real-Time Server Comes of Age

More than a cross-development tool, the real-time server optimizes standard UNIX networking facilities for speed and performance.

by JERRY FIDDLER,
Wind River Systems Inc.

Approaches to reconciling UNIX with real-time computing have ranged from "real-time UNIX" to narrowly bridged cross-development solutions. Lately, however, hardware and software have advanced sufficiently to enable the creation of a third option: the real-time server. A real-time server is a specialized combination of hardware and software that processes and executes real-time tasks while maintaining transparent, interactive links to other networked devices.

The Trouble With UNIX

The main stumbling block for real-time UNIX is maintaining true UNIX compatibility while simultaneously ensuring real-time performance comparable to that achieved by dedicated real-time kernels. UNIX was never intended to act as a real-time operating system. Its designers made many architectural choices that were correct for its intended missions–time-sharing systems, workstations, etc.–but were not appropriate for real-time applications.

For instance, UNIX schedules tasks on the basis of "fairness" in order to maximize throughput. In contrast, real-time systems rely on preemptive, priority-based task scheduling to achieve predictable, time-bounded response to real-world events. Likewise, UNIX's memory management model makes it difficult to impossible to switch tasks quickly and deterministically. UNIX's size, I/O requirements and memory-management needs preclude it from integration in minimal-resource embedded computer systems, by far the largest real-time applications category.

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The real-time server's software architecture provides at least four UNIX communications-related services.

Traditional cross-development is no panacea, either. Although cross-development has grown quite sophisticated over the years, it does not completely solve the UNIX/real-time problem because real-time run-time resources do not maintain interactive relationships with non-real-time UNIX systems. In most cross-development environments, applications are developed on a UNIX (or DOS) host and subsequently downloaded to a target, where they are then tested and debugged in isolation from other systems, devices and peripherals on the network of which they will ultimately be a part.

Thanks to new technological developments, though, cross-development provides a base for integrating real-time into networked UNIX environments. When cross-development from a UNIX host to a real-time target is accomplished using UNIX-compatible standard communications protocols, the resulting real-time system is able to maintain an interactive relationship with other networked resources. The real-time and UNIX systems thus can exchange files, communicate, log in to each other and use each other as servers. At its highest level of integration, the networked real-time resource achieves the status of a real-time server.

A real-time server incorporates both hardware and software elements. Real-time server hardware usually consists of one or more single-board computers. The boards themselves must have enough processing power, memory and networking/communications interface hardware to support real-time computing in the context of transparent connectivity. VMEbus boards utilizing 32-bit microprocessors such as the Motorola Inc. 680X0, Sun Microsystems Inc. SPARC, Intel Corp. 80960 and MIPS Computer Systems Inc. RX000 have emerged as the most popular hardware for real-time servers. UNIX workstations from Sun, Hewlett-Packard Co., Digital Equipment Corp., IBM Corp. and other manufacturers are increasingly used as host/development platforms.

UNIX Networking... And More

The real-time server's software architecture must provide at least four UNIX communications-related services: process-to-process communications, remote procedure calls, user-level access tools and remote file access. Wind River Systems' VxWorks real-time operating system is one software architecture that fulfills these requirements.

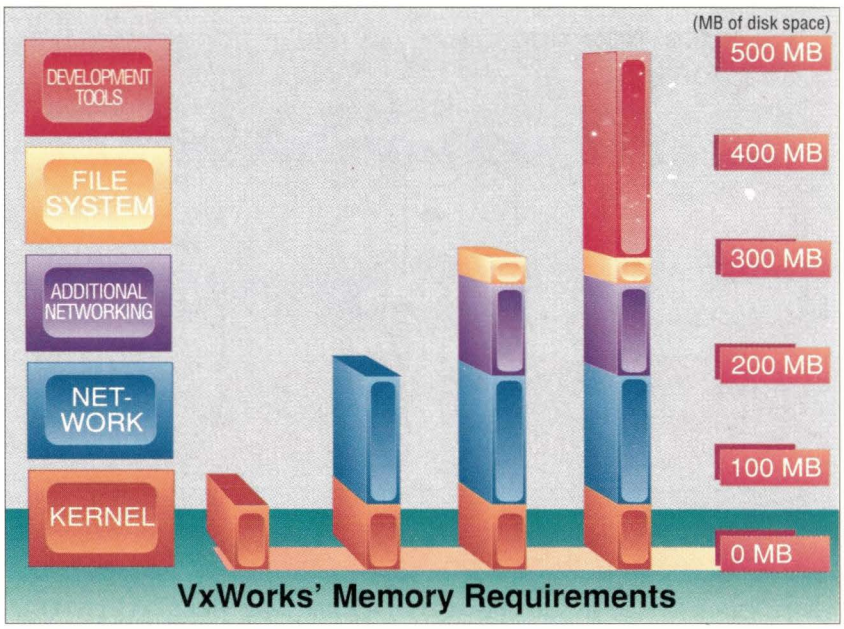
Surrounding the VxWorks' real-time kernel (called *wind*) is the VxWorks operating system. The operating system supports three levels

of connectivity facilities: lower-level network interfaces, a middle level of routing protocols and an upper layer of higher-level protocols. The software's network interfaces include Ethernet, FDDI, serial lines and VMEbus backplane communications. Routing protocols center on the Internet family (IP, TCP, TCP/IP, UDP). Higher-level protocols act as extensions to basic networking facilities and provide special services such as remote procedure calls, file access, remote login, remote-source debugging and remote windowing.

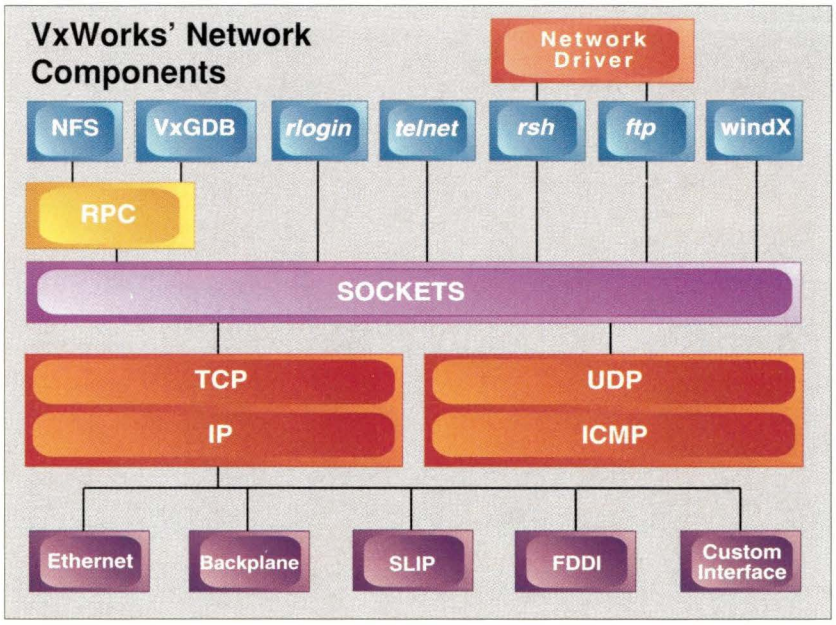
The real-time server's operating system relies on one or a combination of standard UNIX facilities drawn from the three protocol layers to implement the main areas of real-time server connectivity. These facilities include:

• *Process-to-process communications*–UNIX sockets are the basic mechanism for both real-time-to-UNIX and real-time-to-real-time interprocess communications. Routed through the mid-level Internet protocols, sockets can link high-level protocols to lower-level network interfaces connecting with the world beyond an individual real-time server. VxWorks supports three types of sockets: raw (IP), datagram (UDP/IP) and stream (TCP/IP). It also supports the basic Internet protocols ICMP and ARP.

• *Remote procedure calls*–The UNIX Remote Procedure Call (RPC) protocol allows one machine to invoke subroutine and function calls on another machine over a network. In a real-time server, RPC has a number of uses, as it provides a gateway for remote debugging, X Window System remote graph-



VxWorks can be configured from a minimal, standalone OS to a full-scale development platform. Source: Wind Rivers Systems Inc.



VxWorks includes 4.3BSD UNIX-compatible sockets and supports standard UNIX protocols, such as TCP, IP, `telnet`, `ftp`, `login`, *RPC and NFS. Source: Wind River Systems Inc.*

ics and the Sun NFS (Network File Server) protocol. It also can act as a transparent mechanism for application communications. RPC also includes the XDR (External Data Representation) protocol, which automatically handles differences in data format, such as byte ordering, structure padding and floating-point representation.

- *User-level access tools*–These include the remote shell (`rsh`) protocol used to invoke UNIX commands on remote machines with the results returned via socket connections. The `rlogin` and `telnet` protocols further extend inter-machine communications to allow one machine to access others or for a program to execute commands on a remote processor. The remote source debugger (VxGDB) and the X Window System also use the network frequently.
- *Remote file access*–This allows real-time systems to take advantage of one of UNIX's great strengths–the ability to access remote files as if they were local to the real-time system. Protocols supporting this include NFS client and server communications and the File Transfer Protocol (ftp).

Clearly, the VxWorks communications suite closely mirrors SunOS'. This results in seamless integration with SunOS. In addition, the VxWorks application programming interfaces (APIs) to all of these tools are identical to SunOS', providing easy migration of communications software between SunOS and VxWorks.

In addition to working over a network, all of these communications facilities work over a shared memory interface, like VMEbus. The integrated VxWorks backplane driver, with its shared memory capability, enables full, loosely coupled, multiprocessing support. Applications may access multiprocessing communications from several levels, ranging from TCP (for maximum transparency), to the raw driver level (for highest performance).

The features listed above constitute a complete "first generation" real-time server architecture. As the concept advances, real-time server software will expand to support improved graphics, multimedia computing and additional networking, routing and higher-level protocols as they are developed. Any of these will continue to work over Ethernet, FDDI, serial line or any newly added network transport.

Optimizing the Network

Although much of VxWorks network code has been ported from other sources–the basic 4.3 Reno networking environment from Berkeley BSD, and RPC and XDR from the Sun public domain versions–it has been significantly modified and optimized for use in the real-time environment.

In UNIX, most of the network is handled at interrupt level. In a real-time system, this is inappropriate, because it's difficult to prioritize and to preempt interrupt-level code. Therefore, in VxWorks, almost the entire network has been modified to operate at task, rather than kernel, level. Some portions operate within the context of netTask, a system-supplied task, but much of the network operates within the context of the calling task. This makes the entire network, except for a minimal interrupt service routine, preemptible and prioritizable. Since netTask is a normal VxWorks task, any task operating at a higher priority will be unaffected by network activity, and netTask's priority can be changed as required by the application.

Because multiple tasks (or processes in UNIX) have access to the network, interlocking is required for mutual exclusion to network data structures. The network, as delivered by Berkeley, uses an interlocking mechanism called spl, or "set processor level." This actually sets the processor interrupt level to disable *all* task preemption, and not just network-related code. VxWorks has replaced this with binary semaphores, which are fully preemptible. Because these semaphores have priority inheritance, they also solve priority-inversion problems, which occur when a higher priority task is forced to wait for an indefinite period for the completion of a lower priority task.

VxWorks contains all the important optimizations included in SunOS, such as buffer loaning and clustering of mbufs. Because of VxWorks' simplicity, and because of the shared address space, it is also able to perform some additional optimizations that would be far more difficult in SunOS. VxWorks has reduced the number of times data is copied, which is a major bottleneck, and also reduced the number of context switches.

VxWorks network has been clocked at 1.07 MB/s, using a 68040 and an

Intel 82596 interrupt controller, and sends 8-KB packets through TCP/IP sockets. Since Ethernet is a 1.25-MB/s network, the optimizations described above have brought VxWorks very close to the theoretical maximum while remaining fully preemptible.

Server Advantages and Applications

The advantages of the real-time server fall into three main areas: real-time performance, modularity and UNIX integration.

By creating a division of labor between UNIX and real-time, the real-time server brings uncompromising real-time performance to the networked UNIX world. Real-time elements can do what they do best, while communicating and interacting with non-real-time UNIX resources such as file servers, workstations and communications gateways.

Modularity means that it is both easy to add real-time servers as networked nodes and to program them to support multiprocessing, which can be achieved by using the VxWorks shared-memory network interface. In an autonomous vehicle application, such as the Mars Rover Project, separate networked real-time servers can perform specialized roles in graphics, signal processing and number crunching to support the vehicle's control and data-acquisition functions. Processing nodes can be separated by great distances, even from Earth to outer space as in the Mars Rover Project. Multiprocessing also opens the possibility of building fault-tolerant real-time systems where real-time servers take on work off-loaded by a failing CPU.

Integration with UNIX reflects back to the concept of UNIX's role as a framework for networked resources. The UNIX/real-time server relationship means that designers can combine real-time and non-real-time resources in a single system. In the financial industry, real-time imaging, recognition and communications components have been integrated with non-real-time database, data-processing and printing systems to process checks and credit transactions.

UNIX integration also pays dividends in cross-development. Software engineers can take advantage of UNIX's rich development environment and tool chain to efficiently create real-time applications. Separating host/development functions from run-time systems offers greater potential architecture independence. Applications engineers enjoy greater choice over host-target combinations and can migrate to different architectures as technology advances. Transparent networking allows efficient downloading of code from host to target as well as interactive remote source-level debugging. Also, as networked systems, real-time servers can be shared among users to cut per-user development costs.

The Real Future of Real Time

The real-time server model has room to grow and improve as technology advances. Faster networks such as FDDI and Ultranet can more efficiently link processors working in parallel. Integrating additional connectivity features such as ISDN and OSI will extend the reach of real-time server applications. VxWorks will also continue to track changes in SunOS, such as the move towards System V/Solaris.

Hardware advances will also make important contributions to advancing the real-time server. New microprocessor technologies are making incursions into parallelism, neural networks, fuzzy logic and other areas.

Nonetheless, a firm basis for real-time server computing exists today based on off-the-shelf products from workstation manufacturers, peripheral makers, board manufacturers and software vendors. Following the real-time server model, real-time computing is emerging from isolation and joining the open systems world. ⊸

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The SBus programming language and driver needs make special demands on developers.

Go FORTH and Prosper:

Key Design Issues In Developing SBus Products

by Jim Lockwood, Mike Saari, Jeff Siegel and **Jeff Zank,**
Sun Microsystems Inc.

SBus, designed as a high-performance I/O interconnect optimized for future technologies, was introduced as an open specification in September 1989. Since then, many card and system vendors have committed to developing products using this bus architecture. To date, 243 products or services from 103 vendors are shipping for SBus.

To help the growing SBus community shorten development time, Sun is providing technical support in a variety of ways. For example, Sun has established an SBus design center specifically for third-party developers. In addition, the SBus Developer's Kit-II contains 14 separate documents, a floppy disk with sample software drivers and FORTH programs, and two hardware samples. Sun also assists developers with marketing activities (such as field requirements and project justification), sales and distribution.

Through this support, Sun has found key design issues that seem to most concern developers considering SBus projects–the FORTH programming environment and the SBus device-driver structure.

FCode PROM Provides Flexibility

A critical design consideration is programmability. All SBus cards include a PROM that is scanned and interpreted during the power-up cycle of the host system. This PROM contains a program written in "FCode," a byte-coded version of the FORTH programming language. The PROM is referred to as the "FCode PROM."

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HEWLETT PACKARD

Circle No. 21 on Inquiry Card

The presence of an FCode PROM on every SBus device provides flexibility to the board developer. For most applications, two or three lines of FCode text are all that is necessary. But the power of a complete built-in programming language is also available. This allows arbitrarily complex applications to be built into the hardware itself if needed.

FCode (and FORTH) has several noteworthy characteristics. The language is architecture-independent, so SBus systems may be created using any type of CPU. The compiled code is very space-efficient, and has reasonably fast execution times. The compiled code may be executed interactively by typing any desired command name at the ok prompt, which makes hardware and software testing quick and easy. In addition, the FORTH language has been in existence for many years and is especially useful for PROM-based applications. SBus follows the agreed-upon "83-Standard" for FORTH in most respects.

The FCode program may be quite simple or very complex, depending on the needs of the application. Most FCode programs serve one or more of the following functions:

• *Autoconfiguration.* "Autoconfiguration" means that the system automatically links the SBus hardware to the correct SBus software driver. No jumpers or switches of any kind are required for SBus devices. This is done by defining "attributes" within the FCode program. For example, the name attribute identifies the SBus device, thus indicating the appropriate software driver for that device.

The FCode for this declaration appears in FCode text on a single line:

```
"SUNW, zebra-printer"
xdrstring "name" attribute
```

The name attribute (in this case "SUNW, zebra-printer") can be any arbitrary string. By convention, the name attribute always starts with letters that identify the company creating the SBus card. This prevents accidental name "collisions" among SBus cards manufactured by different companies. Other typical attributes include interrupt levels and register locations. The user may also create custom attributes for any other desired purpose.

• *Power-On Initialization.* FCode may be used, if needed, to initialize SBus devices during the host power-on sequence. This could be as simple as turning off interrupts or scrubbing memory. Or, depending on the needs of the SBus device, it could involve an elaborate sequence of events (see below).

```
0 (address) c!              \ Turn off interrupts, by writing a
                            \ "0" byte to a specific address.

5 ms                        \ Delay for 5 milliseconds

(address) 4000 ff fill      \ Fill a region of memory (from
                            \ address to address+4000) with byte "ff"
```

• *Built-In Diagnostics.* SBus card developers can write diagnostic programs in FCode to self-test the SBus device, which can be invaluable for isolating and diagnosing problems because the FCode diagnostics execute independently from the normal software driver. This feature is particularly useful because many hardware faults prevent the operating system from coming up. Diagnostic routines may be simple or arbitrarily complex, depending on a developer's needs.

FCode diagnostics are often written to execute automatically during the power-up cycle. Any resulting status messages will usually come out over the host serial port (or the diagnostic can be programmed to cause on-board LEDs to flash). FCode can query the system "diagnostic switch," using the result of the query to decide whether to perform a quick diagnostic or a longer, slower, more thorough, and/or more verbose test sequence.

Another interesting alternative is to write the FCode so that a diagnostic is compiled but not executed. The compiled routine may then be executed whenever desired simply by typing the routine name at the ok prompt. This feature is useful in manufacturing settings. Or, customers in the field could be instructed to run the diagnostic when a problem develops, possibly eliminating the need for a service visit.

• *Boot Device Support.* A key feature of FCode PROMs is that they allow for the creation of "plug-in" bootable devices. In this context, a "bootable device" is any device that must be accessed and used in the process of booting up the operating system. Although most devices rely exclusively on operating-system-software drivers, bootable devices require an independent driver as well, since the operating system is not up when the device needs to be used. Typical bootable devices are frame buffers (to display power-on and boot messages), disk controllers (needed to access boot files) and network controllers (also needed to access boot files).

In the past, boot drivers for all bootable devices were resident in the system CPU boot PROM. The disadvantage of this method was that it required a modification to the system boot PROM whenever a new boot device was introduced, unless the new device was completely compatible with an existing one.

With SBus, the FCode PROM contains the boot driver for any bootable devices, allowing new devices to simply be "plugged-in" to existing systems. All that is required is that the FCode PROM follow the correct guidelines for that class of bootable device, which entails implementing a fixed set of primitive routines. For frame buffers, these might include "draw-character" or "erase-screen." For disk controllers, the "read-block" routine would need to be implemented. During the power-on cycle, the system boot PROM reads the FCodes of all resident SBus devices. Once this is accomplished, the system can use whatever boot devices are present,

because the required interface routines have now been defined.

Device-Driver Development

No discussion of SBus hardware would be complete without a discussion of supporting software. After all, what good is an SBus card unless the operating system knows how to use it? That's the purpose of device drivers. They link the hardware into the SunOS operating system, which in turn manages these and other devices such as memory, frame buffers and input devices (keyboards and mice) on behalf of the user. SunOS offers a simple yet robust device-driver interface: You can operate a device with a very simple device driver, and almost any kind of device, no matter how complex, can be supported.

There are several common types of device drivers, including character, block, streams, SCSI, network and frame buffers. Character device drivers are the most widely used because they can move characters or blocks of characters to and from the device.

Atlthough space constraints do not allow a detailed description of device drivers and their functions, some basics are in order. (There are several books available on this topic, including two manuals from Sun.)

• *Routines and Structure.* The device driver provides an interface to the user system-call layer by way of the SunOS operating-system kernel. All user programs go through this system-call layer to access kernel resources, such as memory, disks, network devices and expansion boards or, on Sun's SPARCstation desktop machines, an SBus card. The SunOS operating system services interrupt from the device and direct them to the device driver's interrupt routine. The driver packetizes the data going to and from the device in such a way that the kernel can pass data into the system-call layer to and from the user application.

A device driver is not a single subroutine. Instead, it is a series of subroutines that can be divided into three sections: autoconfiguration and initialization routines, routines for servicing I/O requests (the top half) and interrupt service routines (the bottom half). Driver autoconfiguration routines are responsible for identifying the device to the kernel, probing the device to verify its presence, initializing the device to an on-line state and setting device-specific data structures to the state required in order for the hardware to operate with the top and bottom halves of the device driver.

This portion of the driver is usually called only during machine power-up or upon dynamic loading of the device driver. Autoconfiguration and initialization routines are called `identify` and `attach`. The top-half routines–`open`, `close`, `read`, `write`, `ioctl` and `physio`–are called on behalf of user applications making I/O requests of the driver. They are usually interruptible by the kernel for the servicing of other devices configurations. Bottom-half routines–`intr` and `start`–operate in response to device interrupts and are usually not interruptible by other devices. The table above lists routines that could make up device drivers for character SBus/SunOS machines.

By convention, the name of the device prefixes each routine name. For example, if the device name is "bpp," the open routine would be called "bppopen" in your device driver.

• *Kernel Interface.* SunOS also provides a rich set of kernel-resource calls and utilities that allow drivers to perform a host of supporting functions, such as reserving memory for data structures of data transfers and adding or removing a device from an interrupt level.

Each device driver has an entry in either the `cdevsw` or `bdevsw` table, depending on whether it is a character or block driver. These tables contain structure definitions in array form for the device driver's top-half routines. The order in the array depicts the major number to be associated with a device. This major number is used when making the entry point to the driver in the `/dev` directory. (The

Table. *Possible Device-Driver Routines for SBus/SunOS Systems*

Routine	Function
open	Open the device for activity.
close	Close the device.
read	Read data from the device. Could call physio routine with specific parameters, or copy specified data into a kernel's address space.
write	Write data to a device. Parallels the read entry point.
ioctl	Get or set device parameters.
select	Check device to see whether data is available for reading and/or space is available for writing data.
mmap	Map a device's contents into memory.
start	Start data transfer to or from a device.
intr	Device interrupt handler routine.
init	Support for loadable device drivers.

entry point is where the application program opens the entry point in order to request access to and resources from the device.)

The kernel also provides a data structure–dev_info–that represents the configuration of devices in the system. The dev_info structure contains pointers to the device's parent, sibling and slave devices, the name of the device, register information, interrupt information, a pointer to the device's dev_ops structure and a pointer for driver-specific data structure. During the power-up and boot process, vmunix interacts with the Open Boot PROM to autoconfigure the operating system and devices by extracting property and attribute information from the FCode PROM on each board and filling in a dev_info structure for each device.

• *Loadable Device Drivers.* SunOS features loadable device-driver modules, which can be added to SunOS while it is booted without affecting its operation. This greatly simplifies installation: Any user can install third-party products without reconfiguring, rebuilding or rebooting the operating system. Loadable device drivers also shorten development cycles for much the same reason.

Character, block and STREAMS device drivers on the SPARCstation 1, 1+, 2 and IPC can be loaded using the modload(8) command. (Currently, SCSI device drivers and those for bootable devices are not modloadable.) Loadable device drivers work with the vd driver already in SunOS to bootstrap drivers into the running operating system without affecting other devices' operation or user processes. The modload(8), modunload(8) and modstat(8) utilities handle the bootstrapping and removal, as well as status checking of devices with close interaction with the vd driver already in the kernel. Very little is required to make a device driver loadable under SunOS release 4.1.1.

Loadable drivers must contain an initialization routine to be used by modload, modunload, modstat and the vd driver. They must also provide a vdldrv data structure for use by the vd driver and the modload and modunload process. The vd driver works with the modload, modunload and modstat utility to actually load or unload the driver from the running kernel. The vdldrv structure contains fields that define the device type.

Finally, loadable drivers must have a cdevsw or bdevsw data structure for the device. The cdevsw structure array contains entry points to the top-half routines of a character device driver. The values for this array must be provided so that the modload process can configure the device into the system-

Designing and Powering SBus Cards

How can card developers, use SBus' small form factor (a postcard-sized 83.82mm by 146.7mm) to successfully implement a new SBus card design? Think small. Instead of viewing a smaller board as a hindrance to design, consider it an opportunity to rethink implementations. That means look for ways to make the design simpler, more robust, more reliable and easier to manufacture.

It's easy to see how the SBus form factor fits into the highly integrated technologies of the 1990s by comparing the Antares Microsystems SCSI SBus card to the Sun Microsystem Inc. 6U VME SCSI-3. Comparing an SBus to a VMEbus might seem like an "apples and oranges" comparison. However, each board fills a particular need; the two boards actually complement each other in many situations.

Both cards provide a SCSI/DVMA interface. The Sun SCSI board has 83 active devices, while the Antares board has only four active devices, including the FCode PROM. Fewer components means greater reliability, greater manufacturing yields and lower costs. There is little or no performance penalty as a result of the smaller size; in fact, with the SBus SCSI card, there may be a slight gain in performance. These advantages are all natural by-products of the smaller board size resulting from the technological advances that continually shrink the area required to perform any function.

For example, a SPARCstation 2 configured with 8 MB of memory, a monochrome frame buffer on an SBus card and a second SCSI adapter (such as the one from Antares) takes up 77% less board area than the original SPARC workstation, the Sun 4/260, and draws 88% less power. Smaller board areas mean that large form-factor boards are no longer needed to accommodate system-configuration options. Similarly, lower power requirements translate into reduced system power-supply costs and cooling costs.

A concern often heard from SBus developers is that the power available to an SBus card is "only" 10 watts. The power consumption made available to SBus cards is actually a very generous quantity, if developers buy into the idea of design-

wide cdevsw array. If the device is a block device, the bdevsw array is used.

• *Driver Development Steps.* Developing device drivers is easy if you follow a few simple steps. (However, because device drivers are application-specific, you may follow different steps when developing your own.) The first step is to verify that the hardware works correctly and that it is visible to the bus in the way it has been designed to be. To do this, you plug the board into the SBus slot on your Sun SPARCstation and probe it from the Open Boot PROM ok prompt. With the help of the Open Boot PROM Toolkit User's Guide and Reference board, you should be able to verify board addressing, read and write registers on the board and even program it.

The second step is to write a simple driver that will be loadable with modload and perform simple device identification. All you have to write is a driver with open, close, identify, attach and init routines and supporting driver-data structures. The open, close, intr and attach routines should not contain any code, except for debug print statements to show successful entry and exit for these routines. The identify routine is needed for autoconfiguration and identifying the device to SunOS. The only parameter it has is a character pointer to a string. This string is the value of the name attribute taken from the FCode PROM and string, compared with a name value in the identify routine in order to depict a device match and its identification to SunOS. Successful completion of the identify routine signals to the kernel that you have a device match and that its next step is to call the driver attach routine.

At this point, your attach routine should be blank. Your init routine is required in order for your driver to be modloadable and unloadable using modload(8) and modunload(8). To support modload, your driver must fill out a vdldrv structure. In the init routine, set up a case statement that will indicate whether you are modloading, modunloading or modstating the device. In the modload section, set your defined vdldrv pointer equal to the kernel's vddrv structure entry of the same type. Leave the modunload and modstat sections empty. Your driver will still modunload even though you haven't done anything in your driver specifically. During this step you can refer to the *Writing SBus Device Drivers Manual* for code examples and data structure specifics. You should now be able to compile your driver and modload it into the kernel successfully with only a few lines of C code.

The next step is to fill out the

How Low Can You Go?

	CPU	8 MB Memory	B/W FB	1st SCSI	2nd SCSI	Total
Sun 4/260	100W	75W	(incl)	25W	25W	**225W**
SPARCstation 1	12W	(incl)	10W	(incl)	5W	**28W**

ing with the highly integrated technologies of the 1990s, namely ASICs and surface mount. By letting the appropriate technology for the 1990s drive design, power compliance will fall out as a "freebie."

A brief look at two generations of systems helps illustrate this point (see How Low Can You Go?). For example, a SPARCstation 1 configured with 8 MB of memory, a monochrome frame buffer on an SBus card and a second SCSI adapter draws 28 watts, a mere 12% of the power (225 watts) that was needed four years ago by the original SPARC workstation, the Sun 4/260, to accomplish the same job.

For simple or low-end SBus applications, existing programmable-logic technology is more than adequate for adapting an off-the-shelf piece of VLSI to SBus with no more than a single PAL. For high-end, integrated applications, ASIC technology makes it perfectly feasible to put both the application logic and the SBus interface inside a single package.

The key is to think about creating the design in the least amount of space with the fewest number of devices. That should be a design goal, just like designing for "highest performance with least cost." For some SBus card developers, this may be a new way of approaching a hardware design, but the result will be a better overall product.

"Better" means a product that yields well in manufacturing, requires relatively little parts inventory on the line, proves to be reliable in the field, and doesn't cost much to repair if it breaks. "Better" also means a product that an engineer can justifiably forget about once it goes into production. It has a lower overall life-cycle cost that allows a company to price it more attractively in the marketplace. That's the kind of "better" product that results from thinking small.

attach routine with device-specific information, such as the allocation of zeroed memory for unit-specific data structures with kmem_zalloc(). If your FCode PROM on the board contains the reg or the intr attribute, this information will be defined in the dev_info structure passed into the attach routine. You then call addintr() to add this device to the interrupt-level chain in the kernel. Next, call map_regs() to map the device registers into the device driver's address space.

At this point, if your device has device-specific attributes stored in the FCode PROM, call get_prop() to extract them into the device driver. Your attach routine should then perform any device-specific testing and configuration to verify that the hardware is operational, and finally call report_dev() to report the device's availability on the console. After compiling and modloading into the kernel, your device is now autoconfigured and attached in an on-line available state. The registers are mapped into the driver's address space, and the device is registered on the correct interrupt chain. You are now ready to respond to interrupts and read and write to the device.

> Interrupts on Sun's SBus machines are autovectored, polling-style interrupts.

The next step is to add the interrupt-handler routine for your device and fill out the open, close, read and write routines with device-specific information. Interrupts on Sun's SBus machines are autovectored, polling-style interrupts. This means that the kernel will receive an interrupt and transverse each device on that chain to see whom the interrupt is for and call its interrupt-handler routine. The device's interrupt-handler routine then processes the interrupt and continues with any reads or writes to the device. This step fills out the top and bottom levels of the device driver.

What you need to do now almost depends on the device itself. For example, your device could perform DMA or programmed I/O to move data to and from the device and user. If your device uses DMA, is there a need to use DVMA as a data mechanism? Implementation specifics and device design will determine which routines you should use to allocate and set up data transfers to and from the user. The *Writing SBus Device Drivers Manual* can assist you in this area.

The last step in any device-driver development cycle, no matter how simple or complex the driver, is testing. Drivers should be tested with their real-world applications whenever possible as part of the standard soft-

ware-quality-assurance process.

• *Kernel Debugging.* Sun provides an adb-like kernel debugger called kadb that is useful in developing and debugging device drivers. You can use "kadb" to debug the kernel, device driver or any standalone program. Unlike adb, kadb runs in the same supervising virtual address space as the program being debugged. However, it maintains a separate context. The debugger runs as a coprocess that cannot be killed or re-run. There is no signal control, although the keyboard facilities (CTRL-C, CTRL-S and CTRL-Q) are simulated.

While the kernel is running under kadb, the abort sequence (L1-A or BREAK) drops the system into kadb for debugging–as will a system panic from device-driver programming errors. When running other standalone programs under kadb, the abort sequence will pass control to the Open Boot PROM monitor ok prompt. The kadb user interface and commands are similar to that of adb.

kadb is quite powerful. It allows the driver developer to set breakpoints in the driver for debugging, as well as to read and write to kernel and device-driver memory locations, single-step through drivers and print out device-register and structure values. In addition, it allows the driver developer to print out kernel data structures. Using loadable drivers in conjunction with kadb will result in faster development and testing, and will lead to higher quality products.

Summary

SBus was designed to be developer-friendly. Features such as a smaller form factor, a flexible programming environment and simple device-driver interfaces have helped dozens of developers design and ship SBus solutions. The high degree of technical support available from Sun has allowed many of these developers to complete their design cycles on time or even ahead of schedule.

A current or potential SBus developer needs as much information as possible in order to design a successful product. The most important tool a developer should use is the SBus Developer Kit-II, available through Hamilton-Avnet Inc. (800) 426-2742, or Wyle Laboratories (714) 851-9953 for a fee of $85. Developers can also get SBus technical support by contacting Sun's Catalyst Information Center by phone (415) 336-4252, fax (415) 494-3631 or electronic mail (sbustech@sun.com). In addition, SBus card and system developers can visit the SBus design center located on Sun's campus in Palo Alto, CA, for help with debugging and prototyping their SBus products. Sun's assistance lets designers and their companies achieve design successes in the fast-growing area of RISC/UNIX workstations. ⊷

Jim Lockwood is SBus hardware applications engineer, **Mike Saari** is Open Boot PROM and FORTH applications engineer, **Jeff Siegel** is manager Core Technologies Group, Sun Microsystems Computer Corp. and **Jeff Zank** is SBus software applications engineer at Sun Microsystems Inc., Mountain View, CA.

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.

40-MHz SPARCalike

A 40-MHz SPARCalike has been introduced by Tatung Science and Technology.

The COMPstation 40 is a SPARC-based system sporting three SBus expansion slots (one more than a SPARCstation 2), a 19-inch color monitor, 8 MB of RAM, a single-slot graphics card, an internal 207-MB hard disk, and a choice of either Solaris 1.0 or Motif/X11R4/X.desktop.

Pricing on the base configuration is $9,990 (the same base configuration with a 15-inch color monitor is $8,990). In addition, the system can support a maximum on-board RAM of 64 MB, expandable to 128 MB with add-on cards. The COMPstation 40 can also contain up to 680 MB of internal storage, and has room for one 3 1/2-inch floppy.

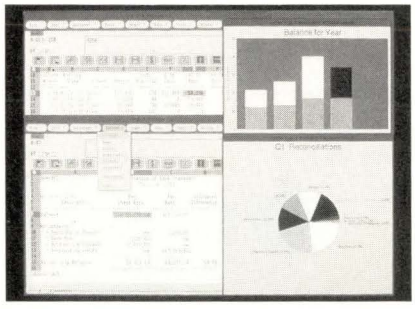
Tatung Science and Technology Inc., 2060 Ringwood Ave., San Jose, CA 95131.

Circle 119

Lotus Upgrade

Lotus has debuted an Open Look interface for the 1-2-3 spreadsheet for Sun and SPARCalike workstations. While 1-2-3 has been on Suns previously, the product had copied the look and feel of the DOS version. The new version incorporates graphical features consistent with the Open Look standard. It is thus more competitive with the Wingz product from Informix.

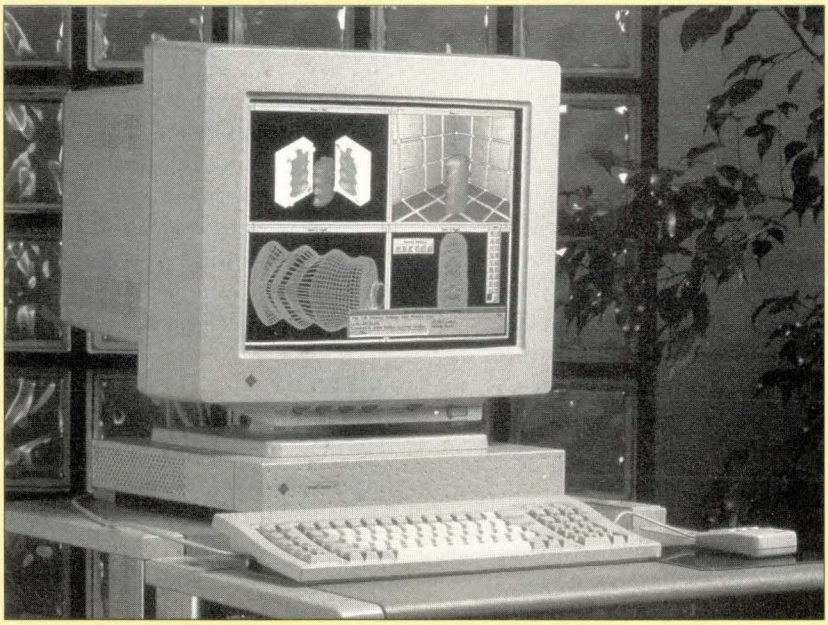
Open Look 1-2-3 is compatible with previous releases of 1-2-3, including the DOS and previous Sun SPARC versions. In addition, the product supports the X Window System; integrates the company's C Add-in Toolkit; features a bundled Sybase SQL Server DataLens Driver; and supports Lotus Real-time, software that feeds real-time financial data directly into 1-2-3.



Pricing begins at $695 per license.

Lotus Development Corp., 55 Cambridge Parkway Cambridge, MA 02142.

Circle 120



MicroStation On SPARC

Intergraph has ported its well-known MicroStation CAD package to the SPARC processor. The product is a general-purpose CAD package widely used in such fields as mapping, GIS, electronics design, mechanical design and manufacturing. It is also the foundation on which several hundred third-party vertical applications have been developed. There are, for instance, MicroStation packages for civil engineering, landscaping and roadway design.

MicroStation has before only been available on Intergraph's own hardware, Macintoshes and PCs. MicroStation running on a SPARCsystem can transparently exchange files with MicroStations running on those other platforms.

MicroStation SPARC is priced at $3,450. A C-based development language, MicroStation Development Language (MDL), will be available in the next few months.

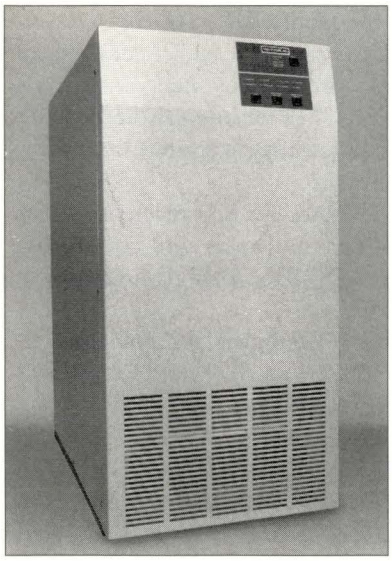
Intergraph Corp., Huntsville, AL 35894-0014.

Circle 118

10-KVA UPS

Para Systems has introduced an uninterruptible power supply for midrange systems and networks. The Minuteman 10KVA is a 10,000 VA on-line UPS that features load handling for both linear and non-linear equipment. It will handle linear loads with a crest factor ratio of up to 2.8:1.

In addition, the product offers a



Static Bypass Switch (SBS) that provides filtered bypass power in case the unit overloads. SBS switching is accomplished in phase with no interruption, and the SBS will transfer back to system operation when the overload condition is removed.

Pricing begins at $16,499.

Para Systems Inc., 1455 LeMay Drive, Carrollton, TX 75007.

Circle 121

Pirate Busters!

An anti-piracy product that protects SPARCstation applications from unauthorized duplication has been introduced by Software Security.

The Activator/WS is a hardware key that users place in the serial port of their workstation. Developers then integrate Software Security's software module with their own products. Once running on a SPARCstation, applications then automatically check to see if one of Software Security's hardware keys is present in its system's serial port. If the key isn't there, the application won't run.

The current version of the product is a standalone offering, though a network version is planned. Pricing on the Activator/WS begins at $85, quantity one.

Software Security, 1011 High Ridge Road, Stamford, CT 06905.

Circle 122

Anti-Virus Software

Software that protects UNIX and other systems from viruses, logic bombs, worms and similar threats has been introduced by CyberSoft.

Called Vfind, the product is a virus scanner that resides on a UNIX system in a heterogeneous network to protect the network as a whole from attack. The company says that Vfind is particularly designed to protect Macintosh and PC systems from viruses that may hide unnoticed on UNIX systems and then infect or reinfect personal systems.

Vfind is available for SPARC-based systems in a variety of different configurations. Pricing for a larger server supporting more than 20 clients is $7,000. At the other extreme, pricing on a standalone system is $300.

Cybersoft, 210 West 12th Ave., Conshohocken, PA 19428-1464.

Circle 123

Software Maintenance On Suns

A workbench designed to assist in the maintenance of existing code has been introduced by Advanced Software Automation. Called Hindsight, the product takes source code and automatically generates structure charts, logic diagrams and technical documen-

tion. Programmers can then edit source code without leaving the product.

Hindsight 2.0 currently supports C code. Support for FORTRAN, Ada, COBOL and C++ is planned. The product runs on Sun, DEC, IBM, HP and Apollo machines under both Motif and Open Look. There are also standalone and network versions of the product.

Pricing ranges from $4,950 to $7,450.

Advanced Software Automation Inc., 2880 Lakeside Drive, Ste. 226, Santa Clara, CA 95054.
Circle 124

Fax for UNIX

Software that allows UNIX hosts to send and receive external fax documents via modem has been released by Unipress Software. VSI*FAX automatically transmits text or PostScript files created by standard document processors, such as FrameMaker, to fax machines or fax modems. VSI*FAX can also allow the user to print faxes or display them under the X Window System.

VSI*FAX was developed by V-Systems of Santa Ana, CA, but is being marketed by UniPress. The product comes with the SX-200 fax modem and associated control software.

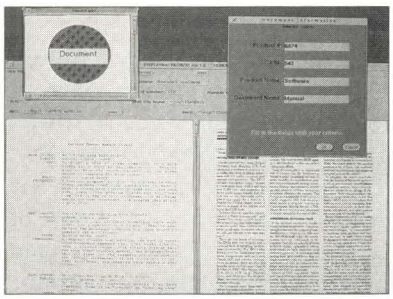
The product can be upgraded with assorted optional modules, including a Motif viewing interface and a PostScript emulator. Pricing begins at $1,600.

Unipress Software Inc., 2025 Lincoln Highway, Edison, NJ 08817.
Circle 125

Multimedia Imaging Platform

ERI has introduced what it calls the OutLook imaging platform. Combining the Xerox Imaging Systems ScanWorX scanner and OCR software, a SPARCstation, an RDBMS and a spreadsheet, the product can store, manage and manipulate several different kinds of documents and data. The product is meant for organizations that have large amounts of information, particularly in the form of hardcopy, which must be rapidly converted to electronic form and then managed afterwards.

OutLook can store as Binary Large



Objects (BLOBs) such material as photographs, audio, video, scanned artwork and images, and text. Users can search, and where necessary, modify that material through OutLook's own user interface.

Pricing begins at $80,000.

ERI, 180 Vanderbilt Motor Parkway, Hauppauge, NY 11788.
Circle 126

FORTRAN Re-engineering Product

A software maintenance product that allows software engineers to understand, evaluate and redocument existing FORTRAN software has been introduced by Reasoning Systems. Refine/FORTRAN reads FORTRAN source code and produces structure chart diagrams, data-flow diagrams, cross-reference reports and coding-standards violation reports.

Users can browse Refine/FORTRAN's reports through its own interface, which runs on the X Window System. Or, the reports can be printed on a PostScript printer. The product can also export its information to assorted CASE tools. There is also a Refine/C, and a version for Ada is planned. The product runs on Sun workstations and SPARCalikes.

Pricing begins at $3,500.

Reasoning Systems, 3260 Hillview Ave., Palo Alto, CA 94304.
Circle 127

Script Writer

Cora Computer Technologies has introduced EZ Builder For Shell, a graphical tool that helps UNIX users create, debug and modify shell scripts for systems installation and administration. EZ Builder generates POSIX-compatible shell scripts for use under sh and the Bourne shell, and is based on the Motif GUI.

Users can make choices of program logic, and Builder then constructs a script. Shell scripts can be created, run and debugged entirely from within Builder.

The product is available on a single-user, multiuser and site-license basis. Price for a single-user copy is $699.

Cora Computer Technologies, 308 Colony St., West Hempstead, NY 11552.
Circle 128

Disaster Recovery Software

A network disaster recovery package has been introduced by Software Moguls. Called SM-arch, the product protects heterogeneous networks by allowing remote file backup on UNIX and non-UNIX systems. SM-arch can back up UNIX workstations (including Suns), MS-DOS machines, Apple Macintosh systems and DEC VAXes running under VMS.

The product supports remote files and remote drives and provides multiple simultaneous backups. There are two parts to the product: a server module that runs on some designated machine in the network, and a client that runs on each end-user system. An SM-arch server module for Sun SPARCstations is $4,000; a client model is $500 for workstations and VAXes and $125 for personal systems.

Software Moguls Inc., 11095 Viking Drive, Ste. 510, Eden Prairie, MN 55344.
Circle 129

OLTP Application Builder

A development environment for online transaction processing applications is now available for Sun workstations from Ally Software. The tool set consists of the Ally 4GL from Ally, the Informix RDBMS and UNIX System Laboratories' Tuxedo transaction manager software. The Ally 4GL allows users to develop and distribute OLTP solutions across heterogeneous networks; the Informix RDBMS provides the underlying RDBMS function; and Tuxedo routes, schedules

and coordinates transactions in multiprocessor environments.

Pricing on the three-part package varies according to the purchaser's site. For the Ally 4GL on SPARC platforms, the cost ranges from $1,256 to $33,750. For the run-time version of Ally, pricing ranges from $375 to $10,125. Tuxedo licenses are $1,250 to $5,000.

Ally Software Inc., P.O. Box 500, Blue Bell, PA 19424-0001.
Circle 130

Frame Filters

Frame Technology has announced FilterPak 3.0, software that allows FrameMaker 3.0 users to import and export a variety of text and graphics to and from Frame documents

Filter Pak provides support for WordPerfect 5.0 and 5.1, Microsoft Word 4.0, Interleaf TPS and PICT graphics. The PICT format is the Apple Macintosh standard, and allows Frame to use graphics from such Macintosh programs as MacDraw II and Canvas.

In addition, FilterPak 3.0 contains a number of enhanced filters, including improved support for graphics in the Computer Graphics Metafile (CGM) format. CGM is one of the standards specified by the U.S. Department of Defense as part of the Computer-Aided Acquisition and Logistics Support (CALS) initiative.

Pricing for FilterPak 3.0 on Sun systems begins at $995 for a new site license. Current users of older Frame FilterPaks can upgrade for $200.

Frame Technology Corp., 1010 Rincon Circle, San Jose, CA 95131.
Circle 131

Systems Admin Package

Probe/X, a systems-administration and analysis package, has been announced by Strategic Software Group.

Probe/X resides on a UNIX system and provides over 20 different screens of information regarding system performance and usage. Among other things, the product shows the level of CPU activity, disk subsystem activity, main-memory utilization, file-system balancing, network statistics and device configuration. In addition, Probe/X provides a data-logging feature that collects and stores information regarding various activity levels within the system.

Pricing begins at $495.

Strategic Software Group Ltd., 11050 5th Ave., NE, Ste. 101, Seattle, WA 98125.
Circle 132

Quintus Applications Shells

Two application software shells, created using the Quintus WorkPro Prolog-based information access/management applications, are now available from the company.

BugQ is designed to coordinate queue management, logging, analysis and resolution of bugs in software development and maintenance. CustomerQ is an interactive customer/technical support application designed to integrate customer histories, problem/solution matching and escalation procedures for use in telephone hotline and email support of internal or external customers.

Average cost per site for either tool is roughly $50,000, with the exact price

dependent upon the integration and support services required.

Quintus Corp., 2100 Geng Road, Palo Alto, CA 94303.
Circle 133

X-Terminal under $1K

A $995 monochrome X-terminal has been introduced by Visual Technology. The TX100M comes standard with a 14-inch, non-interlaced monitor with a resolution of 1,024 by 768 pixels when running at 62 Hz, or 864 by 648 pixels when running at 72 Hz. It has 2 MB of memory, a 16.6-MHz Motorola 68020 processor and Visual's OSF Motif lookalike, XDSwm window manager. The product can also run other local clients.

TX100M also has virtual-screen-panning ability and the option of 1 or 2 MB of flash ROM, which means that the terminal can store multiple, customized fonts within the X-terminal itself. Other options include four-shade grayscale capability and a Flash EPROM for local X server storage with dynamic reprogramming.

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

Board Turns PCs Into X-Terminals

A graphics coprocessor board that can turn AT-or EISA-bus systems into high-resolution X-terminals has been introduced by Number Nine Computer. The #9GXi is a co-processor board based on the 34020 graphics processor from Texas Instruments. It is chiefly meant to give PCs high resolution for CAD/CAM applications. However, the company says that when paired with an Ethernet card and X software, the board makes a PC into an inexpensive X display.

#9GXI can be programmed to provide a resolution from 512 by 480 pixels to 1,280 by 1,024 pixels. It has a vertical refresh rate of up to 72 MHz. It can give a PC 2-bit color and has up to 4 MB of DRAM, and up to 2 MB of VRAM. SuperVGA functionality is built into the board, and there is a floating-point-unit option.

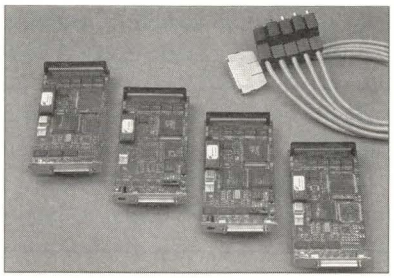
Pricing ranges from $995 to $1,995, depending on configuration.

Number Nine Computer Corp., 18 Hartwell Ave., Lexington, MA 02173.
Circle 135

Five SBus Cards

Five new SBus cards have been introduced by Performance Technologies.

These include the PT-SBS420, which provides SBus systems with a second SCSI port (pricing starts at $495), and the Combo Module, which adds multiple communications functions. There are two models of the Combo–the PT-SBS525, which offers Ethernet, three serial ports and one parallel port; and the PT-SBS540, which offers a SCSI, three serial ports and one parallel port. Both models are $995.



Next in the product line is the PT-SBS515, which provides three 38.4 K-baud serial ports with full modem control and a parallel-port printer interface at $695. The PT-SBS530 offers four serial ports with modem control and 38.4 K-baud performance with prices starting at $695. Finally, the company offers the PTSBS520, which provides a second 10-MB/s Ethernet port. Pricing on the product starts at $395.

Performance Technologies Inc., 315 Science Parkway, Rochester, NY 14620.
Circle 136

UPS For the Office

A new ferroresonant UPS rated at 600 VA/400 watts has been debuted by Alpha Technologies. Designed for office settings, the 600T protects networked or standalone systems from black-outs, brown-outs, surges, spikes and other destructive power fluctuations. It also filters out noise distor-

tion. The ferroresonant transformer has a MTBF of more than 20 years.

The product will signal attached computers of AC failure, low battery and low battery shutdown. Battery packs can be added with a single plug, providing backup power from 40 minutes to eight hours depending on configuration.

Pricing begins at $849.

Alpha Technologies Inc., 3767 Alpha Way, Bellingham, WA 98226-8302.

Circle 137

Flashy Terminal Servers

Terminal and printer/terminal servers using Flash PROM technologies have been introduced by Lantronix.

The units use flash PROMs to store their resident software. The company says this makes them relatively fault-tolerant in that, in the event of power outages, the machines can quickly reload themselves, rather than rely on servers over a network.

Pricing begins at $1,695 for a printer/terminal server with four serial ports and one parallel port. Eight- and 16-terminal versions are also available.

Lantronix, 26072 Merit Circle, Ste. 113, Laguna Hills, CA 92653.

Circle 138

Ruggedized SPARCstation Debuts

IBI Systems has introduced what it's calling a "fully integrated SPARC workstation for industrial, laboratory and rackmount applications."

Based on Sun's SPARCengine 2, which runs at 28.5 MIPS, is the SP-5100. The system comes with two hard drives, a CD-ROM, tape backup, floppy drive and removable hard drive. All of the storage devices are shock- and vibration-isolated and dust-protected.

Total system price is $18,900.

Integrated Business and Industrial Systems Inc., 6842 NW 20th Ave., Fort Lauderdale, FL 33309.

Circle 139

Color Printer For Monochrome Price

The new Seiko Personal ColorPoint is a 300-dpi desktop color printer that works with PCs, Macintoshes and UNIX workstations.

The printer supports Sun's NeWSprint and the X Window System using software drivers and interpreters. The Personal ColorPoint can print a letter-size color page in less than two minutes. It can accept media sizes ranging from postcard (3.54 by 3.46 inches), to the European B4 size (8.53 by 11.93 inches), and it accepts a variety of paper stocks.

The suggested list price of the Personal ColorPoint is $3,999. The system is distributed by Access Graphics Technology Inc.

Seiko Instruments USA Inc., 1130 Ringwood Court, San Jose, CA 95131.

Circle 140

Project Management

Digital Tools has released version 1.2 of AutoPLAN, its graphical project-management software.

The upgrade takes full advantage of Open Look. Its Summary Task feature enables a user to identify a task in AutoPLAN as a summary, or "Parent

Task." This summary can be broken down into "Child Tasks," and then linked to other projects located on the program's project path. The graphical Work Breakdown Structure editor allows the user to subdivide major projects into smaller components, which in turn can be distributed to individual workstations across a network. The new release also incorporates a floating-license server.

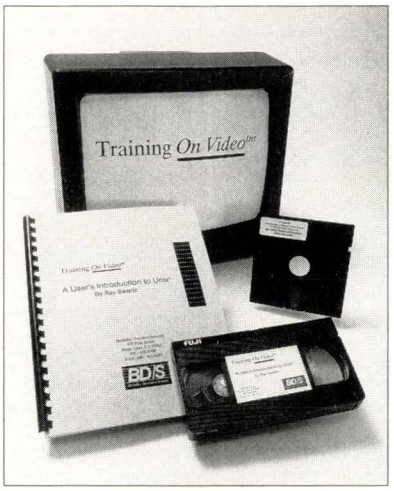
The product is priced at $2,995 per license for the floating-license version and $1,495 for the node-lock version.

Digital Tools Inc., 18900 Stevens Creek Blvd., Cupertino, CA 95014.
Circle 141

Video Training for UNIX

Berkeley Decision/Systems had added another course to its *Training on Video* product line.

Called "A User's Introduction to UNIX," the course starts with an overview of UNIX and its history and continues by showing viewers how to log on, navigate within the file system, manipulate files, edit with `vi`, send



and receive mail, and use commands such as `find` and `tar`.

The material is geared toward users who have previous computer experience, but are new to UNIX. The course comes with a two-hour video cassette, a 150-page manual, a student workbook and a hands-on `vi` tutorial.. The package sells for $295.

Berkeley Decision/Systems
803 Pine St., Santa Cruz, CA 95062.
Circle 142

Unbound's New Optical

A rewritable optical-disk subsystem that provides up to 650 MB of data capacity per removable disk cartridge has been introduced by Unbound.

The OptiStor 650 system is ideal for sophisticated document-image-processing applications, as well as archival storage and retrieval of graphics, photographs, audio, video and multimedia files.

Each double-sided 5 1/4-inch optical cartridge contains up to 594 MB of formatted data. Up to seven drives may be daisy-chained, providing a total capacity of 4.45 GB of on-line data. The Sony drive used in each unit provides a data-transfer rate of 900 KB/s and a burst rate of 1.2 MB/s.

The OptiStor interfaces to DEC, Sun and Macintosh systems via standard SCSI cabling. The table-top model is priced at $4,180 and the rack-mount version is $4,390.

Unbound Inc., 17951 Lyons Circle, Huntington Beach, CA 92647.
Circle 143

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ADVERTISER's INDEX

CIRCLE NUMBER		PAGE
1	Acropolis	45
2	Apex Computer	23
3	Apunix Computer	25
4	Artecon	6
46	Artecon	7
5	Aurora Technologies	75
6	Aurora Technologies	77
7	CenterLine Software	16
8	Computer Upgrade	39
9	Cranel	14-15
10	CS Electronics	75
11	Datalease	77
12	Dataram	20
13	Data Storage Marketing	78
14	Digital Tools	49
15	Eakins Open Systems	48
16	Engineering Design Team	18
17	FirstBase Software	76
18	GNP	5
19	GNP	31
20	GNP	43
21	Hewlett-Packard	65
22	IMSL	27
23	Island Graphics	37
24	Megabyte Memory Products	73
25	MiLan Technology	29
26	Mini Computer Exchange	44
27	Morning Star Technology	24
28	National Instruments	63
29	National Peripherals	2
30	Novadyne Computer Systems	47
31	Parity Systems	inside back cover
32	Polaris Service	17
33	Qualstar	24
34	Rave Computer Association	10
35	Sun Microsystems	60-61
36	Sun Microsystems	70-71
	Sun Open Systems Expo	59
37	Tadpole Technology	inside front cover-1
38	Transitional Technology	back cover
39	Trimm Industries	12
40	Vigra	19
41	Visual Information Technologies	34
42	ZZYZX	9
43	ZZYZX	11
44	ZZYZX	13
45	Zetaco	40-41

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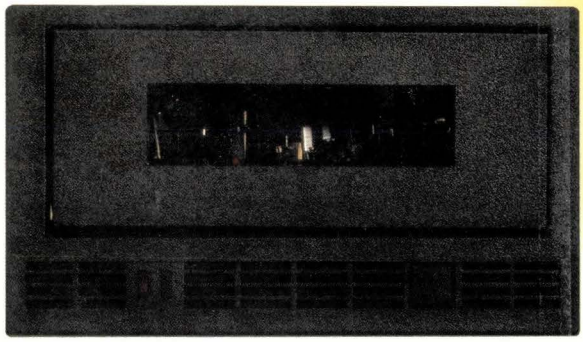

Your basic 8mm drive

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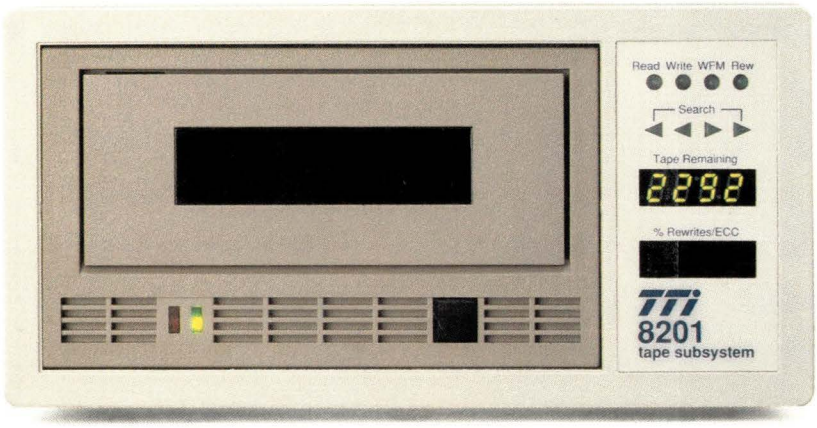

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