

SUN EXPERT

Serving the UNIX Client/Server Network

JULY 1994 Vol. 5 No. 7 \$5.50



Software
Development



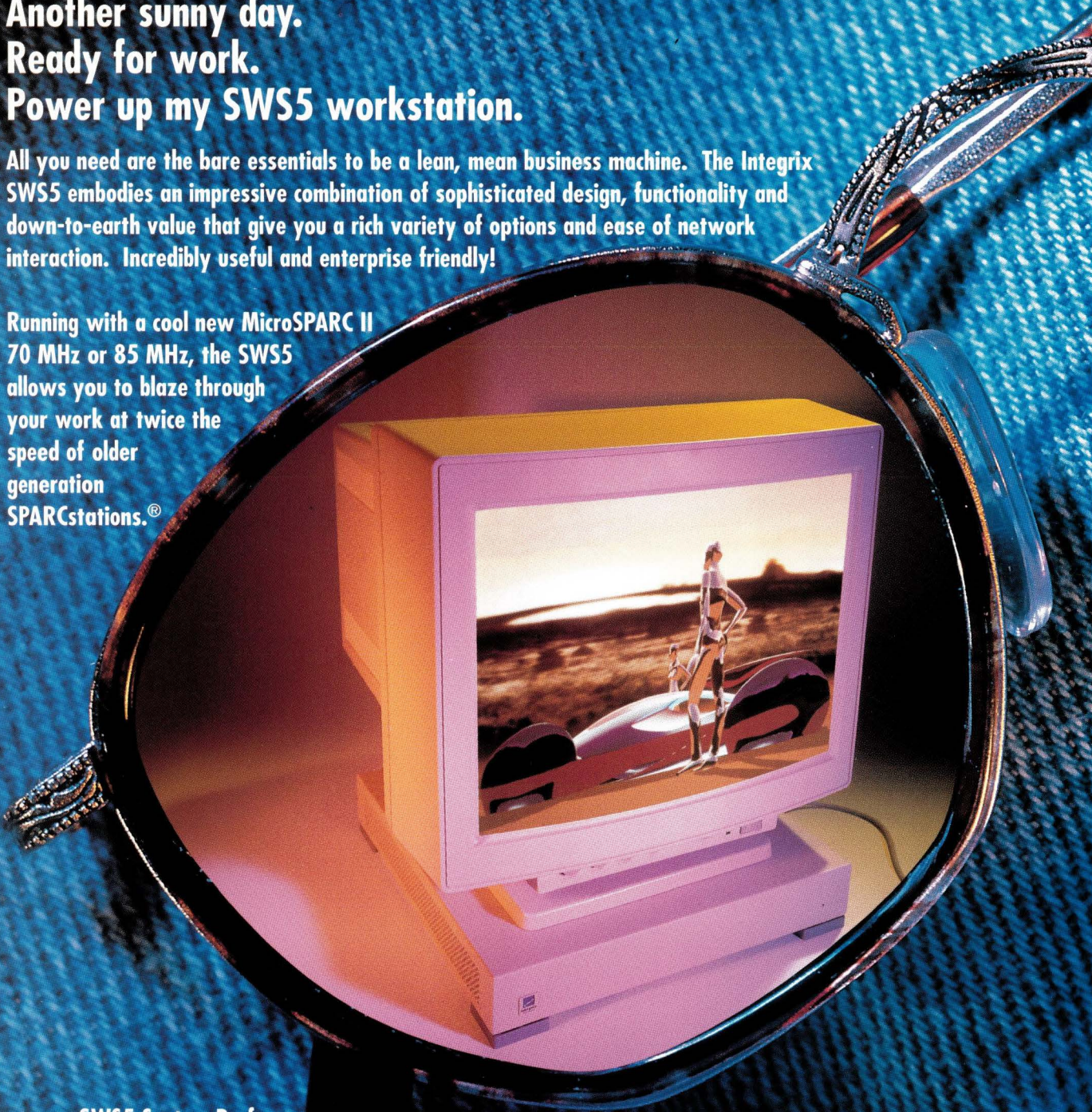
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Cover by Dave Spencer Studio

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SUNEXPERT

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

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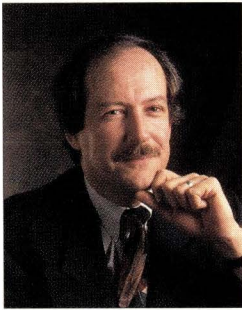
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Editorial

Keeping in Touch

This month, *SunExpert* welcomes a new cohort. Simson L. Garfinkel has joined us as a senior editor. If you are familiar with books on security and NextStep programming, you have probably seen his name. He and Gene Spafford coauthored *Practical UNIX Security*, an O'Reilly & Associates book. He and Michael Mahoney wrote *NeXTSTEP Programming*, which covers object-oriented programming from abstract superclass to zoning memory regions. You might want a copy, given Sun's relationship with NeXT and its plans to make OpenStep a part of its distributed objects strategy. It's published by Springer-Verlag.



Simson's first article for *SunExpert* explores how OpenStep will affect in-house software developers and Solaris software vendors. See "In Steps OpenStep" on Page 53 in this month's feature section for more information about early access to a developer's kit. During the next few months, *SunExpert* plans to keep a regular watch over the integration machinations involving NeXT. It could signal a sea change for how software gets made in the Sun environment in particular and on UNIX platforms in general.

Simson will also be laboring in Computer Publishing Labs testing new hardware, software and communications gear. One of his first systems chores has been to clean up our `/etc/aliases` file to make it easier for you to reach us with any questions or suggestions you want to pass along. For general editorial information, the address is `editors@expert.com`. Letters to the editor—we do like hearing from you—should go to `letters@expert.com`. If you have a news tip, send mail to `news@expert.com`. If you wish your comments or flames to be confidential and off the record, drop a note to `tips@expert.com`. If there's a new product we should know about, please send email to `new-products@expert.com`.

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Doug Pryor

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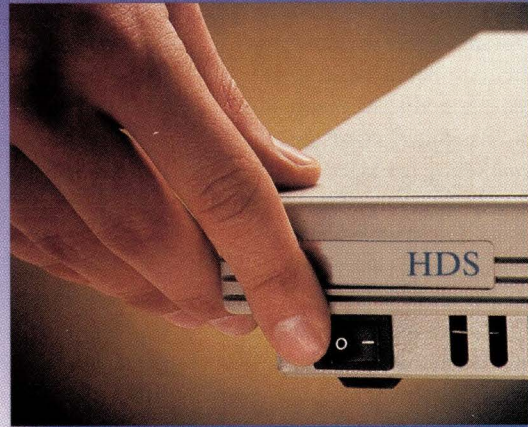
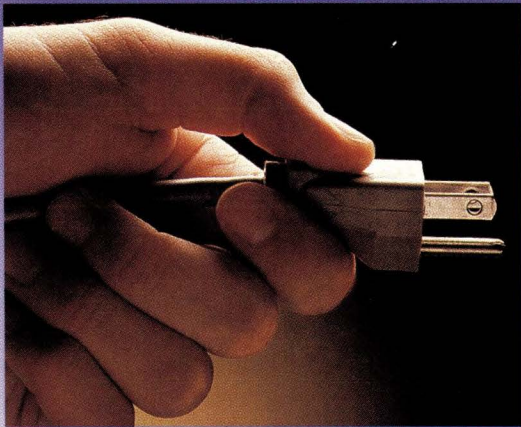
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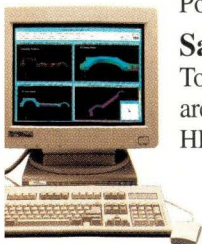
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NEWS

HP Shows X Terms for Sun

Hewlett-Packard Co. has introduced a line of X terminals to be sold into Sun Microsystems Inc. sites and no others. The terminals are said to be uniquely configured to be compatible with Suns. "Basically," says Casey Chavda, marketing manager at HP, "we are introducing Sun-specific X terminals for the Sun installed base. Why? Because Sun has shown no commitment to the market."

Sun has traditionally shied away from X terminals. Alone among the major UNIX vendors, it did not offer its own X terminals. In some ways, this created a market for such companies as Network Computing Devices Inc., which happily sold Sun sites the X terminals that Sun would not provide. Sun finally did introduce an X terminal late last year, the SPARCclassic/X (see "Sun Introduces X Terminal," *SunExpert*, August 1993, Page 6), but the product did not gain a lock on the market.

"Sun has had false starts with X terminals," says Chavda. "When it entered the X terminal market, they took a workstation and stripped it

down." But, he says, the customers didn't want a stripped-down workstation. Chavda says he has seen market research indicating that Sun has sold "maybe 1%" of all the X terminals sold into its own aftermarket.

In an attempt to gain some fraction of the other 99%, HP has introduced the Aptrex line. The machines have Sun Type 5 keyboards and support Sun resolution monitors. "We are better integrated into Sun environments than Sun is," says Chavda. In addition, they come standard with a Sony Corp. of America Multisync monitor; 10BaseT, ThinLAN, a parallel port and serial ports; and will have audio hardware support in the future. There is also a PCMCIA option. In terms of performance, the terminals offer 125K Xstones and 1.55 Xmarks.

The products have Sun install scripts, support for SunOS 4.1.3 and Solaris 2.3, Local Sun OLWM, local CmdTool and ShellTool emulators, local OSF/Motif, auto telnet and a local VT320 emulator. Pricing on the software is via site license rather than per seat.

There are several Aptrex models: a 19-inch monochrome model at \$1,595; a 15-inch color model at \$1,650; a 17-inch color model at \$2,200; a 17-inch multisync model at \$2,800; a 19-inch color model at \$3,000; and a 20-inch multisync model at \$3,350. Quantity discounts are available.

HP says it is targeting not only Sun customers but a specific class of Sun customers. "We have focused on Sun customers that are in small to medium accounts," says Chavda. "We are not

targeting Sun's major accounts."

Moreover, among those smaller accounts, HP is looking for people who "already use X terminals." That is, it is looking for customers who already have networks and are not buying complete systems from the ground up. HP says it believes that these customers, which it calls "product buyers" as opposed to "system buyers," are looking for low prices and long-term support rather than system configuration services and training. HP will tailor its sales efforts to such people. The terminals will be sold via telemarketing, for instance, rather than by an outside sales force that would also be providing some level of on-site consulting.

HP will also be stressing rapid turnaround. At the very worst, "we can fill an order in five days," says Chavda.

For HP, though, the introductions add several levels of complexity. The company now has three lines of X terminals: the high-end Visionary X Stations, the Entria line (for the IBM 3270-replacement market), and now the Aptrex terminals. Moreover, HP support and service personnel will have to have considerable familiarity with Sun environments to support the terminals and their servers.

However, the company says it isn't troubled by the need to support Sun equipment. "One of the directions HP has been going as an entity has been providing multivendor support," says David Roussain, Aptrex line manager for HP. "This [the Aptrex introduction] fits in well with the processes that we've been putting into place to support different platforms."

Meant for Suns, but from HP, the Aptrex X terminals are meant to be sold specifically into Sun sites.



Aptrex

Just in case anyone misses the point, the design element of the Aptrex line of terminals combines a rising sun with a capital X.

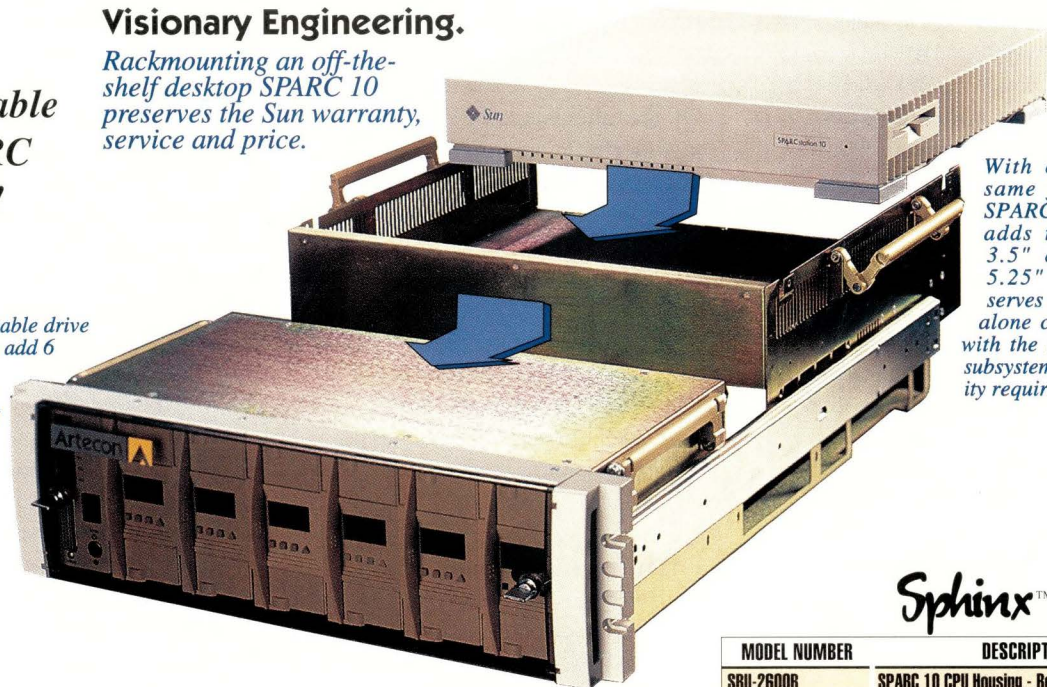
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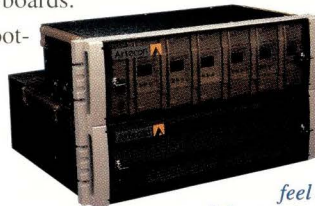
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RDU3-DSK-S-1.6GB	1.6GB 3.5" Removable Disk Module
RDU3-DSK-S-2.0GB	2.0GB 3.5" 5400 RPM Removable Disk Module
RDU3-DSK-S-2.1GB	2.1GB 3.5" 7200 RPM Removable Disk Module
RDU3-4mm-S-2.06GB	2-8GB Removable 4mm DAT Module
RDU3-4mm-S-4.0GB	4-16GB Removable 4mm DAT Module
RDU3-FLP-S-1.4MB	3.5" Removable Floppy Module

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IBM Does DB2 for Suns

IBM Corp. will soon introduce its DB2 RDBMS for Sun Microsystems Computer Corp. workstations and servers. This is part of a larger plan to put the product on a variety of non-mainframe and non-IBM computers.

"Our customers are asking us to do this," explains Janet Perna, director of database technology at IBM's Toronto Laboratory. "If you look at where DB2 is installed today, it is Fortune 100 companies—96 of them use DB2. If you look at the Fortune 500, 80% of them use DB2, and part of those companies use Sun workstations."

DB2 is a database with a history. In the 1970s and early 1980s, relational database technology was widely acknowledged to have technical advantages over flat files but wasn't widely used. The market was dominated by hierarchical databases running on mainframes. The RDBMS vendors, however, gradually began to find a place for themselves on the UNIX systems then being marketed into technical environments or through VARs into commercial markets.

Then IBM introduced DB2—a relational database—for its mainframes. With this mighty endorsement of relational technology, the fortunes of RDBMS products were made. While formerly titanic companies, like Massachusetts-based Cullinet, withered and died, the RDBMS vendors found themselves in the midst of a boom. Customers simply wanted relational technology, both on their mainframes and on their smaller boxes, which were even then starting their slow assault on MIS.

DB2, meanwhile, became the de facto standard for database on mainframes. However, as the mainframe market began to suffer because of the downsizing movement, it seemed that the database might be riding a dead horse. IBM responded by porting it elsewhere. "We've taken DB2 and put it on OS/2 and IBM's UNIX, AIX," says Perna. "And now we're taking it to non-IBM platforms." As of June, DB2 was to be on both HP-UX and Solaris.

But how successful will DB2 be in the world of open systems? Will it be

able to compete with such entrenched players as Oracle Corp. and Sybase Inc.? IBM hopes that DB2 will be as successful against those RDBMS vendors as it was against the flat file vendors of a decade ago. "We haven't been in the UNIX market," says Perna. "But if you go back to the 370 [mainframe] environment, there were non-IBM database competitors on that platform. By and large, they've abandoned it."

On the other hand, the situation is very different in open systems than it was on mainframes. IBM does not control the client/server market the way it did the 370 market. DB2, while important and popular, does not offer significant technical advantages over the Sybases and Oracles of the world, which are every bit as relational as it is. Moreover, the company has never shown itself uniquely adept at selling software to Sun users, where there never are single-vendor shops of any sort, much less DB2 ones.

Perna acknowledges these concerns. The market for DB2 is present, she says, "because customers are telling us they need to be able to integrate mainframe data with workstation data. They want to be able to access from the desktop their corporate data."

IBM is tooling up to sell DB2 to UNIX people, she adds. "We now have a dedicated software sales force. We have 1,800 software sales reps worldwide, and their sole purpose in life is selling database applications," she says.

As for the different mind-set required to play in UNIX, that too is under consideration. "I think if you went to Sybase or Oracle, they'd tell you they want all the business in the world as well. They're not going to share the wealth," says Perna. "But, that said, we understand that there are going to be multiple players in this environment."

In fact, she envisions the product having its greatest impact in situations where there are many different kinds of servers and many different kinds of clients. "There are going to be heterogeneous environments," she says. "But with the DB2 solution, we can make life easier from the database point of view."

Looming Price War?

Although nobody is expecting a return of last year's price war, in which disk drive prices fell faster than the ratings for "LA Law," the cost of storage may plunge once again this summer if manufacturers do not carefully manage recent expansions in their production capacity. Meanwhile, great bargains for workstation-class SCSI drives continue to find their way into the newspapers—a trend sure to increase as more PC users demand these drives for their Pentium and PowerPC-based systems.

"It is a very cyclical business, with some pretty high peaks and some pretty low valleys," says Alexa McCloughan, vice president of financial services at International Data Corp. in Framingham, MA.

During the first half of 1994, a relative shortage of high-capacity disk drives for personal computers kept drives at an artificially high price, says McCloughan. The shortage was the result of two factors: a shortage of custom-built, application-specific integrated circuits, called ASICs, required to build the new generation of tightly integrated drives; and an unprecedented demand for high-capacity drives for use in desktop computers.

"Starting last fall, we saw PC demand going through the roof. Late fall, through early calendar Q1, the forecast demand from our customers was increasing [between] 30% and 40% per month," says Marlin Miller, director of marketing at Quantum Corp., currently the largest volume producer of hard disks.

Sales are up because of the upturn in the economy, because new applications require more disk space for fonts, help files and sample documents; and because of the increased interest in data-intensive applications such as multimedia and imaging. As a result, drives that had once been the sole domain of workstations are now being dropped into low-cost personal computers. "Anything a gigabyte or under is going into PCs," says Miller.

"We are trying to respond to that demand and build more product, but there are limits to how fast you can build production," adds Miller. As a result, prices are dropping only 3% to

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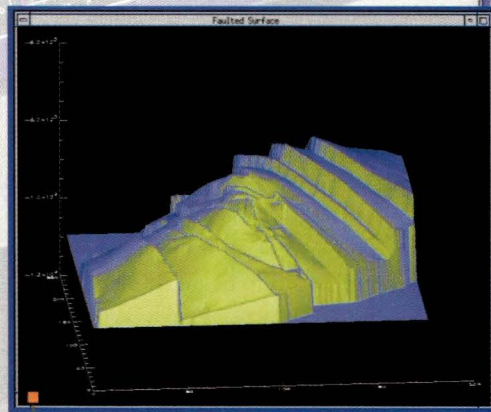
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PV-WAVE Commands Used to Generate the Display Above:

```

WAVE> TEK_COLOR
WAVE> X = (DINDGEN(60) * (((9.142)-(-3.142))/(60-1.0)) + (-3.142)) # REPLIC
WAVE> Y = REPLICATE(1.0,60) # (((3.142)-(-3.142))/(60-1.0))
WAVE> Z = (COS(X) * SIN(Y)) / (2.0 + (SIN(Y) * SIN(X)))
WAVE> SHADE_SURF,z,xy,XStyle=1,YStyle=1,XTitle='X',YTitle='Y',ZTitle='Z' # Cal
    
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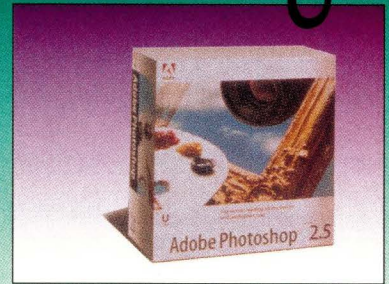
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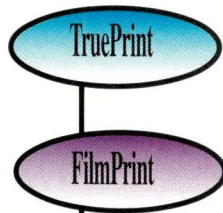
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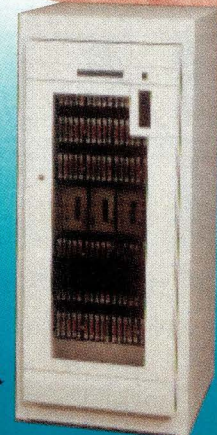
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multiprocessor SPARC-based servers.

However, things began to go wrong for Solbourne in 1991, with the introduction of its first desktop machine, the S4000. This device performed worse, and sold worse, than anyone had expected. The single-chip SPARC that powered it, and which Solbourne and MEI had struggled long to design and develop, proved to be a disappointment as well. Suddenly, there were rumors of troubles between the the company and its Japanese parent.

Worse was yet to come, however. Solbourne's servers were popular not least because Sun did not have a multiprocessor device. That all changed by 1992, by which time Sun had its own multiprocessor servers. Suddenly, the big machines that had been Solbourne's bread and butter faced stiff competition.

There were shake-ups and management restructuring. McGregor left, replaced by Carl Herrmann in May 1992. By 1993, the company was saying that it would focus its efforts on the commercial market, and particu-

larly on selling its machines to MIS officers who needed servers on which to run Oracle Financial applications.

Last February, Solbourne announced a special relationship with Oracle. It announced that it was now an Oracle VAR. At that time, Solbourne told *SunExpert* that it would not leave the hardware business (see "Solbourne to Remarket Oracle Financials," *SunExpert*, April 1994, Page 18).

On May 2, Solbourne announced that it had left the hardware business and posted a notice to that effect on the wire services.

Sun Hits the Highway

Sun Microsystems Computer Corp. has opened its own on-ramp to the information superhighway, unveiling its entire product line on the Internet. Using Mosaic, a software application developed by the National Center for Supercomputing Applications (NCSA), users can now access information about all Sun products, services and related information by pointing and clicking on a document to

find related articles.

"With our networking heritage, it's almost as intuitive for us to use the Internet as the telephone to communicate with our customers, suppliers and partners," says Anil Uberoi, group marketing manager for networking products at SMCC.

Current Mosaic users can access information about Sun by using a search tool and typing in "Sun Microsystems," or entering the URL (Uniform Resource Locator), "http://www.sun.com," into their Mosaic viewer.

For more information on NCSA Mosaic, send email on the Internet to mosaic@ncsa.uiuc.edu.—mm

Arrow Takes Pinnacle Data SPARClikes

Arrow Electronics Inc. in Melville, NY, has signed an agreement to distribute Pinnacle Data Systems' line of SPARClike workstations and servers. Arrow will resell Pinnacle's entire product line, including workstations, servers, upgrades and service contracts. Arrow had carried Sun products, but

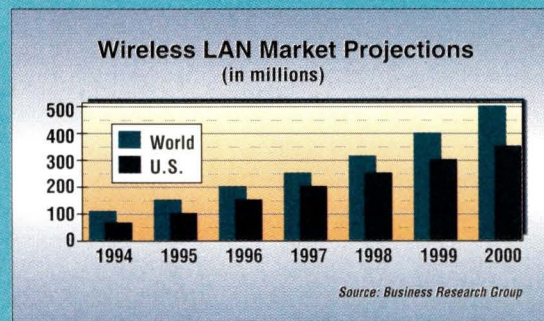
Wireless Wings to Success

The wireless LAN market is poised for big growth, says market research firm Business Research Group, a Newton, MA-based division of Cahners Publishing. BRG says that the U.S. wireless LAN market will grow from \$36 million today to \$350 million by the year 2000.

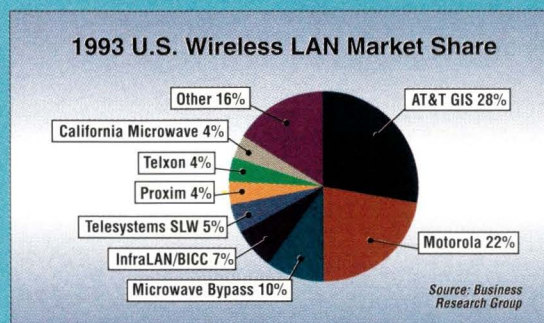
BRG says this nearly tenfold growth will be based on a variety of technologies. It sees, for example, a boom for not only radio-wave-based approaches, but also infrared and other technologies.

Right now, the market is dominated by two big names, says BRG. Some 28% of the market is held by AT&T Global Information Systems, which is the former NCR Corp., with its computer background, rather than AT&T proper, with its communications background.

Motorola Inc. is the other current winner, with 22% of the market. The other 50% of the market, though, is held by a variety of players. They range from relatively small companies, which nevertheless hold relatively large segments of the market, to very large companies, such as Digital Equipment Corp., which hold small fractions of it.

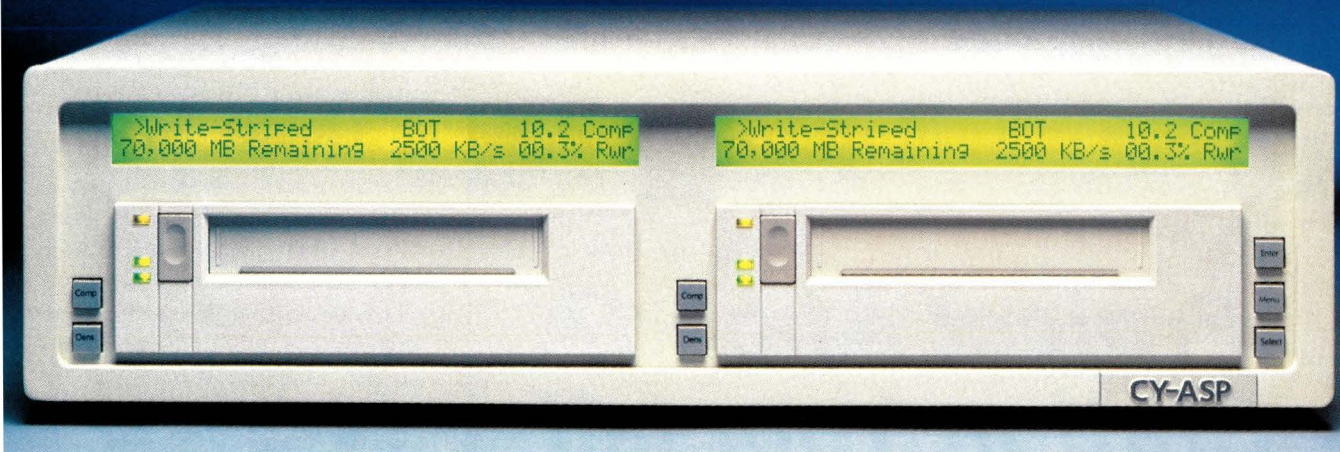


Business Research Group says that the U.S. wireless LAN market will grow from \$36 million today to \$350 million by the year 2000.



Motorola and AT&T lead the market for wireless LANs, according to BRG. But a host of other, smaller players could be coming up fast.

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the two companies broke off their relationship this year. Arrow thus becomes one of several former Sun remarketers and distributors to have recently picked up a SPARClike to replace a lost Sun workstation.

Sun has been reported to be attempting to prune back the number of companies that carry its product. It may be that in so doing it will give a boost to

the SPARClike market, which had been viewed as dead or nearly dead for some years.

Andataco Launches Networking Division

Andataco, the San Diego-based system and peripheral vendor, has announced a new division that will specialize in networking products. The

Networking Division will be headed by Stan Galkin, formerly of Motorola Codex and AT&T Paradyne. Among the division's first products will be the FrameMux, a WAN access product that provides ATM functionality to workstations. Andataco is the first distributor of the product to sell directly to end users as well as to VARs and OEMs.

In other Andataco news, the company has announced a series of new storage products as part of the Smart Storage Systems line. The company says these fall into four categories: desktop storage, bulk storage, performance storage and high-availability storage. In the desktop storage category are the Entree storage systems, which are available in fixed and removable configurations and fit onto the desktop. Bulk storage, meanwhile, is represented by the GigaDISC machine, a magnetic disk tower. The GigaDISC ranges in price from \$7,500 to \$49,995.

The performance storage product, meanwhile, is CacheDISC, a hybrid device with 8 to 128 MB of cache and 2 to 82 GB of disk. Pricing starts at \$7,995 for a 4.3-GB model. The high-availability storage products, finally, are ShadowDISC and GigaRAID. The ShadowDISC subsystem comes with two or more 3½-inch removable SCSI disk drives and a disk-mirroring SCSI processor. GigaRAID is a RAID 0-, 3-, and 5-compatible system that comes in both tower and rack-mount versions. Prices for the GigaRAID start at \$15,600 for a 2.5-GB model and range to \$143,000 for an 82-GB tower system. The ShadowDISC, with 2.1 GB, is \$6,500. →



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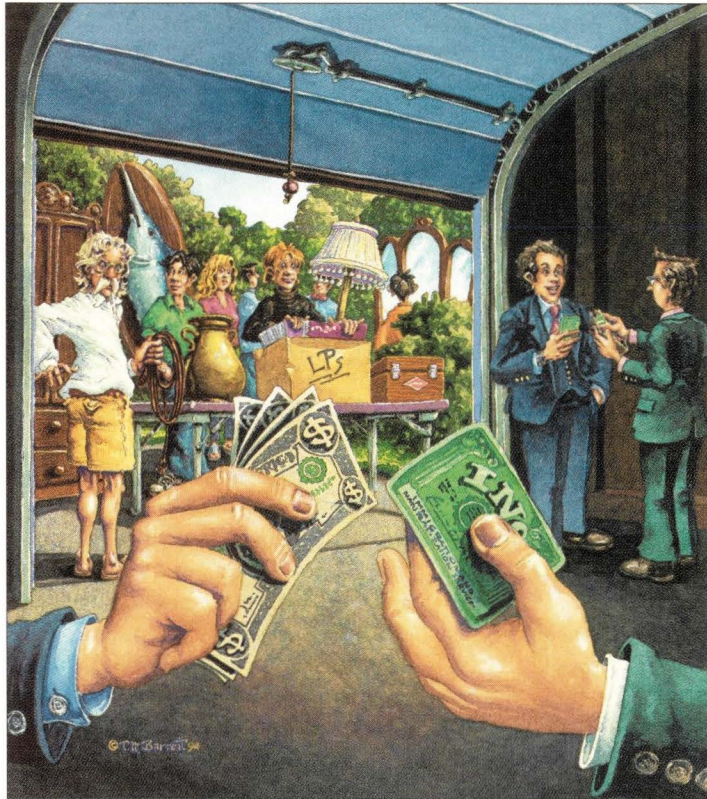
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Correction

Due to a reporting error, the June issue of *SunExpert* incorrectly reported the price of the Ensemble/OFS system from Andataco, San Diego. The price ranges from \$12,995 for a 20-GB system to \$79,995 for a 187-GB system. Ensemble/OFS is an optical disk library that does not require software drivers and is compatible with any system using NFS or Novell Inc. NetWare. *SunExpert* regrets the error.



TOM BARRETT

Mr. Protocol Goes to Market

by MICHAEL O'BRIEN

"EARN MONEY FAST!"
—Dave Rhodes

"Getcher green card now! Ask us how!"
—The Arizona Gang

"In media res."
—Multimedia at its best

Q: I've seen this place hip-deep in Big Stuf Ding-Dong wrappers. I've seen it with so much unspliced cable

lying around that it looked like the set of *Brazil*. But I've *never* seen it looking like this! Every piece of old junk in the place is lying around in the front yard, and people are just wandering around looking uncomfortable. It looks like a yard sale, but no one's buying or selling anything, and Mr. Protocol is just standing there with a bullwhip! Will you please tell me what any of this could possibly have to do with networking? And what in the *world* is with all these little green cards floating around? There seem to be thousands of them!

A: As you may have guessed, this has nothing to do with networking, and everything to do with schizophrenia.

This is what a yard sale looks like on the Internet when strict "netiquette" is being followed. If you look inside the garage, you'll find a quiet corner where people are passing money back and forth faster than a floating craps game. You're watching the way people conduct marketing on the Internet today: They pretend that nothing's happening, except in quiet, dark corners. And the green cards? They're the harbinger of a storm, and it looks like a nasty one.

The history of the Internet has been unique among long-haul networks in that it has been a continuous process of relaxing restrictions. On the ARPANET, which was conducted in many ways like an elite club, the rule of the road was that all traffic was to be official, let alone noncommercial. Extraneous traffic was widely prevalent, of course, because the people

running the net were not fools, but it was kept very quiet, like most less-than-sterling affairs in any elite club. Personal mail was...well, personal! The seamless surface was ruffled on only one occasion, when one of the first mailing lists—WINE-TASTERS, by name—was mentioned in a print publication. The flap that resulted from this surprised most folks. Some sites had to do some very fancy footwork in order to keep their net connections. This sent second-order shock waves through the network community and fostered a “keep-the-lid-on” mentality that colored the network culture for many years to come.

The venerable SF-LOVERS Digest, which was also one of the earliest mailing lists, was forced on several occasions to plead with its readers not to nominate it for the Hugo award, the top award in the science fiction field, to prevent repercussions that would certainly have destroyed it. Saul Jaffe, its longtime moderator, was finally awarded an out-of-the-closet Hugo only two or three years ago, a Hugo generally agreed to have been years overdue.

This heads-down attitude prevailed until the U.S. Department of Defense handed over operation of the Internet backbone to the National Science Foundation. The “strictly official” policy was made increasingly cumbersome when the ARPANET became merely the backbone of an extended internetwork. It was ignored with increasing boldness.

Some usages were merely questionable. For instance, consider one digital special effects house with offices in Hollywood and Toronto that joined CSNET, the Computer Science Research Net. CSNET had jumped through many official hoops (hoops roundly ignored by many others) to ensure that it had official permission to transfer traffic to and from its members via the ARPANET according to CSNET’s own Acceptable Use Policy. The digital effects house, however, had joined CSNET not because of any particular love of computer science, but because this gave it a TCP/IP network linking its two branches. It rarely, if ever, transferred traffic outside its own offices. It

had made CSNET into an internal corporate net, with nothing but commercial traffic flowing.

The largest area of envelope-pushing, however, was doubtless the explosive growth of Usenet.

The notion of a distributed bulletin-board system was, as we have all seen, so mind-bogglingly useful that nothing could stop its spread. The only problem with its continued growth was the astronomical size of the telephone bills engendered by carrying a full feed day after day, especially over long-distance legs of the “backbone” net. The Usenet “backbone” had nothing to do with the Internet and everything to do with companies that were able either to hide the telephone charges, or to avoid incurring them entirely by the use of leased lines. Traffic was carried via UUCP, for the most part, and long-distance hauls of a full feed were affordable only by corporations. These corporate angels made up the so-called “backbone cabal,” which consisted of the systems administrators within those companies.

What they decided to carry got carried, and that was pretty much that, until the anarchic nature of Usenet, and the relentless flaming engendered by the smallest administrative decision, so burned these people out that they ceased to have anything further to do with the mess. Throughout Usenet’s ignoble history, 99% of the people who read Usenet have had absolutely no real power over which groups got carried where. The powerless are always noisy, and the completely powerless have been, historically, completely noisy, at least on Usenet.

While this anarchy was growing, the idea of carrying Usenet traffic over the Internet grew with it. At first blush, this was heresy, because Usenet was and is completely anarchic. No restrictions are placed on content because there is no governing body either to enact them or to enforce them. Because the Internet was still operating under a fairly strict acceptable-use policy, it was obviously out of the question for Usenet traffic to be carried on the Internet.

And home barbecues are easy to assemble.

The initial forays of Usenet onto the Internet were, like other movements counter to the acceptable policy-of-the-day, quiet. It took a number of years for Usenet to be fully integrated into the Internet. Dial-up software to move news still exists, of course, but is used only for leaf nodes not otherwise connected to the Usenet/Internet. When the acceptable-use policy finally reached its current state under the NSF, the Network News Transfer Protocol could be developed and published, which finally made Usenet and the Internet functionally identical. Of course, they still operate as two logically distinct networks and are defined quite differently, but the bytes all move across the same wires for the most part.

Mind you, Usenet still has no official acceptable-use policy whatsoever (mainly because it has no official anything whatsoever), so its coexistence with the Internet, which still does have one, doesn’t bear close examination.

So, why are we examining it closely? Mr. Protocol is glad you asked.

It is impossible to understand the true situation in which the Internet finds itself without understanding the history just proffered so long-windedly by the estimable Mr. P. (they’ve been saying this about Latin America for years—just ask anyone down there). If the Internet is supposed to be the Great White Hope, scattering rosebuds gaily on the cobbles and pointing the way to the Shining Glory of the National Information Infrastructure (cue the cherubs with the banners), why does it still have an acceptable-use policy, and how can Usenet get away with it?

Because this is government work, that’s why. Reality depends on whom you ask.

The Internet backbone is still run by the NSF because there isn’t any viable alternative yet. And the NSF can’t go commercial because the government can’t go commercial, never mind what it says in the movies. The Prez wants to turn air traffic control over to a “semi-public” corporation, just like the U.S. Postal Service, but it’s felt that the NII can be entirely privatized. Until

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that happens, the NSF backbone can't carry purely commercial traffic unless it furthers the aims of the NSF with educational or research content. Says so right here.

And no, Usenet's load of misc. for-sale.buy-my-sister newsgroups doesn't alter that in any way. It's just one of those desperate expedients we have to ignore for now, because it's clear there is a need for commercial traffic on the net, somehow!

Mind you, there are ways around this. Policy-based routing has been a hot topic for just this reason for years now, but it's not ready for prime time yet. The Commercial Internet Exchange forms a point of presence where the different commercial providers can exchange commercial traffic without crossing the NSF backbone, and if all of Usenet could be assured of traveling that path, there'd be nothing further to discuss. But we're not there yet.

Users, however, continue to push the envelope. The Internet is loosely run, and the Usenet isn't run at all, but purely social pressures apply. Most people, as a practical matter, adhere to a code of behavior that has allowed Usenet, at least, to continue to grow. The Internet itself, on somewhat firmer foundation, is growing as well.

As they grow, they attract new kinds of users. Some, such as the school-age bunch, are placed under rigid enough controls that they don't make nuisances of themselves. Others, at various universities of more or less ill repute (a repute, incidentally, that is completely at odds with any academic reputation the institution may have), are less constrained. But no group can compete for sheer annoyance value with the most nerve-wrenching apparition of all: the cold-eyed entrepreneur.

Most often it's merely a cross-eyed entrepreneur. Some years ago, a fellow whose name lives on, one Dave Rhodes, posted a chain letter on every single newsgroup in existence. It was a straightforward Ponzi scheme: Send me money and put your name on the list—the usual. It was squelched, of course, and engendered far more traffic than the original post by many orders of magnitude. However, copies

of the original seem to remain in dark corners of the net, and every so often some clueless person (or some smart person masquerading as clueless) resurrects it and is promptly quick-flamed to a crackly crunch. No matter how many times this scenario is repeated, it never prevents the next bright person who comes along from deciding that this is a wonderful thing.

And as the influx of new users grows, so does the rate of reappearance of the Rhodes letter. Mr. Protocol hereby suggests the definition of a new unit of measurement: the rate at which the same annoying crud is recycled by newcomers to the net. It is measured in disasters per fortnight, and is named the "Rhodes." Mr. P. confidently predicts that the Internet will achieve one kiloRhodes by the end of the millennium.

Mainly because of the other sort of newcomer: the coldly calculating...um, the editor won't let me finish that sentence. Let's just take our most shining example to date. There is a law firm in Arizona that has purchased Internet access through almost all possible providers. It uses each account to post one posting to the Usenet, to every extant Usenet group, including those of purely local distribution, some 5,000 in all, advertising its services: You an immigrant? Want your green card? Talk to us! They are flamed; they ignore it; they hire a student to go through the resulting email at near-minimum wage to recover any possible sales leads. They don't care about netiquette; they don't care about acceptable-use policies; they don't care about flames; they don't care about anything. And it costs them pennies. And they reach *everybody*. It's been so successful for them, they've promised to write a book about it: *How to Market Yourself on the Internet*.

Mind you, "Distribution: world" on everything. I wonder how good they are at getting green cards in Australia?

Unless the government chases after them for acceptable-use violations, it doesn't appear likely that there is anything that can be done to stop this sort of abuse. And that would be a difficult case to make, if only on the basis of selective prosecution.

No, this is the clay plug in the heel of Talos. This is where it all comes leaking out.

The problem is that the net has finally reached people who don't care about anything that can't be brought against them in court. Unless the "code of the net" can be firmly embedded in provider agreements, with likely damage recovery exceeding the likely profit, the entire character of the net will be forced to change after much kicking and screaming. Consider, please, what would happen to all of our paper mailboxes if the U.S. Postal Service worked the same way that the Internet now does, that is, *if the recipient paid the postage, and had no right of refusal!* We'd all be broke in 24 hours, except we'd all be dead, smothered in junk mail.

Either provider agreements are going to have to get a lot stiffer and be backed up by litigation, or the Internet will be forced to move to usage-sensitive pricing, paid by the originator of the message.

In fact, the entire question of Internet charging algorithms is a delicate one. In the face of behavior like that shown by the Arizona Gang, the most idealistic view of the net-free access for everyone—breaks down immediately. Flat-rate service agreements, too, must be hedged with safeguards and surcharges because they're equally ripe for abuse. Usage-sensitive pricing must be carefully worked out, though, or the "Internet culture" will be killed off, bang, deadski, just like the entire nation of Chile, which has been a resounding black hole ever since the Chilean government laid some draconian usage-based pricing schemes on the universities down there. You can shout down the entire spine of the Andes these days and never even hear an echo. And that's a whole big lotta millyuns of dollars that our very own government will have poured down the rathole, carefully nurturing the existing Internet and all its valuable services, if we allow *that* to happen.

But at the same time, what good is a national network, a place for everyone to hang out and exchange views, if it doesn't even have a place to tack up a

card offering your old car for sale?

Balance. Balance must be the key.

Of course, if the NII provider model turns out to be the one proposed by the current big players, we'll all have gigabit gateways into our homes, and 300 baud back out, or basically, just enough to change the channel. Not too much hope for an interactive network from those boys, not the way they see it (cf. Mr. P.'s maanderings on the nature and scarcity of talent a couple of months back—*SunExpert*, April, Page 24—they figure they have all the talent you'll ever want to hear from, right?).

Remember, nobody knew what the national road system would mean to our culture before they could see the roads. Nobody knew what the telephone network would mean to our nation before they could see all the wires.

And just because nobody knows what the NII is going to look like doesn't mean it isn't going to mean something to all of us. This sort of annoyance is part and parcel of the cutting edge: The frontier is never comfortable. No one knows what's going to happen out here! Want the hot-shot hungry two-person law firms to determine how that net's going to work? Easy. Sit back and let them do it for you. They'll be glad to. They'll even sell you a book about it. ➔

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

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

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

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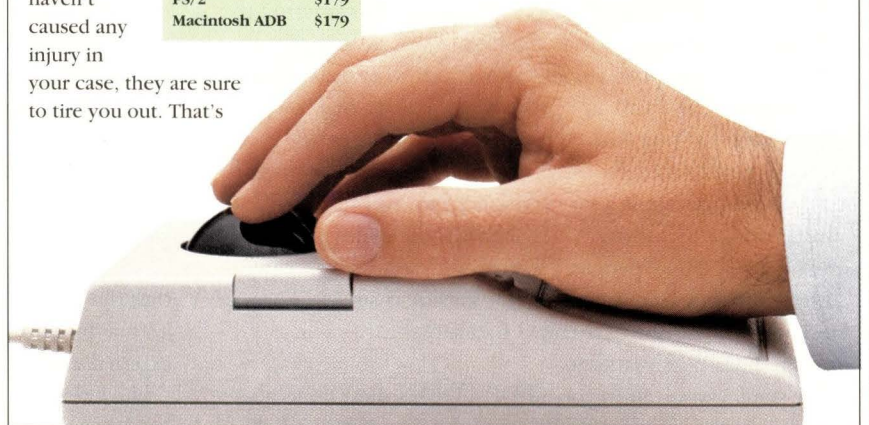
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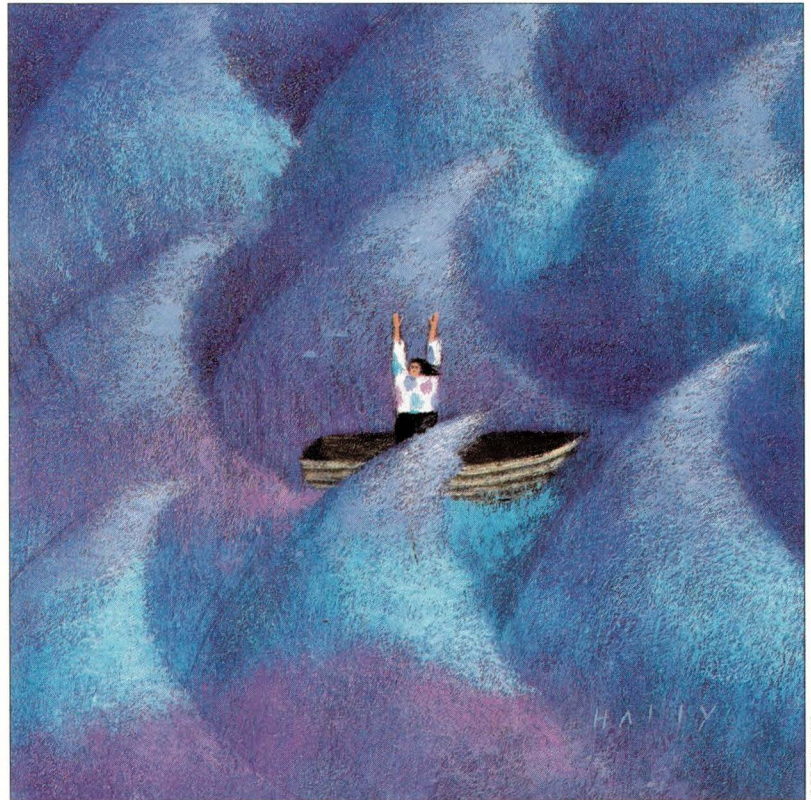


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Basics of UNIX

by PETER COLLINSON
Hillside Systems



Last month in Boston, the Usenix Association celebrated 25 years of UNIX. In an unashamed bout of nostalgia, I thought it might be illuminating to take a peek back at the first UNIX system that I used and to attempt to tell you why it was so exciting. This will undoubtedly cause my good friend Teus to mail me saying “stop looking back, look forward.” He does this every so often, and I generally listen to him. However, 25 years of an operating system is a rare enough event, so I feel justified.

In truth, I wasn't using UNIX 25 years ago. Along with most “early UNIX” people, I started with UNIX Version 6. There were only a couple of UNIX Version 5 sites in Europe (and Teus was at one of them). I first saw the `;login:` prompt a mere 18 years ago.

The system was running on a PDP-11/40. I don't remember how much memory that machine had. I do recall that it had two RK05 drives. These held about 2.5 MB. You got the root of the file system and `/usr` on one of these. Later we got hold of an RP02 drive, a huge 20 MB. I've got twice as much RAM memory in my SPARC than we had disk space at that time.

The Smallest of Kernels

The kernel was small. It had to fit into the address space of the PDP-11/40, and the biggest program the instruction set

could deal with was 64 KB. This limitation meant that many aspects of the operating system were offloaded into user-level application processes. In retrospect, this has been one of the strengths of UNIX. It allows considerable development to take place on machines running user services and ensures that application programs have good access to primitive operations.

A kernel has three main tasks. It deals with user processes, deciding which one should run, coping with memory management and processing system requests. Second, it handles the file system, providing code to map the model that the user processes see into physical disk blocks. Last, the kernel deals with external devices, making sure data from external devices gets to the right user process and vice versa.

The kernel provides a consistent layer that interfaces user-level processes to the outside world and each other. In V6, processes were handled simply. You had to find some memory for them to run in. They were always loaded as a single contiguous chunk of real memory. To run, all the code and data for the process had to be resident in memory.

Dealing with a contiguous chunk of memory also made sense when you wanted to swap processes in and out. You could tell the disk hardware to move a whole process from memory to swap space and back again using one disk setup operation.

When Files Were Just Files

Part of one of the disks was used for swap space. This was (and still is) managed separately from the rest of the file system. It meant that the disk was naturally divided into sections called partitions. Apart from the swap space, each partition contained a complete file system that was joined by the `mount` system call into a whole tree. Incidentally, the V6 device drivers also had support for disk striping, placing one logical disk onto several physical platters.

In V6, each disk partition was divided into two sections. The low part of the partition was the inode table, giving pertinent data for each file, and the rest was used for the blocks comprising the files. Internally to the system, the file was known by its partition number (actually a pair of numbers) and its inode number on that partition.

One task of an operating system is to allow programs to be device-independent.

The inode table was managed simply. The kernel kept a table of 100 free inodes for each disk partition. When that was exhausted, it just scanned the disk looking for another 100 free ones.

The remainder of the disk was controlled by a free list of 512-byte blocks. As a file grew, a new block was allocated to it from the free list. When a file was freed, its blocks were added to the free list. Again, the kernel kept a table of free block numbers in memory. When this was exhausted, it pulled the last block in from disk and this contained a new table of free blocks. The file system-building program was responsible for writing these pointer blocks.

Files were linked structures too. They were not allocated in continuous areas on the disk but were managed by a set of pointers to blocks. A few pointers were stored in the inode. Larger files used “indirect” blocks to contain a table of blocks that contained the data for the file. So small files were very efficient. To access a file, you needed to pull its inode into memory. All the block addresses were then available, and access was fast. Current systems still use this mechanism, although the details have changed.

Things were made faster by the use of a buffer cache for disk blocks. When reading data, a block was read into memory and stayed there until the cache filled and the space was needed by another operation. When writing, the data was moved from the user memory into the cache and placed on the queue of blocks being written to disk. On a lightly loaded system, small files on `/tmp` would never actually get to the disk. They would be written to the buffer cache, linger in memory and then be read back from there. When reading files, the system also anticipated user need by setting up a read of the next block of a file before the user made a reference to it. Again, much of this is in place on current systems.

The result of all this was a very flexible tree-structured file system. The notion of tree structuring was mostly new at the time. It was easy and fast to create and delete files. Also, the ability for users to create and manage their own file name space was revolutionary. Other systems had some form of per-user directory structure but didn't permit users to have more than one level of files in their home directory.

There were no file types. A file is just a file, irrespective of its name. It's just a stream of bytes. It is up to the program reading or writing the file to deal with it appropriately. You can still `cat` binary files and directories to the terminal so there are some problems with this approach.

A file doesn't have a special character inserted at the end to mean “end of file.” The size of the file is stored in the inode, and the kernel keeps track of where you are when you are reading or writing. A program gets an end-of-file indication depending on the size of the file and not its contents.

There were problems with the design. The positioning of the inode table at one end of the disk was a simple solution. But when the disk became full, the heads dashed from one end to the other as inodes were read and file contents updated. The free list approach meant that disks quickly became fragmented and performance degraded.

There were some complex operations that would momentarily leave the file system in an unsafe state. For example, a directory create involved several user-level system calls to change linkage information on the disk. If the process was killed, or the system stopped during the process, or worse, the system crashed, then the file system was left in an inconsistent state. It was hard to kill `mkdir`. It was short and written in assembler, but the potential existed.

This problem was compounded by the buffer cache. At any particular moment, some of the important data that defined the file-system structure was in memory. If the system crashed or was taken down without the issuing of those all-important calls to `sync`, the result was bad news for the file system. This can still be a problem.

There were tools that helped with repair, but sometimes this was very difficult. I once spent two days recovering a file system because it contained someone's thesis that was “lost” when a home directory was trashed. This was partially solved by `fsck`, which appeared in UNIX V7. Most of the problems were solved with the “Fast File system” implemented by Kirk McKusick for the BSD releases.

Making Devices Behave Like Data Streams

One task of an operating system is to allow programs to be device-independent. UNIX manages this by planting access points to devices in the file-system tree and providing interface calls that make devices behave like streams of data. A user-level process addresses a device in the same way it does a file. Devices present a byte stream model to the process. So, for example, you can use `cat` to a file, the line printer and the terminal without changing the `cat` program in any way.

Of course, this is the “party” line. This approach mostly works, but there are rough edges. Magnetic tape is not a stream of bytes; it's a stream of blocks that are read or written. The blocks can be variable in size. Generally, we would

like them to be the same size for each file on the tape. Pragmatism enters here. We need some way to communicate the desired block size to the kernel from the user-level process. This was (and is still) done by using the size of the data that the user passes into the kernel in a single I/O operation. So if the user process writes 1,024 bytes, that's what will be written on the tape in a single block.

The user's terminal also presents some problems. For many applications, we don't need to pass characters from the user into the process one at a time. The process is only really interested in getting a whole line from the user. So we hang onto the data in the kernel until the user types Return. In fact, most V6 processes worked in this way.

The benefit of this is it disassociates user interaction with the system from the process itself. You don't need to have the process running to handle user input (or output) for it. The kernel does all the work, driven by device interrupts.

When a character is typed, it is placed on a list. If the character means "delete the last character," then this can be handled in the kernel too. In the meantime, the process the user is using can be made to go to sleep, leaving the CPU available for other users. The process can even be swapped out to disk; it's not doing anything except waiting for data.

The user is given the illusion of fast response. The process they are using is not awakened to do the work until Return is typed. At this point, it can be swapped in, if necessary, and can be started running.

However, there are applications that would like to see the character as soon as the user types it. The most obvious example is a visual editor, although there wasn't one in V6. Anyway, we need to have the ability to swap in and out of "raw" and "cooked" modes. We also need to change other things about the interface, such as turning off echoing or setting the line speed. All this is done with a system call that affects the internal tables controlling the terminal interface code. The `gtty` call reads the table for a line, and the `stty` call sets it. In V7, these calls were generalized into the `ioctl` interface.

Because UNIX was designed to be interactive, it spends most of its time waiting for the user to type something. I have long suspected the way the terminal interface worked was instrumental in its success. It ensured that users were given good response while putting their processes to sleep. This left enough CPU and disk bandwidth free for other people to use the machine.

The Shell—Past and Present

For many everyday uses, you could use the V6 shell today. After you logged into the machine, you saw a percent prompt and could type commands and their arguments. There was no environment, so there were no search paths for commands. The shell searched in the current directory, `/bin` and `/usr/bin` before giving up. If you typed a character in the argument list that expanded to a number of files, perhaps `*`, `?` or a square bracketed list, the shell invoked a process that would do the expansion. This was `/etc/glob` and gave its name to the operation: *globbing*.

Again, here was a quiet revolution. It was not the job of the commands to expand their argument lists; they were presented with a fully expanded list of file names. This ensured that all commands used files in a consistent manner. The same was not true of the options to the commands. You had to code this by hand, and every command did it slightly differently. I wonder if command options would be less idiosyncratic if the `getopt` routine had been present on UNIX V6.

The shell could do nearly all the I/O redirection that we are used to today. It supported pipes, allowing processes to be run together in parallel. If your terminal didn't have the vertical bar symbol (and some didn't), you could use the caret (`^`) to mean a pipe. The shell allowed you to launch things into the background using the ampersand at the end of the command line.

You could create shell scripts. In fact, the `man` command was a shell script. Programming the shell was done with programs on `/bin` rather than built-in commands. You could do tests with an `if` command and make loops using a `goto`. Positioning in the script was done by moving the read pointer to the file that was being read and executed.

Making It Work Faster

So what could you do? Well, I guess most people sat around and wrote C programs. The C compiler was fast and generated excellent code. You rarely wanted to code things in assembler.

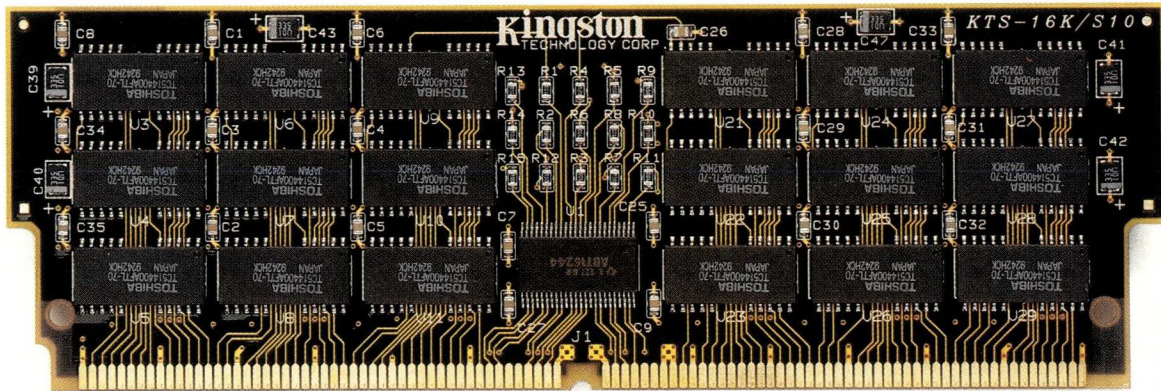
C used the fact that UNIX could handle files efficiently by splitting the compiler into several well-defined passes that communicated by temporary files. From source files, C generated assembler code that was processed into a linkable object file. The modules that made up the program were linked with libraries to make an executable program. If you were worried about execution speed, you could write routines in assembler and inject them into the compilation stream. The old UNIX maxim of "make it work, then make it work faster" applied here. C made it easy to split large programs into sensible modules.

The executable binary that C created could run stand-alone on the machine. The kernel was generated using the same compilation method as any normal utility. This was a huge win; you could sit down and develop kernels very quickly.

For utilities, C came with a small library. This was mostly mathematical functions, although it did include `qsort` for sorting. There was an I/O library that transmuted into the standard I/O library when UNIX V7 came out. Finally, there was an early version of `yacc`, the compiler-compiler. It was only used by `bc`, so was a little unapproachable.

There were a couple of debuggers. The `db` program was a very basic octal debugger that could be used to examine files. These were usually core files. It had the ability to take a name list from an executable so you could look at locations in the core file using names from your program.

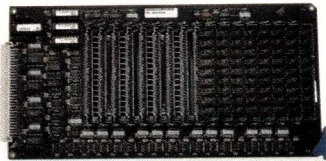
The `cdb` program was a debugger that knew about the code C compiled. In addition to examining data and code or printing stack frame values, you could run a program under



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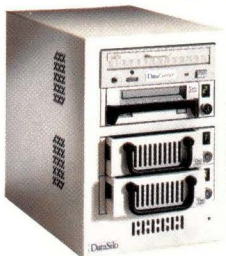


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the control of the debugger. You could set break points and see why your program was broken. You did need to know about the PDP-11 instruction set to use these tools to their full extent. The `cdb` debugger just needed the name list added to the executable file by the link loader; you didn't have to take any special action to compile in hooks for it to be useful.

There was `cref`, a program that died and did not make it onto UNIX V7, and from there to the wider world. It produced cross-reference listings of C programs. It was used by John Lions, who produced the definitive two-volume manual on how the kernel worked.

Somehow, the primitive operations UNIX provided were the right ones. They didn't stop you doing the things you wanted to do.

Finally, and let's not forget this, there was the source. There was mountains of source (or so it seemed), all written in a consistent style and largely uncommented. It was mostly in C. If you wanted to do new things, you could poke about and find some example to modify. You were no longer isolated as a programmer; you could see how someone else had tackled a problem and either use the method or perhaps improve on it.

Cheap and Easy Utilities

Most administration jobs on the system were controlled by text files. This was cheap because all you needed to establish and maintain these files was the editor, `ed`. I still use `ed` for quick jobs today. It was designed for frequent users. It has no command prompt and three error messages: "?," "??," and "TMP." It's extremely powerful. The use of regular expressions for character matching, combined with a simple command structure, makes it a delight to use.

The basic command set for file handling was in place. Many of commands have not altered significantly in functionality. We had `cp`, `mv`, `rm`, `mkdir`, `rmdir` and so on. The `ls` command just generated a single column of files when called with no arguments; Berkeley added columnated `ls` output much later. I used to tell people about directories when they had more files in their home directories than would fit on a screen.

You could move about the file system with the `chdir` command (`cd` came later, in what we knew as the "Yale Shell"). The `chdir` command was a shell built-in.

Although there were no supertools like `awk` or `sed`, the basic tool kit of `grep`, `wc`, `diff`, `comm`, `cmp` and `tee` were all in place. The `file` command for guessing file types was

available in rudimentary form with the file types compiled into it. The `diff` command had the annoying habit of saying `Jackpot` when it found that the files were very different. The algorithm for `diff` changed with V7. The `find` command was available, although you had to explicitly supply the `and` operators.

For communicating with other humans on the machine, there was `write` (and `mesg`, so you could be private). There was `who` so you could find out who was logged in. The `ps` command could be used to find out what you were doing on the machine. You could see what other other users were doing too. There was an email program called `mail`. With the `wall` command, you could ask people to log off because you were reloading the kernel. There was a simple line printer spooler, which only dealt with one printer.

For text processing, there was `roff` and `troff`. The `troff` program needed a CAT typesetter, and we didn't have one of those. The manual pages were on-line in `roff` source, so you could print them off or search them using `grep`.

All this stuff is familiar. Much of it is still in place, although I have no idea how many lines of the original code are used today.

So What Was Good About It?

Never having to say no.

UNIX V6 lasted a long time. The V6 manual set is dated May 1975, and the next release, V7, is dated January 1979. I ran UNIX V6 from 1976 to 1980, when we got the VAX and ran UNIX 32V.

UNIX V6 was a system composed of many simple programs, most of which fitted together in a way that made something greater than the whole. If you embraced the philosophy, you could add to that repertoire. I remember someone senior walking in the office and complaining that his program listings didn't have line numbers. I didn't hack the `pr` program; I wrote a filter called `num` that added line numbers. This was not a huge job, but it was better than telling the guy that he didn't need line numbers because the editor had adequate context searching.

Most of the people who started to be involved with UNIX at this time were kernel hackers. I guess most of us wrote device drivers. In the days before the Internet, we were isolated and had to look at the code to understand how it worked before we could change things. Most things were modular, and you could learn about small pieces on a need-to-know basis.

Somehow, the primitive operations UNIX provided were the right ones. They didn't stop you doing the things you wanted to do. Of course, some people had problems. It took some years to get a file-locking standard that was usable. Developers of database systems had a hard time controlling disk accesses in the way that they were used to on other systems.

UNIX was (and is still) good because it's an open system. I mean it was designed to allow you to see everything on the machine. You can see other users; they can see you. It's a place to meet other humans. You get in each other's way too. People leave litter in the form of unused files all over the

machine, and the disks fill up. UNIX scheduling has always depended on the fact that most processes interact with the system frequently and are put to sleep while they wait for some resource to become available. The worst UNIX user is the person running long compute bound jobs in the background.

UNIX works best in the environment where a smallish group of people are working together. It has none of the formal controls on resource usage that other systems provide as a matter of course. OK, UNIX systems these days have disk and other quotas.

Mostly, UNIX has no support for dictators. It permits users freedom on the machine, with the attendant problems this type of freedom brings. You can choose to be a good citizen or a not-so-good one. On systems shared by small groups, this is self-policing. Peer pressure keeps the naughty people from exceeding the bounds of decency. On large systems, this is harder. The management needs to establish self-policing mechanisms.

UNIX took us all from the age of batch computing using cards into the era of interactive systems on visual display units. It generated the C language, which has had a greater effect on computing than UNIX itself. UNIX set the standard for the systems-development platforms and provided some very broad shoulders for later developers to stand on. It provided a vocabulary for programmers that enabled the development of worldwide networking, truly portable applications, multivendor consortiums and open systems.

What's perhaps curious is why the world is now filled

with MS-DOS machines running Windows. What's more curious is why those machines now have better-looking applications than UNIX. These applications are deemed more user-friendly, a term that defies definition. They run in a computing environment where one application can interfere with another, where the operator can work for several hours and have the machine crash or require a reboot, and where machines are mostly networked using a proprietary standard. It's as if UNIX has taught the world nothing. This is a failure, not of UNIX, but of the people who develop and sell it.

Further Reading

If you are interested in history, then original UNIX technical paper is worth looking at. This was "The UNIX Time-Sharing System" printed in the *Communications of the ACM*, July 1974. Another good read is the entire edition of the *Bell System Technical Journal*, July-August 1978.

Peter Salus has written a book that documents the development of UNIX. It's called *A Quarter Century of UNIX* and is published by Addison-Wesley Publishing Co. (ISBN 0-201-54777-5). →

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 2. Email: pc@expert.com.

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ROBIN JAREUX

by RICHARD MORIN,
Technical Editor

Firewalls and (Perhaps) Boiling Oil

I recently attended a tutorial on firewalls given by Brent Chapman (Brent@GreatCircle.com). I found it very interesting and informative, if a bit discouraging. That is, it's nice to know what one can do to discourage intruders, but it would be nicer to know how to stop them.

In any event, Brent described the construction of "bastion" machines, remarking that the name came from the part of castles from which one would pour boiling oil on intruders. Unfortunately, there does not seem to be any networking equivalent to this practice. Worse, an intruder is almost guaranteed the ability to arrive, do his or her worst, and leave without being identified.

To see why this is so, let's take a (naive) look at the nature of the Internet. The Internet shares many characteristics with the lowly Ethernet. Any machine, by and large, can send packets to any other machine.

If a packet passes through a compromised machine, or even through a

local-area net (LAN) touched by such a machine, the packet can be saved and analyzed by unauthorized parties. Such parties can then use the illicitly obtained information to launch attacks against other machines.

One obvious example of this kind of activity is password grabbing. Every time a user initiates an ftp or telnet session, he or she must send an unencrypted password over the Internet. If a cracker is monitoring the session, he or she now has a new account to explore.

For this reason, many Internet administrators are taking a hard look at alternatives to the standard UNIX login machinery. Password key cards are one usable option (contact cert@cert.org for more information). Kerberos (available via FTP from [athena-dist.mit.edu](ftp://athena-dist.mit.edu)) is another.

Alternatively, an intruder may seek to exploit a hole on the target machine's operating system or administrative practices. Older SunOS systems, for instance, are rife with security holes. If

you run SunOS, get and install Solaris 1.1.1 at once. It contains security-related patches, and the cost is trivial.

Intruder Tracking

By cracking and entering a number of machines in series, a cracker gains a peculiar kind of invulnerability. To apply any sanctions, the pursuer must successively "expose" the cracker on each machine in the series. The chances of accomplishing this without the cracker noticing, let alone getting bored and logging off, are very small.

Worse, many administrators are unwilling or even unable to aid in such tracking. If the pursuer hits one of these machines, the cracker simply gets away. What information should your staff be willing to give an unknown, but plausible-sounding administrator from another site? If your site got a call for help in tracing a cracker, would your staff know what to do?

Over the longer term, such manual tracking techniques are doomed to fail-

ure. The Internet is growing at a phenomenal rate, and the number of crackers is growing apace. If a site is getting hit with dozens of intrusion attempts a day, there is no reasonable way to track them all manually.

Alternatives

Perfectly maintained sites with totally trustworthy administrators, software and users need not worry about intrusion attempts. The remaining 99.999% of us would be well advised to spend some thought on the subject. Unfortunately, there aren't any totally reliable solutions, other than pulling the plug on the Internet feed.

Some purists maintain that external security measures are unnecessary at best, and deceiving at worst. Make all your machines secure, they say, and you won't have to worry.

I find this advice to be both naive and impractical. Even with totally trustworthy vendor software (hah!), errors and lapses in judgment can make any machine on the local network a source of infection. Today's multivendor environments multiply the chance of such errors into a near certainty. So, count me on the side of defense in depth as a general policy and packet filtering as a specific tool.

Rigorous packet filtering certainly can be used to keep all external traffic from entering the local net. If you don't trust your local users, you can also disallow most internally generated sessions as well. Unfortunately, if nobody allows external access, there isn't much point in having a worldwide network.

More usefully, sites can maintain reasonably accessible bastion machines, while keeping external traffic off the internal network. The theory here is that bastion machines can be made arbitrarily hard to crack, and that cracking one does not, in any case, compromise the site.

This may be a bit too expensive (not to mention complex) for smaller sites to consider. Brent Chapman's preferred recipe requires two packet-filtering routers (one tied to the external network, one to the local network). The bastion machine sits on a "perimeter net" shared by the two routers.

A scaled-down version requires the bastion machine to filter external traffic. A separate router provides further protection for the local network. The external filtering is somewhat suspect in this arrangement, however, because the bastion machine could have gotten compromised.

Futures

The cracker problem will not go away without some real changes in the way networking code is written. There are several possible fixes, and we may have to employ more than one.

Vendors could install session-tracking logs into operating systems. These could, for instance, track the IP addresses, start and stop times, and local user information (user id, port number, etc.) for every TCP session going through an external network interface. The logs could be discarded after a few days, to conserve disk space.

With this kind of distributed database in place, it would be relatively trivial to do an automated back-trace. Email could then be sent to each administrator in the chain, advising of a suspected break-in. With a bit of luck, a cracker might occasionally be nabbed.

In another scenario, we might find systems such as SOCKS and Kerberos becoming standard for all Internet-based access. These systems log and verify identity, removing the anonymity that crackers use to shield their efforts.

It is possible, of course, that some of this logging and tracking could be abused. A totalitarian regime, for instance, might find it very gratifying to be able to know which users are talking to which Internet systems. I'm not in love with this, but I think it can be exposed and controlled. Without these kinds of tools, I'm quite certain that crackers cannot. ➔

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

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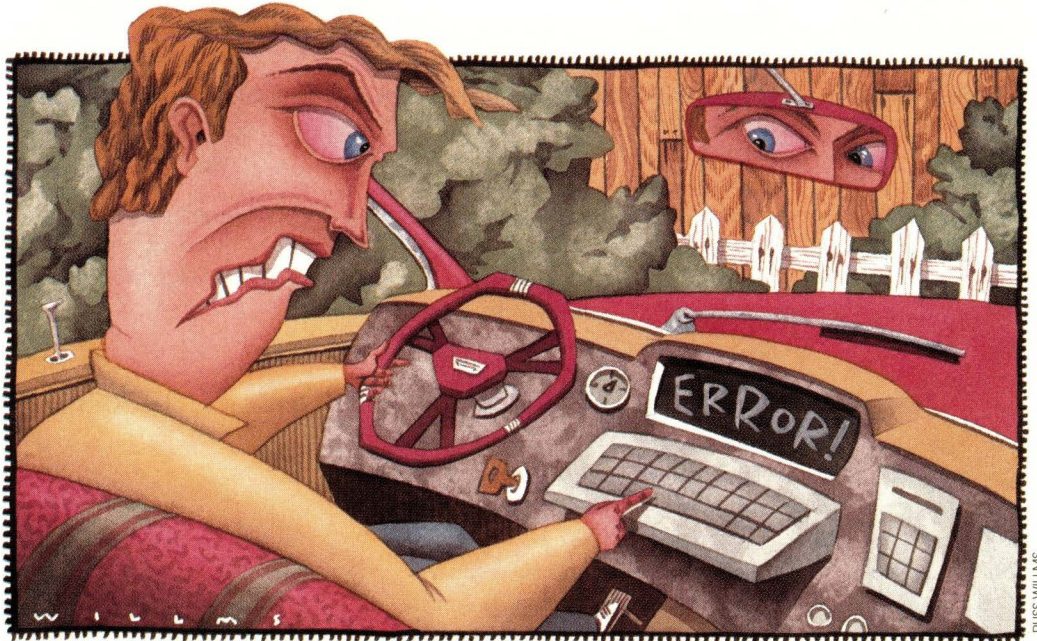
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The Network is the License!

by S. LEE HENRY

Imagine you're walking out your door in the morning, still yawning in the morning dew and trying to remember where you parked your car. You bump into it, fumble for the keys, and flop into the bucket seat. You turn the ignition key and nothing happens. Suddenly very awake, you glance at your dashboard and see that an error message has appeared on the message console right below the odometer:

```
7/11 7:11:00 (gmgrd) FLEXturbo - Copyright
1994, Highwayman Software, Inc.
license manager: can't initialize: no IGNITION
lines in license file
```

Instantly enraged, you try to calm yourself. OK, where is that file stored? Why this morning? Are there too many cars on the beltway? Did you park on the wrong side of the street?

Why, you ask yourself, did you buy this car? The idea of a smart ignition that helped to regulate neighborhood traffic and time your merge onto the beltway to speed your trip

seemed great. It's worked flawlessly—until this morning. Now you can't even leave the curb, and you've no idea why.

Far-fetched? Maybe not. Slee's predictions include things like, "By the turn of the century, cars will sense rain and automatically close their own windows." Why not help regulate traffic? Anyway, this scenario is likely reminiscent of a problem that all of us have had to face from time to time: the headache of managing license managers!

Why It's So Bad

The basic reasons just about everyone hates license managers are: 1) license management schemes are implemented because software vendors don't trust their buyers, and 2) license management software works flawlessly—except when it doesn't—and when it doesn't, it's totally opaque. It's likely been working flawlessly for so long that it's hard to know where to begin to look for the problem. We haven't had to think about the format of the license files or where they're stored or what daemons should be running in background mode or even how and when they start. And now, disaster!

License management problems are also hateful because, generally, all our users are affected and possibly all our licensed software as well. You're either gliding up the parkway at 75 mph or traffic is at a standstill. It's hard to prepare.

Figure 1. Server Line from License Data File

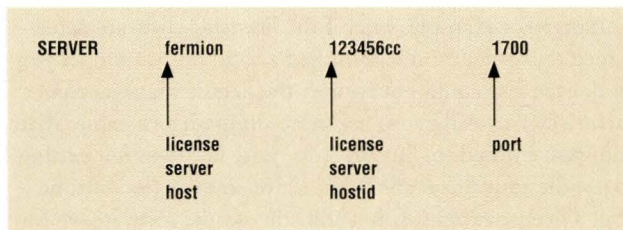


Figure 2. Feature Line from License Data File

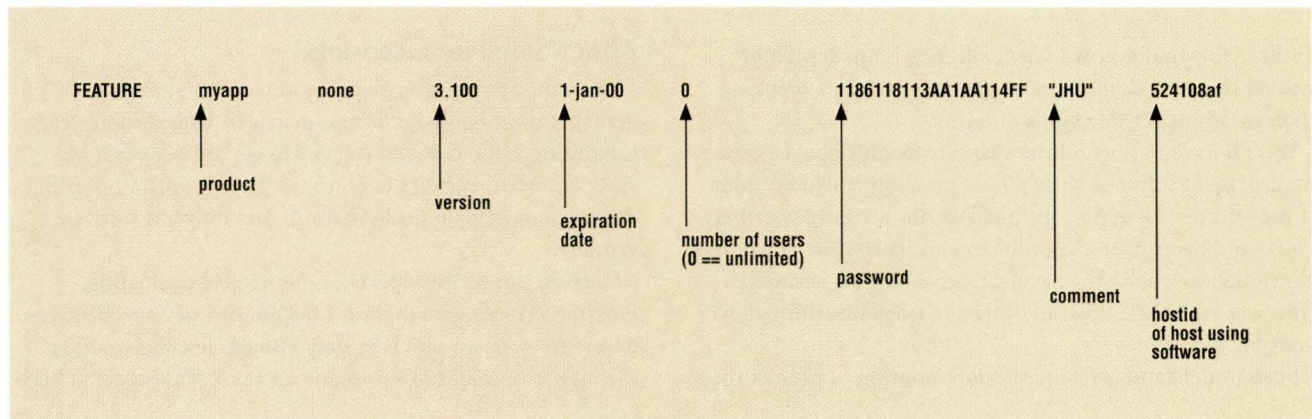


Figure 3. Using lmstat

```
hbar# ./lmstat -a -c /usr/local/lang/SunTech_License/license.dat
lmstat - Copyright (C) 1989, 1990, 1991, Highland Software, Inc.
Flexible License Manager status on Thu 5/12/94 13:55

License server status:

    licmgr: license server UP (MASTER)

Vendor daemon status (on licmgr):

    suntechd: UP

Feature usage info:

Users of sunpro.sparcworks.tools: (Total of 160 licenses available)

Users of sunpro.cc: (Total of 40 licenses available)

slee at boson on /dev/tty0 (v2.000), started Thu 7/21/94 at 6:01
fred at fermion on /dev/ttyd (v2.000), started Thu 7/21/94 at 10:30

Users of sunpro.c: (Total of 40 licenses available)

Users of sunpro.f77: (Total of 40 licenses available)

mark at hbar on /dev/pts/9 (v2.000), started Thu 7/21/94 at 13:52

Users of sunpro.pc: (Total of 40 licenses available)
```

To compound the problem, most of us have virtually no information on the license manager software. It was thrown in with whatever software we're licensing, whether it's a Sun compiler or a spreadsheet from a company in Texas. All we get are some instructions on how to install the license in the first place and, if we're lucky, this process may include a script. We get nothing on the license manager itself.

Software from Hell?

When you're in the middle of a struggle with a license manager, it's easy to come to the conclusion that all evil springs from license protection schemes. It isn't quite that bad. After all, I'm sure programmers must all go to Heaven, which leaves nobody to build them at the "other place." No,

license management software comes from... Well, you probably obtain your licensing software from Sun, but even Sun doesn't build its own anymore. Sun generally uses software sold by Highland Software and actually developed by Globetrotter Software. Is this software any good? Well, you can decide this, but clearly there are a lot of problems that sometimes make its administration a real pain in the rear end. Here's just a smattering of the errors you might see:

```
Inconsistent encryption code
Cannot connect to license server
Can't get server: cannot find license file
Retrying socket bind (address in use: port
1700)
license file does not support this version
Not a valid server host
```

I have to wonder how many collective hours have been wasted this year alone by systems administrators wracking their brains over these kinds of errors.

Yes, I'll have to dust off my soapbox for this one! License management software should fail open, but it seldom does. If the affected software continued to run but gave warnings, you could investigate the problem and fix it while your users continued to work. Then you'd receive only an occasional "message from hell" instead of having users breathing down your neck.

I can understand software vendors wanting to protect their

investment. After all, I am enough of a student of human nature to know that people will make excuses to cheat if it's easy enough. But I still get really piqued when software I've spent big money on won't work because of whatever licensing scheme the vendor is using to protect himself from the possibility that I'm less than honest. Wouldn't it be much nicer if failures of certain types allowed you to continue working? For example, what if the licensing software determined that you at some point had a valid license and let you work even if it could not contact the license manager right then? Maybe you'd get to use more simultaneous copies than you were entitled to, but isn't this more fair than not getting to use the software at all? What if, for some period of time after a license expires, you could still use the software, enduring only an occasional reminder that you needed to renew your license?

About Software Licensing

From the administrator's point of view, the best license manager is probably no license manager. Unless some very interesting value is added (maybe usage statistics that help you plan what software to continue buying and supporting), license managers do nothing for us and only aid software vendors.

Licenses can be user-locked, node-locked or floating. Floating licenses give the most flexibility and cost-effectiveness since you can purchase only enough licenses to cover the highest number of simultaneous users you expect. This is

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usually much easier to set up than node-locked licenses. When I had to set up licenses for three products for each of several hundred systems (and from a paper list of passwords), I aged quickly. With floating licenses, you don't have node-specific keys.

They're Trying

Sun has built scripts to make installing licenses easier, although for non-Sun software, this isn't much help. Still, installing licenses, for the most part, is not too bad. Tempers start to flare only when it stops working in the middle of everything and users end up waiting around to use software that they know they're entitled to use while you frantically try to figure out why they're getting, instead, some confusing error from the license manager.

To make it through these times, you should have information on what files your license manager uses, where it starts up (probably in your `/etc/rc.local` file), what license files look like, and what commands give you information on the status of your licensed software.

Structure of License Files

The license data file contains the name of the server running the license manager software along with other information about expiration dates and the number of licenses that are available at any time.

The server line provides the names and hostid of the host running the license server and the port address.

If you use redundant license servers, you need to make sure you have several such server lines—good idea so you'll still run if one of three is down. A reasonable representation of a typical server line is shown in Figure 1.

Feature lines (like the one shown in Figure 2) correspond to applications and contain the names of each licensed product, its version, the expiration date of the software, and the hostid of the host on which the software can be used, along with other information.

Floating licenses will not have the ending hostid on the feature lines, and demo software will often have the word `demo` in this location. Sometimes, a specific daemon will be included in the feature line as well.

If you have a number of products from the same vendor (e.g., SunPro), you should set up a combined license file and run all the licenses from it. This is much easier to manage since you can start up all of your licenses with a single command. Generally, you don't want to combine licenses from different vendors because you might run into incompatibilities between the versions of the license manager that each product supports.

You will often see a C Shell environment variable used to identify the license file. A line like this in a user's `.login` file will ensure that the application he uses knows how to locate the required license file.

```
setenv LM_LICENSE_FILE
/usr/local/myapp/license.dat.anything
```

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Checking on License Usage

Use the command `lmstat` to see how licenses are currently being used. You'll get a report like that shown in Figure 3, which lists the products supported and the current users of each.

Common Problems

Let's just look at a couple common licensing problems.

"Inconsistent encryption code" problems may mean that the version id in the license file is wrong. It should be a floating point number, like 2.0. You could also have errors in your hostid (6's and b's look a lot alike, especially if you're over 40). The password and the vendor string might be in error.

The "Retrying socket bind (address in use: port 1700)" problem may mean there is a previous license manager process running. Maybe you did not properly shut down the license manager before trying to restart it. If so, use the `lmdown` procedure to shut it down first. If the running license manager is supporting some other software, change the port address in the new license file and restart the license manager. Use a value close to 1700, like 1715 or 1725, as long as it doesn't conflict with one that is in use.

There is more information that will help you understand and fix software license manager problems. For a list of the

most frequently asked questions regarding licensing for Sun compilers, send email to:

`langapp_support@unicorn.Corp.Sun.Com`

Now the Quiz

License management software should:

- a** be easy to use
- b** be easy to install
- c** allow you to easily check license usage
- d** be easy to understand (e.g., the configuration)
- e** be easy to start and stop
- f** be able to generate usage statistics
- g** all of the above
- h** none of the above

If you answered "g," you get an A (congratulations!). One credit toward your graduation from *SunExpert* Academy.



S. Lee Henry is on the Board of Directors of the Sun User Group and manages computer and networking services for the Physics and Astronomy Department at Johns Hopkins University. Send mail to `slee@expert.com`.

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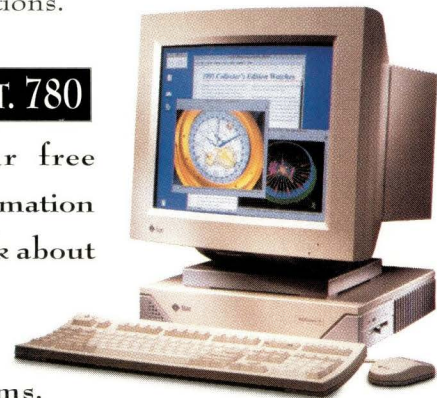
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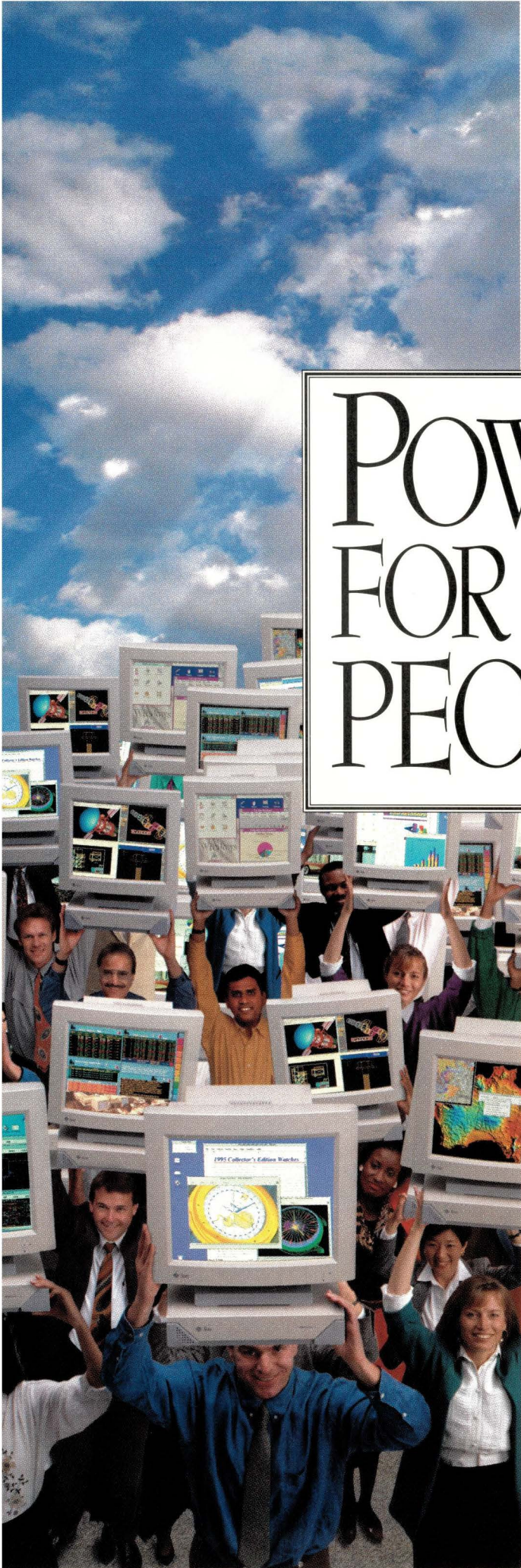
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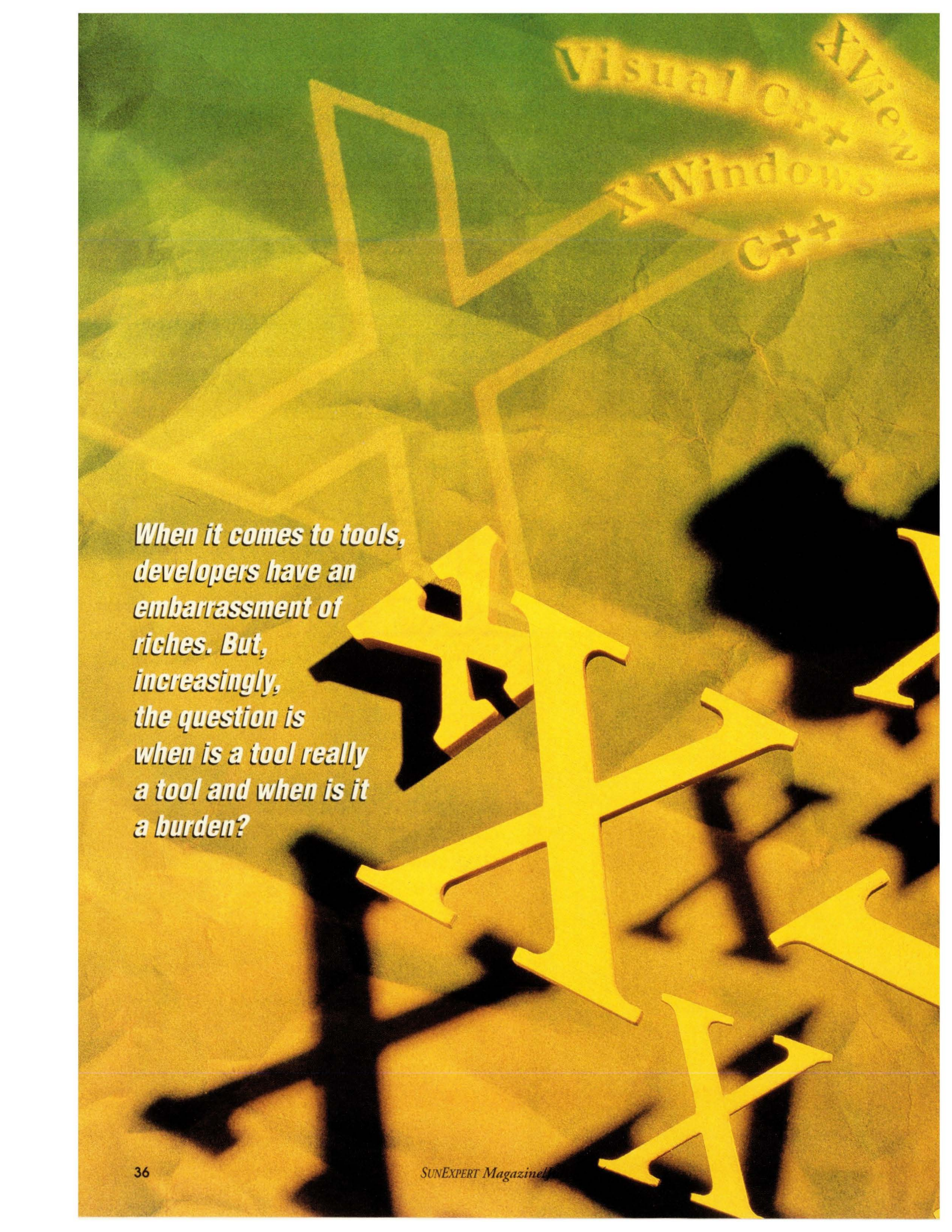
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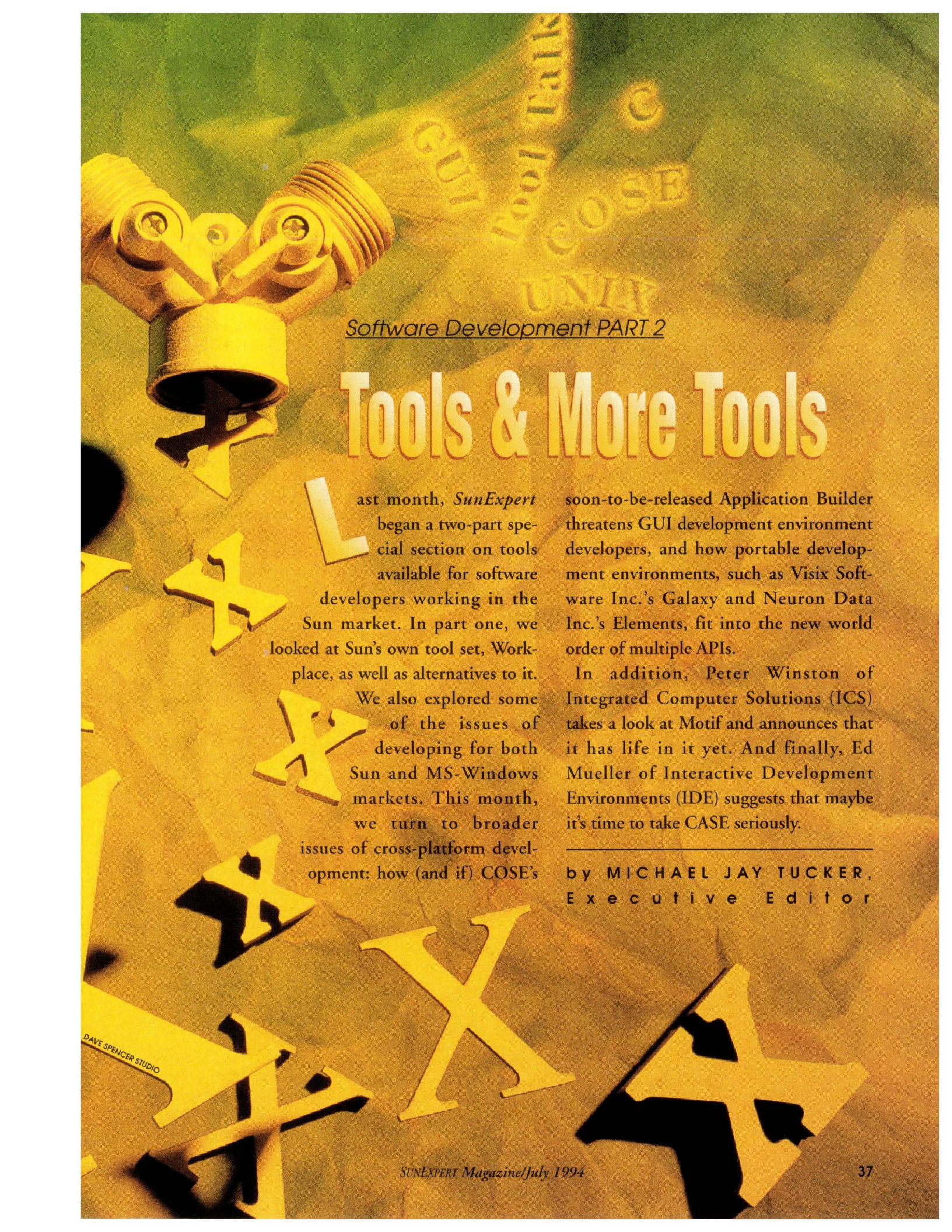
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embarrassment of
riches. But,
increasingly,
the question is
when is a tool really
a tool and when is it
a burden?*



Software Development PART 2

Tools & More Tools

Last month, *SunExpert* began a two-part special section on tools available for software developers working in the Sun market. In part one, we looked at Sun's own tool set, Workplace, as well as alternatives to it.

We also explored some of the issues of developing for both Sun and MS-Windows markets. This month, we turn to broader issues of cross-platform development: how (and if) COSE's

soon-to-be-released Application Builder threatens GUI development environment developers, and how portable development environments, such as Visix Software Inc.'s Galaxy and Neuron Data Inc.'s Elements, fit into the new world order of multiple APIs.

In addition, Peter Winston of Integrated Computer Solutions (ICS) takes a look at Motif and announces that it has life in it yet. And finally, Ed Mueller of Interactive Development Environments (IDE) suggests that maybe it's time to take CASE seriously.

by MICHAEL JAY TUCKER,
Executive Editor

DAVE SPENCER STUDIO

It's Called Gooney, But It's Dang Hard All the Same

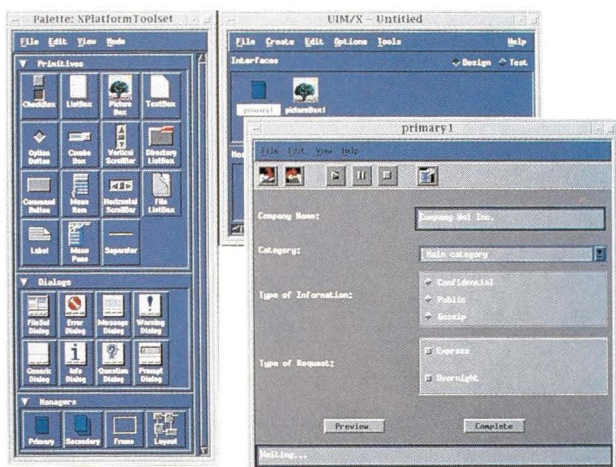
Among the most useful tools available to developers in the Motif world are GUI development environments. They range from what market research firm Dataquest Inc. calls interactive design tools (IDT) to interactive management systems (IMS). IDTs are primarily aimed at doing screen layout and design, whereas IMSs provide those functions plus certain programming features, such as interpreters or scripting languages (see "Widgets, Gadgets and Palettes, Oh My!" *SunExpert*, May 1992, Page 54).

IMS/IDTs are a hot market. Any number of companies now offer products that go into one category or the other, and in some cases, both at the same time. They include Alslys Inc. with its TeleUSE, Integrated Computer Solutions with Builder Xcessory, iXOS Software GmbH with iXBUILD, Non Standard Logics Inc. with its XFaceMaker2, Sunrise Software International with ezX, V.I. Corp., which remarkets Imperial Software's X Designer, Visual Edge Software Ltd. with its UIM/X, and so on.

But how viable is the market? As part of the industrywide effort to product a common development environment, the Common Open Software Environment (COSE) group is developing "Application Builder," which will perform some of the functions of a GUI tool. Application Builder will be a screen design and layout tool with Motif-based interfaces. With it, developers would be able to perform some of the functions of more sophisticated GUI tools, such as placing buttons and menu objects on a screen and hooking them to an application.

The GUI tool vendors say they're confident about their future. "You know what they say about an elephant being a horse designed by committee," says one vendor, who asks not to be named. "Well, I think that's what you're going to have with App Builder."

However, Michael Foody, president of Visual Edge Software, thinks it could have some effect on some vendors' businesses. "I think there is a certain class of builder that App Builder will put a dent into," he says. "Certain of our competitors, who just do layout, could have some problems."



Visual Edge makes UIM/X, one of the market leaders in the GUI tool business. This is an IMS that includes a C language interpreter. It also offers a cross-platform option in that it is available on Motif and MS-Windows. It is also remarketed with enhancements for database development by Bluestone.

Foody says his product has a "top-down approach" to cross-platform development, in which objects that are present in Motif but not in Windows are painstakingly re-created in the PC environment and vice versa. He contrasts this approach with that of XVT Software Inc., whose XVT design appears on Motif, Windows and Macintoshes, among many other platforms. "They're able to cover more platforms, but we'll have a higher level of sophistication."

XVT's product is a layer of software that resides on top of the native libraries of its various systems and calls on those libraries when necessary. A frequent criticism of the approach is that, in the words of Barry Libenson, Visix's vice president of business development, "you get the lowest common-denominator problem." He says the drawback of the approach is that developers are restricted to features common to all the platforms they wish to support.

Not surprisingly, XVT says this isn't the case. Their concerns are valid, but they're wrong, says XVT's vice president of marketing, Roger Obert. "Technically, there isn't enough in common between the various tool kits of all the different platforms we support to be a valid API." In fact, he says, XVT has ported high-level functionality to each of the platforms it supports. "My evidence for this," he says, "is that if we were trying to provide only what was common, you couldn't have sophisticated applications, like MapInfo, written on XVT."

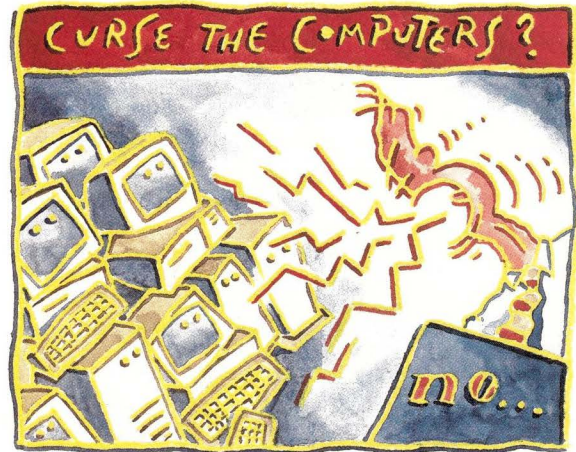
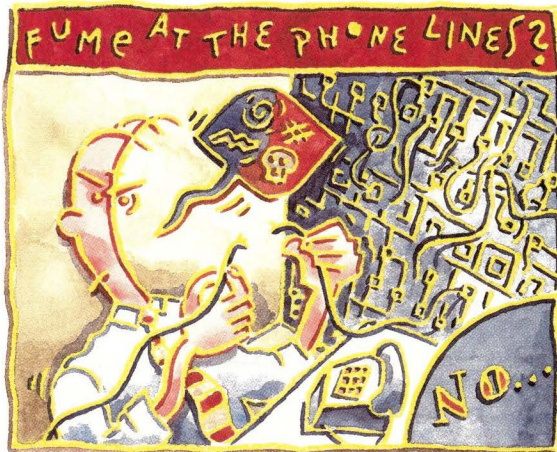
The company's director of product planning, Greg Klinkel, says that the criticism of his company as "low level" actually reflects a misunderstanding of what developers really want. "They [critics] are probably referring to the fact that we don't give developers access to every resource for every widget in Motif." But, he says, most of those resources aren't particularly useful to developers working on other platforms. "A lot of those abstractions are just not portable across Windows to the Mac." So, instead, he says, XVT focuses on porting what's actually useful from one platform to another.

However, XVT does agree with Foody's analysis of the COSE App Builder on the GUI tool market. "We are in the cross-platform business. We relieve developers from the concern about what platform they might ultimately want to put their application on," says Obert. "That is not a need that would be met with App Builder." Still, he suspects that App Builder will put pressure on other vendors.

UIM/X, from Visual Edge Software, is a GUI tool that allows programmers to develop on Motif without much of the pain and effort usually associated with that environment.

Indeed, that seems to be the theme of the piece. Everyone agrees that App Builder is going to put pressure on somebody, and everyone agrees that the somebody

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in question isn't them. In fact, the vendors say that their real concern is competition with one another, rather than with anything from an incomplete specification just leaving the drawing boards of COSE.

And each of the vendors has different things to compete over. There's ease of use, for example. "ezX is easy to use," says Bonnie Williams, a technical sales representative for Sunrise Software. "It's a very intuitive GUI builder. You don't have to know X to use it. A lot of GUI builders require a great deal of familiarity with X and Motif. We've had customers switch to ezX simply because it was less difficult to use." She also notes that it has loyal fans in the government because it comes with Ada language bindings.

Then there's pricing. "We're the least expensive of the market leaders," says John Casanova, manager of inside sales at V.I. Corp. V.I. remarkets Imperial Software's X Designer. "It costs only \$3,500, and that includes support. The other thing my customers say is that it is easy to learn, and that it produces better code."

However, he says, choice of a GUI builder "really just boils down to a matter of taste. It's a religious thing, like whether

you drive a Chevy or a Dodge or a Mercedes."

But would the sales of Chevys, or Dodges or Mercedes remain as strong if someone, anyone, were passing out VW Beetles for free? "I think some of the vendors are going to be hurt [by App Builder]," says Greg Kiessling, president of KL Group Inc. KL offers a catalog of Motif widgets available to developers for inclusion in their own programs. "Right now, developers get Motif out of the box, and then they say, 'Oh! I need a tool' But, once they've got App Builder right out of the box, some of them are going to say, 'That's good enough.'"

App Builder: What Is It Really?

What is App Builder, and how frightened of it should GUI tool developers really be? The first part of that question is answered easily enough. "The App Builder is a simple, easy-to-use GUI application builder for the CDE [Common Desktop Environment]," says Lin Brown, program director for CDE and SunSoft Inc. "Its goal is to make

Motif Is Still Your Best Friend

Some developers are turning away from Motif entirely. They say that the only GUI that developers really need to worry about is Windows. For a spirited defense of Motif, SunExpert turned to Peter Winston, president of Motif-oriented Integrated Computer Systems.

Many software developers are debating whether they should choose between new technologies such as Windows NT or continue with X/Motif. The question isn't really should they choose between X/Motif or Windows. Motif and Windows solve different problems and follow a variety of different business models. Be it in the financial services, manufacturing or aerospace industries, it is most likely Windows would be used to create accounting documents or human resource files, but Motif is much better for writing applications that need to be customized for core business. To understand why Motif is still growing, it is important to realize why people do Motif development, and why people do PC development and use PCs. People use PCs to save money on both their hardware and software purchases and because it makes it easier for the individual. People use workstations to make more money for their companies and help

them stay competitive. For corporations that rely on writing their own customized applications to improve and differentiate themselves from their competition, Motif and UNIX offer the best solution.

Weathering the storm of changes in alliances, consortiums and foundations, Motif has been expanding and is still the best environment for developing corporate, "bet your business" applications. Why? All applications will be going GUI in the future, if they are not there already. Currently, Motif is the best solution when it comes to developing GUI applications.

In our quest to find the best windowing system for corporate mission-critical software development, we have overlooked the most obvious solution. One concern some people have about Motif stems from comparing the cost and the amount of shrink-wrapped software available for Windows and NT, instead of comparing the total cost of ownership and how much money their whole computing system saves the company.

New technologies such as Windows NT seem exciting but, realistically, are years away. People need to develop their critical applications today. Motif has never been in a better position to solve our corporate development problems. The COSE and

CDE announcements have given Motif another three to five years of life. With CDE spending \$30 million enhancing X and Motif—allowing it to evolve faster—and with Sun's huge installed base of customers migrating from Open Look to Motif, you can be sure that Motif isn't dead or going away soon. In fact, according to one market study from Sentry Market Research, the growth of the workstation software market is still significantly outpacing PC software development. According to the report, in 1994 workstation development grew at 45%, while in the same year PC software development grew only 36%.

Why wait for some emerging technology way off in the future that promises to take Motif's place and emancipate the software community from its development problems? Motif is robust and is capable of helping you create your best corporate-wide applications.

Peter Winston is the founder and president of Integrated Computer Solutions, a provider of products and services that help developers working with mission-critical technologies to become more productive. He can be reached at peter@ics.com.

by PETER WINSTON

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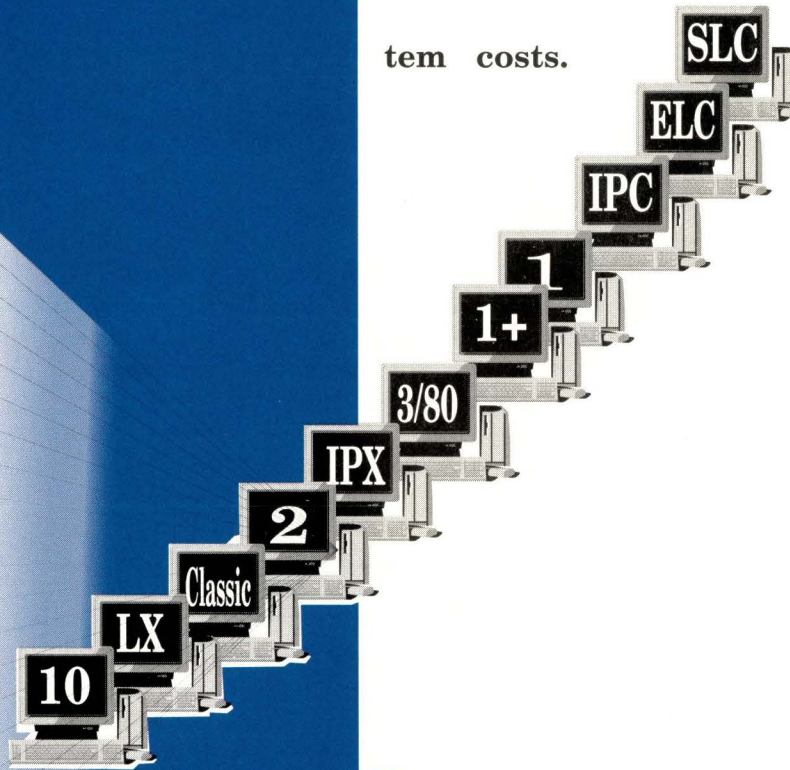
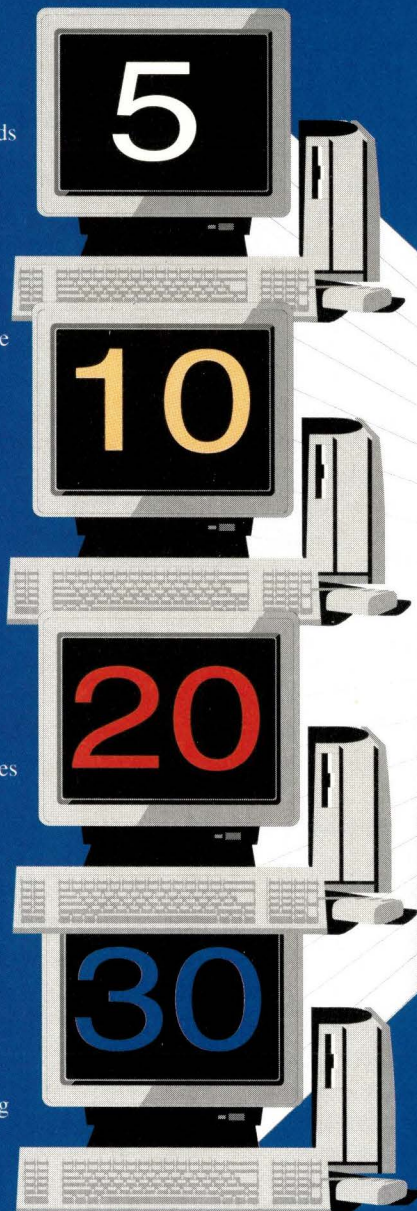
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it easy for developers to get CDE applications as quickly as possible.”

App Builder is part of a larger effort collectively known as COSE. Sun, or more precisely, the SunSoft part of Sun, is the COSE member leading the development

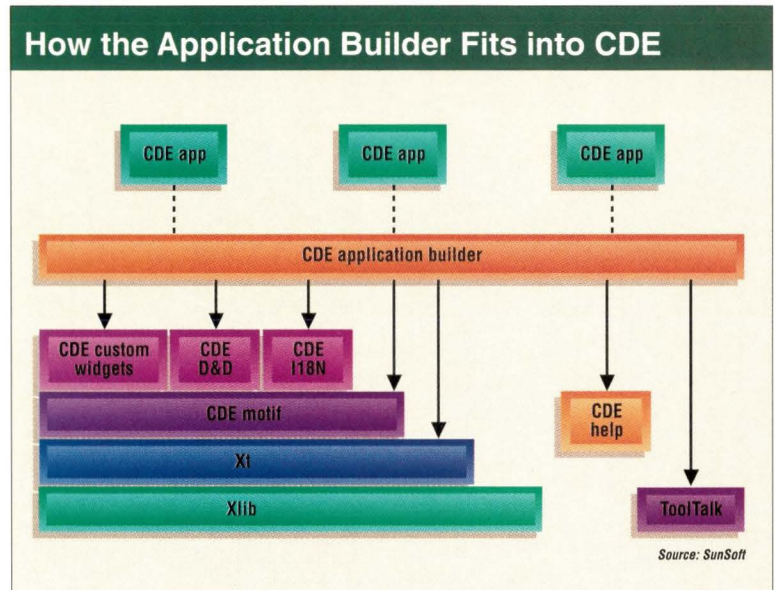
of App Builder. It is reasonably close to being, if not finished, at least partly finished. Brown says that the first snapshot of App Builder is already in circulation. “You could probably start developing applications now,” he says, though “the final version is targeted for the end of the year.”

App Builder is “both a product and specification.” This is to say that it will be made available to COSE members, who will then add their own touches and sell it.

Brown says that vendors can expect to find four major categories of tool within App Builder. These will include an object palette, a properties editor, a layout editor and a connectors manager, which links objects to program behaviors.

How much impact will App Builder have on the GUI market? Brown doesn't think the Visual Edges and XVTs of the world have a lot to worry about. “We want to kick-start the CDE environment. We want to provide some fundamental, basic capabilities,” he says. “It's like text editors. We also provide a text editor in our basic environment, but we aren't going to put Frame [Technology Corp.] out of business.”

A quick and dirty tool to kick-start CDE, App Builder fits between a CDE application and the rest of the CDE environment.



instance, will run across many UNIX systems, and even, in some cases, Windows ones.

But, for pure portability, there is no beating common application and development environments, like those from Visix and Neuron Data, which run across many platforms and then emulate the look and feel of the native environments. They give the developer the ability to run across everything from Motif systems to PCs and Macs.

But are they worth the price?

These systems typically work by disregarding all or part of the native Windows, Mac or UNIX environment and putting a proprietary solution in their place. “What they give you is a high-level abstraction library of their own,” explains KL Group's Kiessling. “Then, when you write an application, you link with their library.”

The users may not even recognize that they aren't working with the native Windows, Motif or whatever because the new environment painstakingly re-creates the look and feel of the old. In effect, products like Visix's Galaxy and Neuron Data's Open Interface Elements are master mimics that can make themselves at home in many different environments.

There are many traditional criticisms of this approach. One of the biggest ones is that emulation is never as good as the real thing. “The problem with those is that you're not

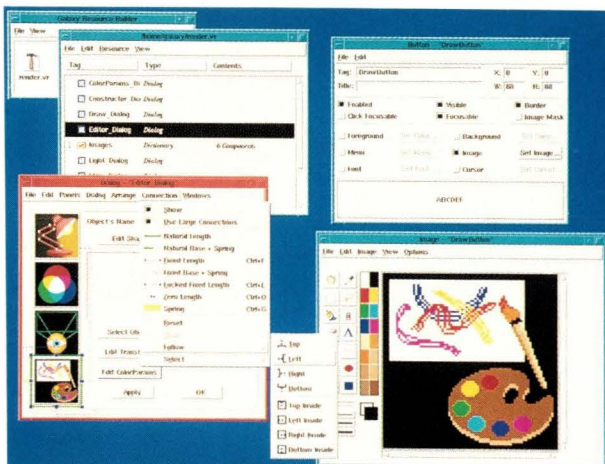
building real anything,” says V.I.'s Casanova. “But you get real problems, including the least-common-denominator syndrome.”

Visix's Galaxy provides a common environment across many platforms. This greatly simplifies work for programmers and marketers alike, but some ISVs worry about linking their fate to that of Visix.

Then there's the issue of compatibility. Galaxy and Elements stand outside the rest of the industry, says Visual Edge's Foody. “That gives them a strength in that they don't have to worry about where the rest of the industry is going. But it also means they have to compete with the whole industry. There are lots

The Emulation Routes

Developers who need to deploy their work on multiple platforms have options other than simply recoding for every machine they wish to support. Some GUI tools, for



of Motif widgets around. How many Galaxy or Neuron Data components are there?"

And there are lots of other questions that developers raise. Not the least of them is whether one really wants to link one's product's fortunes with that of some other company, and its licensing policies. What happens if the company that makes the environment your product needs to survive suddenly goes bankrupt?

However, Visix and Neuron Data have answers at hand. As for basing your product on someone else's software, "well, you're always betting on somebody," says Neuron Data's director of marketing, Barbara Hochgesang. "Our business partners, which include IBM and NASDAQ, seem to be comfortable with us."

"When you decide to go the cross-platform route," agrees Barry Libenson, vice president of business development at Visix, "you've got to wed yourself to someone's software. And with the current state of OSF, I'd say they weren't as good a bet as Visix."

As for technical issues, the companies deny there's anything worse about going with emulation than going with native code. "We're typically two to four times faster than things built with Motif—and two to four times smaller," says Libenson.

As for being competitive with the rest of the industry, Libenson responds, "You can go to numerous shops that will build Galaxy widgets for you. But, you see, the people who are building Motif widgets are making money because it is so hard to use Motif. The process of building your own objects in Galaxy is largely trivial."

Visix and Neuron Data, then, say their approach is no more, and perhaps less, risky for developers than going with native environments. The question, though, may be whether both native and emulation techniques are not equally threatened by powerful market forces. At least in corporate America, "cross-platform development" increasingly means UNIX servers and Windows clients.

CASE Grows Up

by ED MUELLER

With the possible exception of that great '80s fiasco, artificial intelligence, few technologies in history have promised more and delivered less than computer-aided software engineering (CASE). CASE vendors, however, say they've gotten a bad rap. Ed Mueller, of Interactive Development Environments, says that CASE has actually grown in to a productive adulthood in the last decade.

Like the development life cycle it supports, CASE has endured its own, sometimes rocky evolution. CASE was the software development panacea of the '80s, until undelivered CASE infrastructures, low user acceptance of structured development, slow pilot projects and shelfware gave the technology a public relations problem. More recently, CASE-bashing has become a popular pastime, and we CASE vendors have turned to more politically correct and economically astute names such as "application development environments." But a funny thing happened on the way to the thesaurus. CASE grew up.

Now CASE (or rather, application development environment) vendors openly concede that CASE, by itself, isn't the "magic bullet" as touted in the previous decade. But vendors also point to significant technology advances and a rapidly

evolving, next generation of development tools that make project managers take a second look when conducting evaluations. CASE, in fact, is delivering on its earlier promises.

Not that CASE in the '80s was all bad news. There were many published success stories detailing how organizations successfully implemented CASE to shorten development cycles and produce robust, high-quality software.

These corporate and government projects succeeded because senior engineering managers and project leaders understood the importance of correctly setting expectations of upper management, especially on critical issues such as governing process change and providing resources, both of which are critical factors in successfully implementing automated tools. (An excellent example is training engineers on how to apply new object-oriented approaches). All too often, however, expectations were set incorrectly—or worse—not at all. And by definition, projects fail when they have nothing to be measured against.

CASE today offers a more robust and complete technology. The leading products are open and are delivered to users already integrated with other products that cover other phases of the life cycle. Users are thus able to assemble their own tool

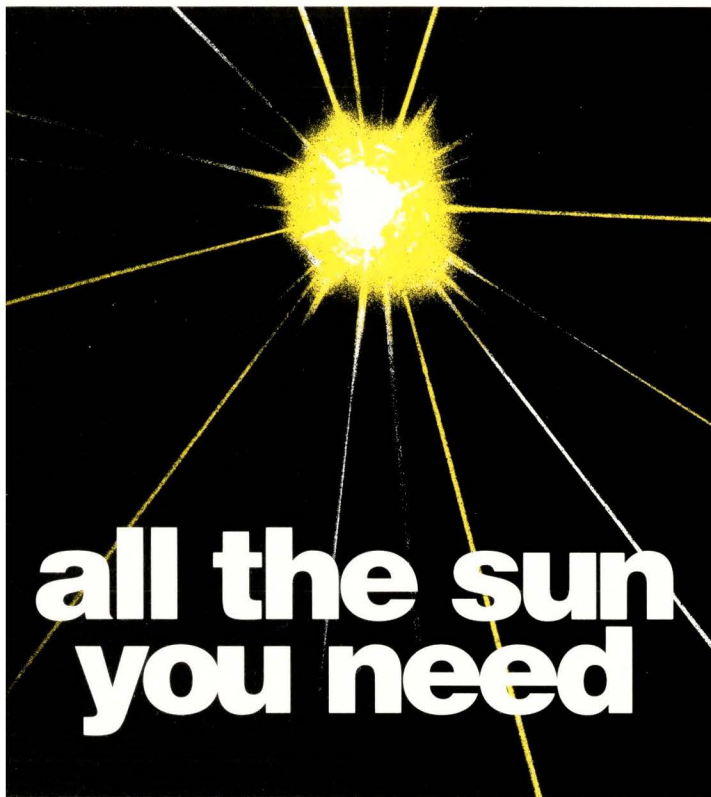
"workshops." Modern CASE is also easier to use, more powerful, scalable to large groups and supports object-oriented methodologies such as the popular Object Modeling Technique (OMT).

Yet objects and CASE don't merely complement each other. CASE provides excellent examples for organizations moving to object technology. If project leaders can apply the lessons learned from CASE to the adoption of object techniques, projects will be better received, designed and executed. The biggest lessons: educate management, choose projects that are logical and likely to succeed, invest in training your engineers, then deliver and set clear criteria to evaluate effectiveness.

Although CASE has suffered the scrapes and bruises of childhood, it has evolved into adulthood with a maturity and strength that ensures its growing presence in software development. Enlightened management techniques can help ensure success. By providing object technology "children" with lessons in growing up, CASE brings even greater value to the technology table of the '90s.

Ed Mueller is director of marketing at Interactive Development Environments in San Francisco. IDE is the vendor of CASE product family Software Through Pictures.

That fact prompts at least some developers to suggest that there's only one GUI to worry about, and that's Windows. "What people are saying is 'Why bother with a Visix?' 'Why bother with a Neuron Data?'" says Chane Cullens, product manager for Wind/U for Bristol Technology Inc., which makes products that allow Windows applications to run on UNIX platforms. "They're asking, 'Why are we sitting on our Sun workstations and paying thousands of dollars for those products, or for Visual Edge's UIM/X, when we can get a whole PC with software for the same money?'" →



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Circle 142

Bristol Technology Inc.

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Ridgefield, CT 06877
Circle 143

Integrated Computer Solutions

201 Broadway
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Circle 144

iXOS Software GmbH

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D-85630 Grasbrunn
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Circle 145

KL Group Inc.

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Circle 147

Non Standard Logics Inc.

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Circle 148

Sunrise Software International

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Circle 149

SunSoft Inc.

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CA 94043-1100
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V.I. Corp.

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Visual Edge Software Ltd.

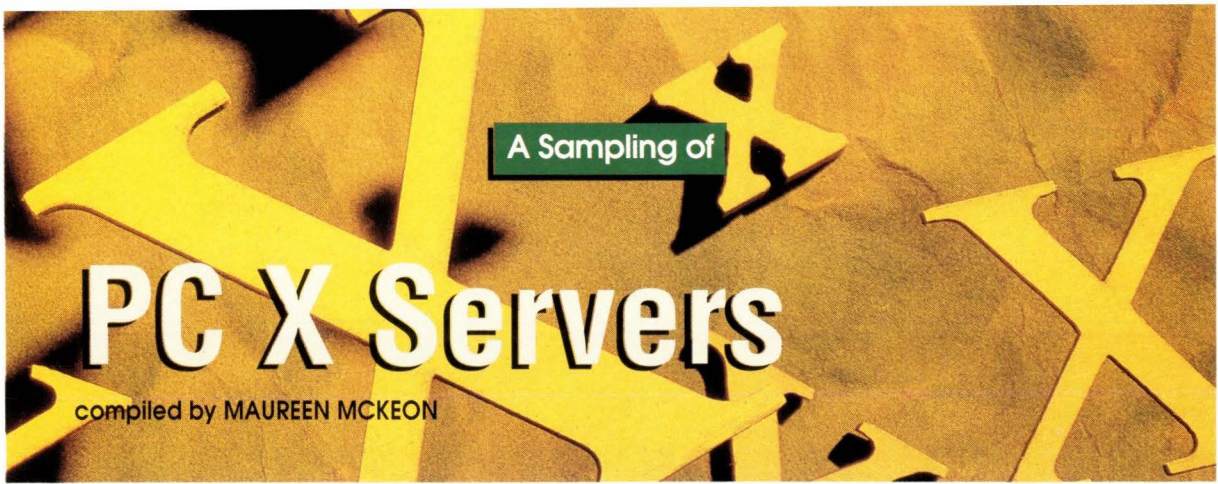
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Circle 152

Visix Software Inc.

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Reston, VA 22091
Circle 153

XVT Software Inc.

4900 Pearl East Circle
Box 18750
Boulder, CO 80308
Circle 154



Company/Manufacturer Model	OS supported	PC platforms	X release	Supports font conversion/substitution (yes/no)	Scalable fonts (yes/no)	xtrace support (yes/no)	Virtual desktop support (yes/no)	Transport	Window manager local/remote	Built-in clients	Price (\$)
AGE Logic Inc., 9985 Pacific Heights Blvd., San Diego, CA 92121. Circle 200											
XoftWare for Windows Desktop Edition	MS-Windows	80386, 80486, Pentium	X11R4	Y/Y	N	Y	Y	TCP/IP	MS-Windows Program Manager/all X-based window managers	None	195+
XoftWare for DOS	MS-DOS 3.1 or higher	80286, 80386, 80486, Pentium	X11R4	Y/N	N	Y	Y	TCP/IP	—/all X-based window managers	None	295+
XoftWare/32 for Windows	MS-Windows	80386, 80486, Pentium	X11R5	Y/Y	Y	Y	Y	TCP/IP, IPX/SPX, PPP, SLIP, CSLIP, serial	MS-Windows Program Manager/all X-based window managers	None	395+
XoftWare/32 for OS/2	OS/2	80386, 80486, Pentium	X11R5	Y/Y	Y	Y	Y	IBM TCP/IP	IBM OS/2 Presentation Manager/all X-based window managers	None	395
XoftWare/32 for Windows NT	MS-Windows NT	80386, 80486, Pentium, MIPS, Alpha	X11R5	Y/Y	Y	Y	Y	TCP/IP	MS-Windows NT Program Manager	None	495
Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014. Circle 201											
MacX	Macintosh OS 6.0.5 or later or A/UX	Motorola 68K series, Power PC	X11R4	N/N	Y	N	Y	AppleTalk, TCP/IP, DECnet	Finder/Motif, Open Look, twm	None	289
Control Data Systems Inc., 9315 Largo Drive West #250, Landover, MD 20785. Circle 202											
Vista-eXceed	MS-DOS, OS/2, MS-Windows, MS-Windows NT	80286, 80386, 80486, Pentium	X11R5	Y/Y	Y	Y	Y	TCP/IP, IPX, DECnet, serial	MS-Windows, HWM/Open Look, twm, 4DWM, MWM	HWM, Telnet, FTP, LPD, transport monitor, Xstart, Daemon, Xmag, Xlogo, lco, Xev, Showcmap, Maze, Xdpyinfo, bitmap, Seltest	500
FTP Software Inc., 2 High St., No. Andover, MA 01845. Circle 203											
EntranX/32 for Windows	MS-Windows 3.1	80386, 80486	X11R5	Y/Y	Y	Y	Y	TCP/IP	MS-Windows/all X-based window managers	None	275
Hummingbird Communications Ltd., 480 San Antonio Road, Ste. 100, Mountain View, CA 94040. Circle 204											
eXceed 4	MS-Windows 3.0	80286, 80386, 80486, Pentium MIPS, Alpha	X11R5	Y/Y	Y	Y	Y	TCP/IP, DECnet, IPX, SPX, SXP, Window Mgr., HWM	Window manager, HWM, PM Windows/all X-based window managers	x clock, logo Maze, full suite of Xlibraries, etc.	545
eXceed/NT	MS-Windows NT	80386, 80486, Pentium, MIPS, Alpha	X11R5	Y/Y	Y	Y	Y	TCP/IP, DECnet, IPX, SPX, SXP, Window Mgr., HWM	Window manager, HWM, PM Windows/all X-based window managers	x clock, logo Maze, full suite of Xlibraries, etc.	545
eXceed/DOS	DOS 3.3 and above	80286, 80386, 80486, Pentium, MIPS, Alpha	X11R5	Y/Y	Y	Y	Y	TCP/IP, DECnet, IPX, SPX, SXP, Window Mgr., HWM	Window manager, HWM, PM Windows/all X-based window managers	x clock, logo Maze, full suite of Xlibraries, etc.	545
eXceed/OS/2	OS/2 Version 2.0	80386, 80486, Pentium, MIPS, Alpha	X11R5	Y/Y	Y	Y	Y	TCP/IP, DECnet, IPX, SPX, SXP, Window Mgr., HWM	Window manager, HWM, PM Windows/all X-based window managers	x clock, logo Maze, full suite of Xlibraries, etc.	545

PC X Servers

Company/Manufacturer Model	OS supported	PC platforms	X release	Supports font conversion/ substitution (yes/no)	Scalable fonts (yes/no)	Xtrace support (yes/no)	Virtual desktop support (yes/no)	Transport	Window manager local/remote	Built-in clients	Price (\$)
JSB Corp., 108 Whispering Pines Drive, Ste. 115, Scotts Valley, CA 95066. Circle 205											
MultiView/X	OS/2, MS-Windows	80386, 80486	X11R5	Y/Y	N	Y	N	TCP/IP, DECnet, PPP	MS-Windows/all X-based window managers	None	495
Network Computing Devices Inc., PC-X Division, 9590 S.W. Gemini Drive, Beaverton, OR 97005. Circle 206											
PC-Xware v.103	MS-Windows 3.1	80386, 80486, Pentium	X11R5	Y/Y	Y	Y	Y	TCP/IP, DECnet, serial, WinSock	MS-Windows, NCDwm/ all X-based window managers	Window manager	545
Process Software Corp., 959 Concord St., Framingham, MA 01701. Circle 207											
XoftWare/32 for Windows	MS-Windows, MS-Windows NT, OS/2, MS-DOS	80286, 80386, 80486, Pentium, MIPS, Alpha	X11R5	Y/Y	Y	Y	N	TCP/IP, DECnet, IPX/SPX, serial, PPP, SLIP, CSLIP	MS-Windows/Motif, Open Look, HPVue, DECwindows	None	395
Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405. Circle 208											
DESQview/ x 2.0	MS-DOS, MS-Windows	80386, 80486, Pentium	X11R4	Y/N	Y	Y	Y	TCP/IP, IPX, Netbios SLIP/PPP, Unixware, SPX	DESQview Window Manager/ Motif, Open Look	Xclients, xclock, file manager, window manager	275
Tenon Intersystems, 1123 Chapala St., Santa Barbara, CA 93101. Circle 209											
MACH TEN X	Macintosh OS System 7	Macintosh, Power Macintosh	X11R5	Y/Y	Y	Y	Y	TCP/IP	Open Look, Motif, twm	Xclients, xclock, etc.	295
Transparent Technology Inc., 5757 West Century Blvd., Suite 490, Los Angeles, CA 90045. Circle 210											
eXceed 4	OS/2, MS-Windows, MS-Windows NT, MS-DOS	80286, 80386, 80486, Pentium, Alpha, MIPS	X11R5	Y/Y	Y	Y	Y	TCP/IP, DECnet, IPX, SPX, SXP, Window Mgr., HWM	Window manager, HWM, PM-Windows/all X-based window managers	Xclock, logo Maze, full suite of Xlibraries, etc.	545
Unipress Software Inc., 2025 Lincoln Hwy., Ste. 209, Edison, NJ 08817. Circle 211											
Vista-eXceed	MS-Windows	80386, 80486, Pentium	X11R5	Y/Y	Y	Y	Y	IPX, TCP/IP, DECnet, serial	MS-Windows/all X-based window managers	None	500
Visionware Inc., 4500 Bohannon Drive, Menlo Park, CA 94025. Circle 212											
Vista-eXceed	MS-Windows	80386, 80486, Pentium	X11R5	Y/Y	Y	Y	Y	IPX, TCP/IP, DECnet, serial	MS-Windows/all X-based window managers	None	500
White Pine Software Inc., 40 Simon St., Nashua, NH 03060. Circle 213											
eXodus for DOS	MS-DOS	80286, 80386, 80486	X11R4	Y/N	N	Y	N	TCP/IP, FTP	—/Motif, Open Look, HPVue, DECwindows	None	295
eXodus for Windows	MS-Windows 3.1	80286, 80386, 80486	X11R5	Y/Y	Y	Y	Y	TCP/IP, DECnet, serial	MS-Windows Program Manager/ all X-based window managers	Terminal emulation, file transfer	495
WRQ Inc., 1500 Dexter Avenue North, Seattle, WA 98109. Circle 214											
Reflection X version 4.1	MS-Windows	80386, 80486, Pentium	X11R5	Y/Y	Y	Y	N	TCP/IP, Winsock, DECnet, serial, SLIP, CSLIP, PPP	MS-Windows/all X-based window managers	Lpd/lpr, drag-and-drop FTP, FTP server, SNMP MIB II, VT320	469+
X Link Technology Inc., 1546 Centre Pointe Drive, Milpitas, CA 95035. Circle 215											
X KiR/Win	MS-Windows 3.1	80386, 80486, Pentium	X11R5	Y/Y	Y	N	Y	TCP/IP, FTP, Telnet SLIP, WinSock	MS-Windows/ all X-based window managers	None	125
X KiR/DOS	MS-DOS	80386, 80486, Pentium	X11R5	N/Y	Y	N	Y	TCP/IP, FTP, Telnet SLIP	—/all X-based window managers	None	155
X KiR/Link	MS-Windows 3.1	80386, 80486, Pentium	X11R5	Y/Y	Y	N	Y	TCP/IP, FTP, Telnet SLIP, WinSock	—/all X-based window managers	None	175
X KiR/NFS	MS-Windows 3.1	80386, 80486, Pentium	X11R5	Y/Y	Y	N	Y	TCP/IP, NFS, FTP, WinSock	MS-Windows/ all X-based window managers	None	199

X Myths

X is a collection of myths that have become so widespread that many of them are now accepted as fact.



Editor's note: These myths were excerpted from *The UNIX-HATERS Handbook*, by Simson L. Garfinkel, Daniel Weise and Steven Strassman, published by IDG Books Worldwide Inc. The myths are: X Demonstrates the Power of Client/Server Computing, X Makes UNIX "Easy to Use," X is "Customizable," X is "Portable," and X is Device-Independent. The last three myths are included here.

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Myth: X Is 'Customizable'

...And so is a molten blob of pig iron. But it's getting better; at least now you don't have to use your bare hands. Hewlett-Packard Co.'s Visual User Environment is so cutting-edge that it even has an icon you can click on to bring up the resource manager: It pops up a `vi` on your `.Xdefaults` file! Quite a labor-saving contraption, as long as you're omniscient enough to understand X defaults and archaic enough to use `vi`. The following message describes the awesome flexibility and unbounded freedom of expression that X defaults fail to provide.

Date: Fri, 22 Feb 91 08:17:14 -0800
From: beldar@mips.com (Gardner Cohen)

>I guess josh just sent you mail about .Xdefaults. I'm
>interested in the answer as well. How do X programs
>handle defaults? Do they all roll their own?

If they're Xt, they follow some semblance of standards, and you can walk the widget tree of a running application to find out what there is to modify. If they're not Xt, they can do anything they want. They can `XGetDefault`, which doesn't look at any class names and doesn't notice command line `-xrm` things.

Figuring out where a particular resource value is for a running application is much fun, as resources can come from any of the following (there is a specified order for this, which has changed from R2 to R3 to R4):

- Command line `-xrm 'thing.resource: value'`
- `xrdb`, which the user runs in `.xsession` or `.xinitrc`; this program runs `cpp` on the supplied file name argument, so any old junk may have been `#included` from another planet. Oh, and it `#defines` `COLOR` and a few other things as appropriate, so you better know what kind of display it's running on.

- File name, pointed to by `XENVIRONMENT`
- File name that's the class name of the application (usually completely nonintuitively generated: `XParty` for `xparty`, `Mwm` for `mwm`, `XRn` for `xrn`, etc.) in the directory `/usr/lib/X11/app-defaults` (or the directory pointed to by the `XAPPLRESDIR` environment variable). The default for this directory may have been changed by whoever built and installed the x libraries.

Or the truly inventive program may actively seek out and merge resource databases from other happy places. The Motif-ified `xrn` posted to the net recently had a retarded resource editor that drops modified resources in files in the current directory as well as in the user's home. On startup, it happily looks all over the place for amusing-looking file names to load, many of them starting with dots so they won't "bother" you when you list your files.

Or writers of WCL-based applications can load resource files that actually generate new widgets with names specified in those (or other) resource files.

What this means is that the smarter-than-the-average-

bear user who actually managed to figure out that

```
snot.@#&*@#$.stupid.widget.fontList: micro
```

is the resource to change the font in his `snot` application, could be unable to figure out where to put it. Joe sitting in the next cubicle over will say, "just put it in your `.Xdefaults`," but if Joe happens to have copied Fred's `.xsession`, he does an `xrdb.xresources`, so `.Xdefaults` never gets read. Joe either doesn't `xrdb`, or was told by someone once to `xrdb .Xdefaults`. He wonders why when he edits `.Xdefaults`, the changes don't happen until he "logs out," since he never reran `xrdb` to reload the resources. Oh, and when he uses the NCD from home, things act "different," and he doesn't know why. "It's just different sometimes."

Pat Clueless has figured out that `XAPPLRESDIR` is the way to go, as it allows separate files for each application. But Pat doesn't know what the class name for this thing is. Pat knows that the copy of the executable is called `snot`, but when Pat adds a file `Snot` or `Xsnot`, nothing happens. Pat has a man page that forgot to mention the application class name and always describes resources starting with `***`, which is no help.

Pat asks Gardner, who fires up `emacs` on the executable, and searches for (case-insensitive) `snot`, and finds a few `SNot` strings, and suggests that. It works, hooray. Gardner figures Pat can even use `SNot*fontList: micro` to change all the fonts in the application, but finds that a few widgets don't get that font for some reason.

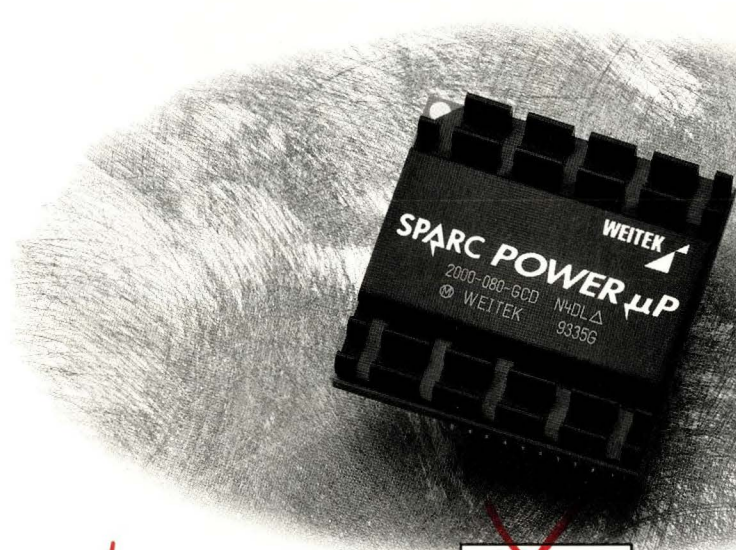
Someone points out that there is a line in Pat's `.xresources` (or was it a file that was `#included` in `.xresources`) of the form `*@#%&*@#*fontList: 10x22`, which he copied from Steve who quit last year, and, of course, that resource is "more specific" than Pat's, whatever that means, so it takes precedence. Sorry, Steve. You can't even remember what application that resource was supposed to change anymore. Too bad.

Sigh. It goes on and on. Try to explain to someone how to modify some behavior of the window manager, with having to re-`xrdb`, then select the window manager restart menu item (which most people don't have, because they copied the guy next door's `.mwmrc`), or logging out. Which file do I have to edit? `.mwmrc`? `Mwm`? `.Xdefaults`? `.xrdb`? `.xresources`? `.xsession`? `.xinitrc`? `.xinitrc.ncd`?

Why doesn't all this work the way I want? How come when I try to use the workstation sitting next to mine, some of the windows come up on my workstation? Why is it when I rlogin to another machine, I get these weird X messages and core dumps when I try to run this application? How do I turn this autoraising behavior off? I don't know where it came from, I just `#included` Bob's color scheme file, and everything went wrong, and I can't figure out why!

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Circle No. 31 on Inquiry Card

Myth: X Is 'Portable'

...And Iran-Contra wasn't arms for hostages. Even if you can get an X program to compile, there's no guarantee it'll work with your server. If an application requires an X extension that your server doesn't provide, then it fails. X applications can't extend the server themselves—the extension has to be compiled and linked into the server. Most interesting extensions actually require extensive modification and recompilation of the X server itself, a decidedly nontrivial task. The following message tells how much brain-searing, eye-popping fun compiling "portable" X server extensions can be:

Date: Wed, 4 Mar 92 02:53:53 PST
 X-Windows: Boy, Is my Butt Sore
 From: Jamie Zawinski [jwz@lucid.com]
 To: UNIX-HATERS
 Subject: X: or, How I Learned to Stop Worrying and Love the Bomb

Don't ever believe the installation instructions of an X server extension. Just don't; it's an utter waste of time. You may be thinking to yourself, "I'll just install this piece of code and recompile my X server and then X will be JUST A LITTLE BIT less MORONIC; it'll be EASY. I'll have worked around another STUPID MISDESIGN, and I'll be WINNING." Ha! Consider whether chewing on glass might have more of a payoff than what you're about to go through.

After four hours of pain, including such loveliness as a dozen directories in which you have to make a symlink called "X11" pointing at wherever the real X includes are, because the automatically generated makefiles are coming out with stuff like:

```
-l../../../../include
```

instead of:

```
-l../../../../include,
```

or, even better:

```
-l../../../../mit../../../../include
```

and then having to hand-hack these automatically generated makefiles anyway because some random preprocessor symbols weren't defined and are causing spurious "don't know how to make" errors, and then realizing that "makedepend," which you don't really care about running anyway, is getting errors because the extension's installation script made symlinks to directories instead of copies, and "." doesn't WORK with symlinks, and, and, and...

You'll finally realize that the only way to compile anything that's a basic part of X is to go to the top of the

tree, five levels higher than the executable that you actually want to generate, and say "make Everything." Then come back an hour later when it's done making the MAKEFILES to see if there were any actual COMPILATION problems.

And then you'll find yourself asking questions like, "why is it compiling that? I didn't change that. What's it DOING?"

And don't forget that you HAVE to compile ALL of PEX, even though none of it actually gets linked in to any executables that you'll ever run. This is for your OWN GOOD!

And then you'll realize what you did wrong, of course. You'll realize what you should have done ALL ALONG:

```
all::
    $(RM) -rf $(TOP)
```

But BE CAREFUL! That second line can't begin with a space.

On the whole, X extensions are a failure. The notable exception that proves the rule is the Shaped Window extension, which was specifically designed to implement round clocks and eyeballs. But most application writers just don't bother using proprietary extensions like Display PostScript, because X terminals and MIT servers don't support them. Many find it too much of a hassle to use more ubiquitous extensions like shared memory, double buffering or splines: They still don't work in many cases, so you have to be prepared to do without them. If you really don't need the extension, then why complicate your code with special cases? And most applications that do use extensions just assume they're supported and bomb if they're not.

The most that can be said about the lowest-common-denominator approach that X takes to graphics is that it levels the playing field, allowing incredibly stupid companies to jump on the bandwagon and sell obsolete junk that's just as unusable as high-end, brand-name workstations:

Date: Wed, 10 Apr 91 08:14:16 EDT
 From: Steve Strassmann <straz@media-lab.mit.edu>
 To: UNIX-HATERS
 Subject: the display from hell

My HP 9000/835 console has two 19-inch color monitors and some extremely expensive Turbo SRX graphics hardware to drive them. You'd think that I could simply tell X Windows that it has two displays, the left one and the right one, but that would be unthinkable simple. After all, if toys like the Macintosh can do this, UNIX has to make it much more difficult, to prove how advanced it is.

So what I really have is two display devices, `/dev/crt0` and `/dev/crt1`. No, sorry, I lied about that.

You see, the Turbo SRX display has a graphics plane (with 24 bits per pixel) and an overlay plane (with 4 bits per pixel). The overlay plane is for things like, well, window systems, which need things like cursors, and the graphics plane is to draw 3D graphics. So I really need four devices:

```
/dev/crt0    the graphics plane of the right monitor
/dev/crt1    the graphics plane of the left monitor
/dev/ocrt0   the overlay plane of the right monitor
/dev/ocrt1   the overlay plane of the left monitor
```

No, sorry, I lied about that.

`/dev/ocrt0` only gives you three out of the four overlay bits. The fourth bit is reserved exclusively for the private use of federal emergency relief teams in case of a national outbreak of Pixel Rot. If you want to live dangerously and under threat of FBI investigation, you can use `/dev/o4crt0` and `/dev/o4crt1` in order to really draw on the overlay planes. So, all you have to do is tell X Window to use these o4 overlays, and you can draw graphics on the graphics plane.

No, sorry, I lied about that.

X will not run in these 4-bit overlay planes. This is because I'm using Motif, which is so sophisticated it forces you to put a 1" thick border around each window in case your mouse is so worthless you can't hit anything you aim at, so you need widgets designed from the same style manual as the runway at Moscow International Airport. My program has a browser that actually uses different colors to distinguish different kinds of nodes. Unlike an IBM PC Jr., however, this workstation with \$150,000 worth of 28-bits-per-pixel supercharged display hardware cannot display more than 16 colors at a time. If you're using the Motif self-abuse kit, asking for the 17th color causes your program to crash horribly.

So, thinks I to myself cleverly, I shall run X Window on the graphics plane. This means X will not use the overlay planes, which have special hardware for cursors. This also means I cannot use the super cool 3D graphics hardware either, because in order to draw a cube, I would have to "steal" the frame buffer from X, which is surly and uncooperative about that sort of thing.

What it does give me, however, is a unique pleasure. The overlay plane is used for `/dev/console`, which means all console messages get printed in 10-point Troglodyte Bold, superimposed in white over whatever else is on my screen, like for example, a demo that I may happen to be giving at the time. Every time anyone in the lab prints to the printer attached to my machine, or NFS wets its pants with a timeout, or some file server threatens to go down in

only three hours for scheduled maintenance, another message comes onto my screen like a court reporter with Tourette's Syndrome. The usual X commands for refreshing the screen are helpless to remove this incontinence, because X has no access to the overlay planes. I had to write a program in C to be invoked from some xterm window that does nothing but wipe up after the mess on the overlay planes.

My super 3D graphics, then, runs only on `/dev/crt1`, and X Window runs only on `/dev/crt0`. Of course, this means I cannot move my mouse over to the 3D graphics display, but as the HP technical support person said, "Why would you ever need to point to something that you've drawn in 3D?"

Myth: X Is Device-Independent

X is extremely device-dependent because all X graphics are specified in pixel coordinates. Graphics drawn on different resolution screens come out at different sizes, so you have to scale all the coordinates yourself if you want to draw at a certain size. Not all screens even have square pixels: Unless you don't mind rectangular squares and oval circles, you also have to adjust all coordinates according to the pixel aspect ratio.

A task as simple as filling and stroking shapes is quite complicated because of X's bizarre pixel-oriented imaging rules. When you fill a 10-by-10 square with `XFillRectangle`, it fills the 100 pixels you expect. But you get extra "bonus pixels" when you pass the same arguments to `XDrawRectangle`, because it actually draws an 11x11 square, hanging out one pixel below and to the right! If you find this hard to believe, look it up in the X manual yourself: Volume 1, Section 6.1.4. The manual patronizingly explains how easy it is to add 1 to the x and y position of the filled rectangle, while subtracting 1 from the width and height to compensate, so it fits neatly inside the outline. Then it points out that "in the case of arcs, however, this is a much more difficult proposition (probably impossible in a portable fashion)." This means that portably filling and stroking an arbitrarily scaled arc without overlapping or leaving gaps is an intractable problem when using the X Window System. Think about that. You can't even draw a proper rectangle with a thick outline, since the line width is specified in unscaled pixel units, so if your display has rectangular pixels, the vertical and horizontal lines will have different thicknesses even though you scaled the rectangle corner coordinates to compensate for the aspect ratio.

The color situation is a total flying circus. The X approach to device independence is to treat everything like a MicroVAX framebuffer on acid. A truly portable X application is required to act like the persistent customer in Monty Python's "Cheese Shop" sketch, or a grail seeker in "Monty Python and the Holy Grail." Even the simplest applications must answer many difficult questions (see Figure 1).

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Circle No. 27 on Inquiry Card

Server: *What is your Display?***Client:** `display = XOpenDisplay("unix:0");`**Server:** *What is your Root?***Client:** `root =``RootWindow(display, DefaultScreen(display));`**Server:** *And what is your Window?***Client:** `win = XCreateSimpleWindow(display, root, 0, 0, 256, 256, 1, BlackPixel(display, DefaultScreen(display)), WhitePixel(display, DefaultScreen(display)));`**Server:** *Oh all right, you can go on.***(Client passes)****Server:** *What is your Display?***Client:** `display = XOpenDisplay("unix:0");`**Server:** *What is your Colormap?***Client:** `cmap = DefaultColormap(display, DefaultScreen(display));`**Server:** *And what is your favorite color?***Client:** `favorite_color = 0; /* Black. */``/* Whoops! No, I mean: */``favorite_color = BlackPixel(display, DefaultScreen(display));`**Client:** `/* AAAAYYYYYEEEEEE!!! */``(client dumps core and falls into the chasm)`**Server:** *What is your display?***Client:** `display = XOpenDisplay("unix:0");`**Server:** *What is your visual?***Client:** `struct XVisualInfo vinfo;
if (XMatchVisualInfo(display, DefaultScreen(display), 8, PseudoColor, &vinfo) != 0)
visual = vinfo.visual;`**Server:** *And what is the net speed velocity of an XConfigureWindow request?***Client:** `/* Is that a SubStructureRedirectMask or * a ResizeRedirectMask? */`**Server:** *What?! How am I supposed to know that?*`Aaaaauuggghhh!!!!``(server dumps core and falls into the chasm)`

Figure 1. Just understanding the X server's questions can be a trying experience.

On the Road to Nowhere

X is just so stupid. Why do people use it? Beats us. Maybe it's because they don't have a choice.

Nobody really wants to run X; what they do want is a way to run several applications at the same time using a large screen. If you want to run UNIX, it's either X or a dumb character-based terminal.

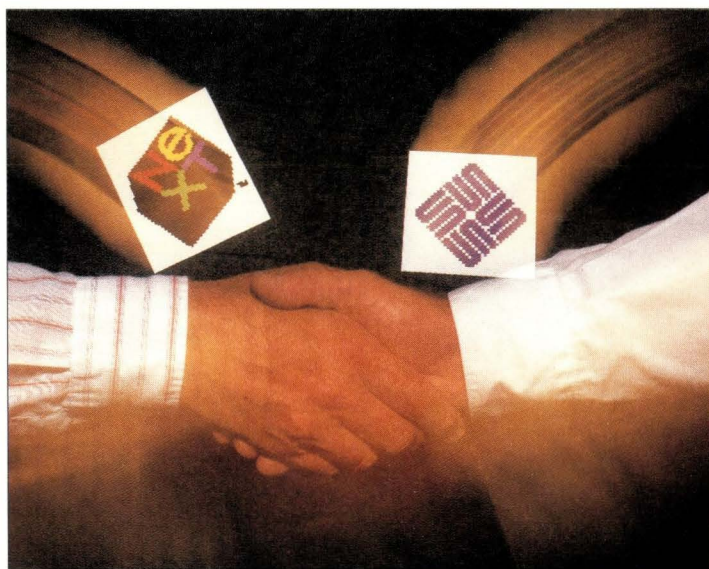
Pick your poison. ➡

In Steps OpenStep

This April, the Solaris software community got to taste the first fruits of Sun's collaboration with NeXT Computer Inc. The product: SunSoft's OpenStep Developer Starter Kit, a \$3,995 box containing everything that Solaris developers need to get started writing their very first OpenStep program.

Inside the Starter Kit are two CD-ROMs containing an object-oriented operating system that installs on almost any industry-standard computer equipped with an Intel Corp. 486 or Pentium processor. It includes a working version of the UNIX operating system; a compiler for C, C++ and Objective-C (the OpenStep object-oriented language of choice); a preliminary implementation of the OpenStep libraries; and a manual that tells the programmer which parts of the API will be in the final OpenStep system and which are going away.

NeXTers and developers who have experience with NeXT Computer's own object-oriented operating system will probably feel right at home with the OpenStep Starter Kit: The software is an exact copy of NeXT's NextStep 3.2 User (\$795) and Developer (\$2,995) packages. That's not terribly surprising. Sun's stated goal in teaming up with NeXT is to take the best parts of NeXT's object-oriented development environment, work with NeXT to turn it into an industrywide standard called "OpenStep," and put an implementation of that standard in Sun's upcoming Distributed Object Environment. Since DOE 1.0 won't ship until early next year, the Starter Kit lets Sun's developers get a head start by getting started with NextStep today.



If Sun deploys a NextStep workalike in DOE or future versions of Solaris, the OpenStep Starter Kit should steer you in the right direction.

BRIAN MALLOY

by **SIMSON L. GARFINKEL**, Senior Editor

"What Sun is doing is very smart," says Gregory Anderson, president of Anderson Financial Systems, which makes custom-built trading systems for some of Wall Street's largest companies. "Sun is saying 'We intend to deploy something that is plug-compatible with NextStep. Here is the Intel version. If you get familiar with how this development environment works on Intel, you won't be surprised when OpenStep goes on Solaris.'"

It's important for Sun to get its customers excited now, says Anderson, because object-oriented systems like NextStep have steep learning curves. "For a lot of companies, the first object-oriented project actually takes longer, because you've actually got training costs." It's only after companies start building their

second or third project that they see a significant speedup in their programmers' productivity, Anderson says.

Helping to eliminate those surprises is the Starter Kit's short manual, enti-

Join the DOE Beta Program

SunSoft plans to start a beta release program this fall to give developers early access to the DOE beta release. People interested in joining the beta program should contact Sun by electronic mail. The email address to use is doe-beta-request@sun.com.

itled "Developing OpenStep Applications Using NextStep 3.2." In the absence of a finalized OpenStep specification (which both companies promised to have ready by June 30, 1994), the manual tells developers

which kinds of NextStep's currently supported calls will be supported in the final OpenStep environment, and which should be avoided. Generally speaking, functions that depend upon NextStep's Mach kernel (such as Mach messaging or memory management) are out, as are parts of the API oriented toward NeXT's hardware (such as functions for sound, MIDI and three-dimensional animations with Pixar's RenderMan). By reading and rigorously following the advice given in the manual's pages, programmers can be sure that the object-oriented systems they develop today will easily port to DOE 1.0 when it finally ships.

So why does the OpenStep Starter Kit cost \$205 more than the identical software when purchased from NeXT?

Backgrounding Jobs

When Steve Jobs started NeXT Inc., after being forced out of Apple Computer Inc., his vision was to strike gold once again and create the third desktop computer that would be used in the business and educational worlds. A grandiose vision for some, perhaps, but probably not for Jobs, who had already inaugurated the microcomputer revolution by giving the world the Apple II, and then created "the computer for the rest of us" by overseeing the creation of the Apple Macintosh. The NeXT Cube was supposed to be the "next big thing": an interpersonal computer for the networked '80s.

In the years following the Cube's 1988 introduction, Jobs had considerable trouble getting the rest of America to agree with him. Initially, he aimed the NeXTcube at the academic market, but the computer's black magnesium case, optical drive and 68030-based processor were too expensive to compete with Macs and PCs and too slow to displace engineering workstations. At the time, the computer's most important quality—its object-oriented operating system—went largely ignored by the media and the computer industry at large.

Because NeXT was wed to Motorola Inc.'s 68000-family processors, the company had to wait two years to overcome its speed problem. Yet even after the introduction of NeXTstations powered by the 25-MHz 68040, NeXT found that it couldn't live down the reputation of selling computers that were slow and expensive.

Adding to the company's problems was a classic chicken-and-egg problem: Few people wanted to purchase the NeXT computers because there was little software available, and few developers wanted to write programs for the systems because so few of the computers had been sold. Over the following three years, NeXT hopped from market to market, hoping to gain a foothold. It tried desktop publishing, then government, then health care and finance. Through it all, the lack of mainstream productivity

applications such as word processors and spreadsheets was a constant handicap.

The one place where the dearth of shrink-wrapped applications wasn't a deal killer, it turned out, was Wall Street, where NeXT's customers were using the computer's object-oriented application framework to develop their own client/server systems. "You can't go to Egghead software and buy a shrink-wrapped package to run your investment house," said Jobs in countless presentations. Finally, NeXT had found its niche.

But companies were hesitant to plunk down the money for NeXT's proprietary hardware. Finally, NeXT decided to bite the bullet. In May 1992, NeXT announced that it was following Sun and porting its workstation operating system to the so-called "industry-standard" Intel Corp./IBM PC architecture. Making the software available on the Intel platform, NeXT reasoned, would make people less fearful of purchasing the black hardware.

From the beginning, NeXT planned to support both the Motorola and Intel architectures. For example, NeXT modified its operating system so that executable code for both Motorola and Intel processors could be included in a single executable file. Likewise, engineers modified NeXT's UNIX file system so that hard disks could be freely moved back and forth between Motorola- and Intel-based systems.

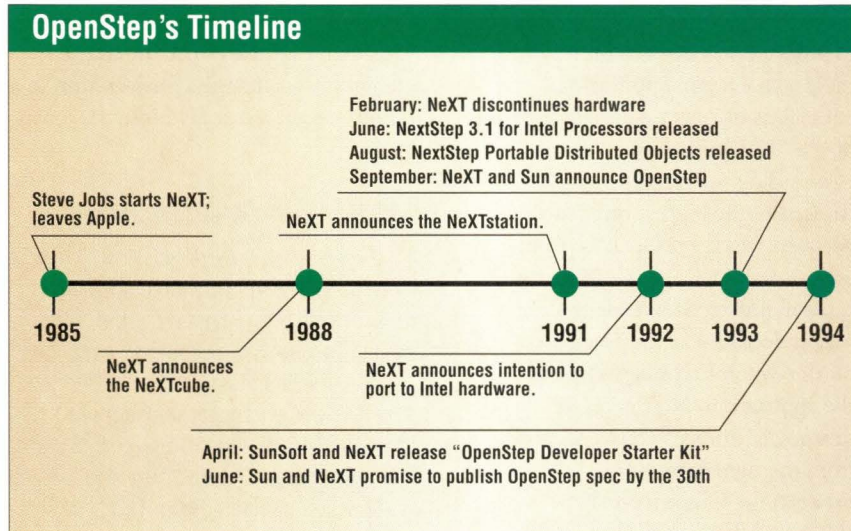
But hardware sales remained moribund. In January 1993, Jobs decided to shut down NeXT's factory and make NeXT a software-only company. The date for the shutdown was set for May 1994, when the NextStep for Intel Processors was to be formally released at the company's trade show. But within a month, the news had leaked to the press, forcing Job's hand. With the public acknowledgment that the hardware line was doomed, hardware sales were sure to drop like a stone. Three months before the Intel product was ready, Steve Jobs abandoned his black workstations and fired half the company.

Because “you get the manual!” quips Jim Green, SunSoft’s director of object products.

On a more serious note, Green says, “I think that the difference in pricing is an artifact” of bundling the software together and looking for a conventional price point. Indeed, until the differences between the NeXT and Sun prices were brought to Green’s attention, he had been under the impression that both companies were charging the same price for the same product. “We’re within 10%. In fact, we are within 5% or so, so it is essentially the same,” he says.

The minor confusion over the Starter Kit’s pricing is indicative of the hectic pace with which Sun is incorporating NeXT’s technology into the Solaris environment. Everything is in a topsy-turvy state. For example, even though Bud Tribble, SunSoft’s vice president for object products, outlined the Solaris road map in his address at the Solaris Developer’s Conference in April, the company has not made fundamental decisions about which part of the NextStep operating system will be included in the OpenStep system it plans to have on the market in less than 12 months.

Likewise, says Green, “We have not determined packaging, pricing...or



bundling options” for the DOE system. Another question that has yet to be answered is whether Sun will bundle DOE into Solaris or sell the object-based system as an option. “What we do know is that we will be producing a product called DOE 1.0, [and] we will find some way of getting it to the customers.” More important, Sun also has a clear idea of who DOE’s target customers are likely to be: organizations with active in-house development efforts that are building large-scale distributed applications, a market that NeXT took four years to discover (see “Backgrounding Jobs”).

Sun won’t use DOE to replace its plans for a Common Desktop Environment (CDE), says Green. Instead, Solaris will offer developers both environments. CDE will remain the environment of choice for companies engaged in multiplatform development, whereas DOE will let developers exploit the object-oriented paradigm.

But the stakes for DOE could be much higher than merely the future of in-house software development. If DOE becomes popular, it could pave the way toward fundamental changes in the way that almost every UNIX application is designed and developed.

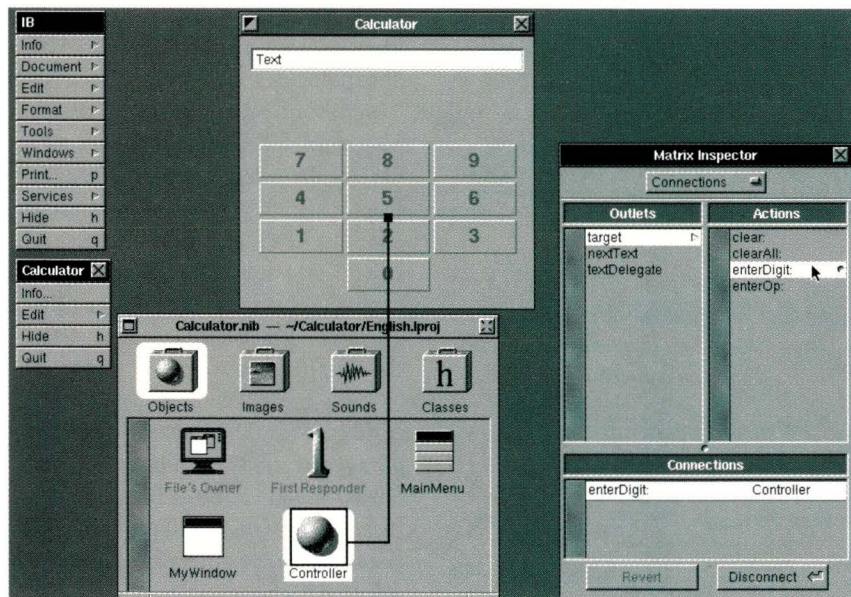
DOE, a Dear?

With DOE, Sun is taking the object-oriented frosting from NeXT’s embattled NextStep operating system and bringing it to another operating system that has also been less than enthusiastically received: Solaris 2.X. Nevertheless, Sun is sure that by the time DOE is available in early 1995, Solaris will be widely accepted by Sun’s customer base.

Sources close to Sun say that the job of porting NeXT’s Application Kit from NeXT’s Mach-based Berkeley 4.3 UNIX system is going much easier than had been anticipated. Already, Jim Green is putting together a beta release program for developers who want to get early access to the software (see Join the DOE Beta Program).

According to SunSoft’s Tribble, DOE will ship with a distributed object debugger, a visual application builder and

With NextStep’s Interface Builder, developers can build graphical user interfaces simply by drawing lines to connect objects. Interface Builder, or something like it, will almost certainly be part of DOE 1.0 when it ships early next year.



more than 200 snap-together objects that developers can use for building their own custom applications.

It's these objects that are at the heart of the DOE's strategy.

According to Gregory Anderson, the biggest difference between NextStep/OpenStep and other development environments is the ability to write code that makes decisions at runtime based on the dynamic configuration of the application. NextStep gets this power from Objective-C, and from the tight integration between the Objective-C language and the NeXT Application Kit. Because messages are resolved at runtime (using a mechanism that is analogous to C++'s "virtual" functions), it is easier to eliminate dependencies among different parts of

an application program. With NextStep, for example, a user interface designer can change a push-button to a slider, or put a text field into a scroller,

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without changing a single line of code in the application program.

"We've actually identified two savings," says Anderson. "One is in the

amount of time to get the project done. The other is that our training times have dropped dramatically—from three months to a month. The programmers don't need as much application-specific knowledge in order to get productive work done," because the object-oriented design does a better job of compartmentalization.

These advantages can help out third-party software developers as well. Many applications currently for sale on the NextStep platform were developed by two or three people in six months or less. Developers create these programs by creating their own object libraries, then tying these libraries together with the objects that are provided as part of the NextStep environment.

Many commercially available programs for NextStep come with documented application program interfaces (APIs) that let the customer use them as the basis for their own in-house programs. For example, Mesa, a NextStep spreadsheet sold by Athena Design in Brookline, MA, comes with an object library that has been used as the basis for real-time stockmarket feeds and sophisticated financial analysis packages, which are incorporated into the Mesa spreadsheet through an object-oriented AddIn feature.

Other companies in the NextStep marketplace sell standalone object libraries. New York-based Objective Technologies Inc. sells four different "palettes" of NextStep objects that plug into NeXT's Interface Builder. One of the palettes is SmartFields Palette, which gives developers validated input fields; another is Graph Palette, which lets developers drag and drop a sophisticated PostScript-producing graph object right into their own applications.

Nearly every NextStep developer contacted for this article was eager to port applications from NextStep to Solaris as soon as DOE is available, meaning that there will probably be a large number of object kits and object-oriented application programs ship-

Parts of OpenStep Desktop

As of press time, Sun had yet to formalize the individual parts of DOE 1.0. It will probably be based on the following Sun and NeXT technologies:

Application Kit

This kit forms the basis of NextStep's object-oriented framework. It includes Objective-C classes that allow programs to create user interface objects such as windows, scrollers and buttons, communicate with the window manager, and manipulate the pasteboard.

Database Kit

This kit gives OpenStep programs a single object-oriented framework for accessing information stored in many different kinds of database systems.

Display PostScript

OpenStep will use Adobe's Display PostScript (already a part of Solaris) as a device-independent imaging model for both displaying information on the screen and printing.

OMG CORBA

DOE 1.0 will use the Object Management Group's Common Object Request Broker Architecture as a means of communicating between object-oriented applications running on one, two or more computers.

Objective-C

Currently, OpenStep's language of choice is Objective-C, an object-oriented version of the C programming language that includes a dynamic runtime system and a rich class library, although work is under way to allow the Objective-C objects to be called from C++.

Unlike C++, Objective-C allows dynamic loading of classes, allows messages to be sent to class objects themselves (in addition to merely sending objects to instances of classes), and allows messages to be dynamically created and sent at runtime. NextStep currently uses Version 2.2 of the Free Software Foundation's GNU C Compiler for C, C++ and Objective-C.

ping within a few weeks of DOE 1.0's initial release.

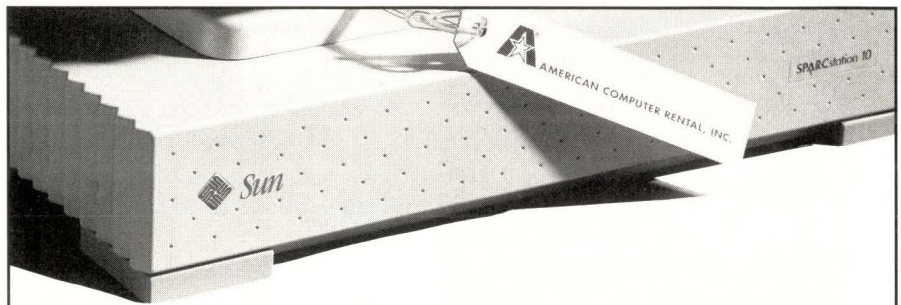
"We are very interested and we think that it is going to be a very big market," says Eric Bergson, managing director for Objective Technology, a New York-based firm that sells applications and object libraries for NextStep. "Our expectation is that the marketplace is going to be similar to NeXT's current market: large-scale, mission-critical application development and custom software. I think that our whole product line will be applicable."

Customers are also pleased with the OpenStep direction. That's because, despite the fact that it is relatively easy to develop a NextStep application, NeXT could never claim more than a few dozen shipping applications at any time: the number of computers sold simply could not support a large third-party market. Solaris, on the other hand, will still be able to run DOE programs, Common Desktop Environment (CDE) programs and Windows programs (with Wabi).

"The advantage of OpenStep will be to have all of these off-the-shelf applications that you can buy and be able to run on the same computer as the custom apps you build yourself," says John Bruns, vice president of technology at NationsBanc-CRT in Chicago, a NextStep customer. "I think that it is absolutely the right way to go."

Currently, though, Bruns is just watching, since NationsBanc has Hewlett-Packard Co. workstations but no Suns. "At HP, they are holding their breath right now and saying that this is a bigger job than Sun and NeXT think," says Bruns. "If Sun actually has it, and HP doesn't, HP is putting itself at a big disadvantage. There are very few things that would cause us to jump ship and go with Sun, but if [DOE] is something that we could [use] to meet our business needs... I'm not sure that we would give up our HP stuff, but all of a sudden we might become 'open,' and then they would be fighting for their contracts."

Indeed, that's just what Sun is hoping for. ->



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In The Works

SEPTEMBER

Downsizing: A MidWare Crisis

If Sun workstations are part of your rightsizing hardware strategy, where can you turn for the middleware to enable peer-to-peer networks, or help integrate legacy systems?

BONUS DISTRIBUTION: UNIX Expo, New York

OCTOBER

The Network Organizers: Terminal & Communication Servers

Whether network planners are cleaning up a wiring plant, sharing peripherals, segmenting a network, or providing remote access, they need to keep the plan simple and the workstations and terminal accessible.

NOVEMBER

SPARClikes and Solaris on X86

In an already lackluster market, the advent of Intel-based Solaris may be the last straw for many SPARClike vendors. But some are taking an if-you-can't-beat-em attitude and announcing 486 and Pentium systems that offer appealing price/performance.

BONUS DISTRIBUTION: Comdex/Fall, Las Vegas

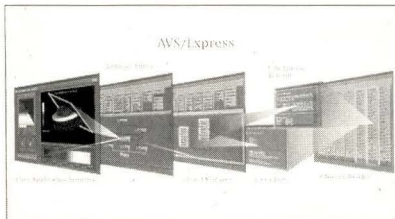
SURVEY: Solaris on Intel Systems

NEW PRODUCTS

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

AVS Shows Express

Advanced Visual Systems (AVS) has announced AVS/Express, a multiplatform application development environment for coding technical applications. AVS/Express combines aspects



of AVS' graphics technology with various application development tools. The latter include, for example, a Network Editor, which displays an application's structure in a flow chart

to give developers quick insight into the various components of the application. AVS/Express also contains libraries of objects for user interfaces, graphics, imaging and visualization functions.

In addition, the product contains various kits that can be used to produce applications or application prototypes rapidly. Some of the kits offered cover data visualization, imaging and graphics display. AVS/Express is available on Sun workstations, as well as systems from Digital Equipment Corp., Hewlett-Packard Co., IBM Corp. and Silicon Graphics Inc. Pricing begins at \$18,000.

Advanced Visual Systems Inc.
300 Fifth Ave.
Waltham, MA 02154
Circle 101

CNT Provides SCSI-Mainframe Link

Have a client/server architecture but want to take advantage of the mainframe and its storage peripherals? Computer Network Technology may have an answer. The company has announced a version of its Channelink

product that connects SCSI devices with mainframe tape systems. The Channelink SCSI Gateway accepts commands and data from a SCSI host then converts them to Channel Command Words (CCWs) consistent with IBM Model 3480/3490 tape drives. The product then presents these CCWs to the IBM tape controller via the company's FIPS-60 channel. Data and instructions can come back the other way via the same process in reverse.

Pricing on the Channelink SCSI gateway begins at \$35,500 for a single SCSI channel to a single FIPS-60 channel gateway configuration.

Computer Network Technology Corp.
605 N. Highway 169, Suite 800
Minneapolis, MN 55441
Circle 102

Auspex Shows Seven Models

In what amounts to a major overhaul of its product line, Auspex Systems has introduced seven new UNIX network file servers. Like the company's other products, the NS 7000 NetServer machines provide increased NFS file-

E&S Unwraps CDRS 6

The Design Software Group of graphics technology vendor Evans & Sutherland has introduced Version 6 of its Conceptual Design and Rendering Software (CDRS). This is a modeling program that is particularly useful to designers because it produces representations of objects that are not only graphically appealing but also mathematically correct, or, as the company puts it, "surfaces remain attached and continuous as a form is created and modified." Translated, this means that CDRS can import data from or export it to a variety of CAD systems that link, in turn, directly to manufacturing facilities.

The new version of CDRS extends users' control over complex curves and surfaces. It also offers bump-mapping, a process by which the



user can add texture to an object. Pricing begins at \$18,000.

Evans & Sutherland Computer Corp.
Design Software Group
580 Arapeen Drive
Salt Lake City, UT 84108
Circle 100

server performance within networks. The 7000s, however, provide a number of new features. All, for instance, have offloaded networking tasks to a dual-CPU SPARC-based network processor board. Each also has a hyper-SPARC host processor.

In addition, the NS 7000s provide new entry-level and high-end points for the line. At the low end, they include the NS 700 Series 200, with three machines, ranging in capacity from 1.75 GB to 61 GB of disk storage. The 200 machines can support up to 12 Ethernet and up to four FDDI or MLT connections.

Pricing on the entry-level systems begins with Model 200, with a price of "under \$65,000." The Model 210 provides the base unit and one expansion cabinet at \$73,000. The Model 220 has a base unit and two expansion cabinets at \$80,000. System software for the 200 series is an additional \$15,000.

There are four models in the high-end 500 series. The series supports six to 24 Ethernets, 64 to 640 MB of cache memory, one to 60 SCSI drives and has a disk capacity of 3 to 180

GB. The base Model 500 is \$115,000; the Model 502 comes with a base unit and redundant power supplies for \$140,00; the Model 510 comes with the base unit and one expansion cabinet for \$145,000; and the Model 512 has a base and expansion cabinet with redundant power supplies for \$190,000. System software is \$27,500.

Auspex Systems
5200 Great America Parkway
Santa Clara, CA 95054
Circle 103

HP/SSS Windowing Terminal

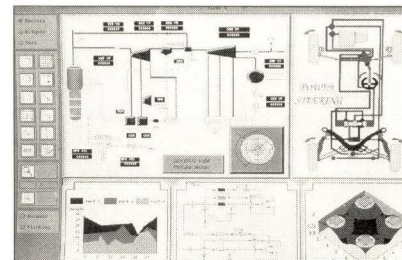
Hewlett-Packard Co. and Structured Software Solutions (SSSI) have jointly announced the HP 700/70 windowing terminal. The ANSI product combines features of traditional ASCII terminals with those of more expensive windowing displays. It is compatible with both ASCII applications and those written for Alpha Windows terminals. (Alpha Windows terminals are displays that conform to the Alpha standard developed by character terminal vendors to bring windowing to their products.)

The machines come bundled with SSSI's FacetTerm windowing software. It connects to Sun workstations and servers, as well as other UNIX systems, via serial line. It comes with a 14-inch monochrome display, a keyboard, a user's manual and a power cord. There is also an optional mouse. Pricing begins at \$499.

Structured Software Solutions Inc.
4031 W. Plano Parkway, Suite 205
Plano, TX 75093
Circle 104

LOOX for Graphics

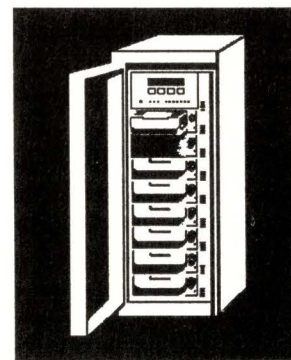
LOOX Software has introduced Version 2.1 of its LOOX graphics development tool. LOOX, which was announced in January, is a GUI



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- * Driverless *RAID* (no CPU overhead), Supports *RAID* levels 0, 3 and 5
- * Hot Swap Power Supplies with power sharing and Removable Fans
- * Multi-platforms: *Sun, DEC, HP, IBM, SGI, and PC (DOS, OS/2, NT, Novell)*



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Fax: 713/552-0550

development tool kit that produces easy-to-use and understand interfaces that run on top of Motif and X Window System environments. However, the company says that LOOX goes beyond traditional GUI builders in that it also supports interactive animated graphics. With it, developers can draw or import diagrams, pictures, graphics, etc., which then become active parts of an application.

There are two parts to LOOX. First is LOOXMaker, which is an interactive graphics editor and vector-based drawing program. It comes with its own library of graphics objects and supports scanned images and objects from other sources. The second part of the product is LOOXlib, a vector-based C function library with 200-plus functions.

LOOX Version 2.1 features enhancements such as a Component Editor, which allows users to create portable graphics components. It also has a variety of sample and demonstration programs to help programmers develop their own applications.

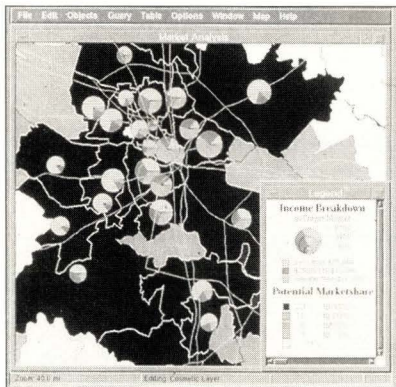
LOOX supports OSF/Motif on SunOS 4.1 or Solaris 2.3. Pricing begins at \$9,950.

LOOX Software Inc.

151 S. Bernardo Ave., Suite 45
Sunnyvale, CA 94086
Circle 105

MapInfo Enhanced

MapInfo, the geographic information system (GIS) and database product, has been significantly enhanced and re-released by its creator, MapInfo.



Version 3.0 contains several new data-visualization features such as support for raster images underlying the product's vector-based maps and enhance-

ments for "thematic maps," that is, maps that represent associations among multiple variables. In addition, Version 3.0 has new polygon operations and a variety of new editing functions.

One of MapInfo's traditional strengths is that it is not just a GIS product; it also provides links to RDBMSs. Version 3.0 carries that theme further with an SQL Datalink that connects Oracle and Sybase databases.

MapInfo also has a new language—MapBasic 3.0. With MapBasic, ISVs and other developers can construct customized maps for unique applications or for resale into vertical markets.

Pricing on MapInfo for UNIX begins at \$2,495. MapBasic sells for \$1,595, and SQL DataLink costs \$1,195.

MapInfo Corp.

1 Global View
Troy, NY 12180-8399
Circle 106

Graphical Multiprocessor Language

A graphical programming environment for multiprocessor and distributed systems has been introduced by Dynetics. Called DataFlo MP, the product allows users to create applications by connecting icons to build up a block diagram. DataFlo comes with a library of more than 250 icons, performing signal processing and data processing tasks.

Users can add their own functions and icons to the library by simply writing them in C. The product also supports self-documentation and rapid debugging. DataFlo is available on Solaris as well as other UNIX systems. Pricing begins at \$4,800 for a single-seat license.

Dynetics Inc.

P.O. Drawer B
Huntsville, AL 35814-5050
Circle 107

Secure Database Tool

A tool that identifies security vulnerabilities and secures database passwords has been introduced by BrainTree Technology. The company says the product, called SQL<>Secure, defines and implements a database security policy. Its components include

the Password Client, which allows a user to change his or her own password. It also checks passwords for "guessability" and rejects those it deems too simple.

There is also a Password Server that controls password verification and changes. It communicates with the Password Client to determine whether proposed passwords are too short, match old passwords, match user names and so on. Finally, there is a Password Checker, which scans existing passwords for those that might be insecure or illegally changed.

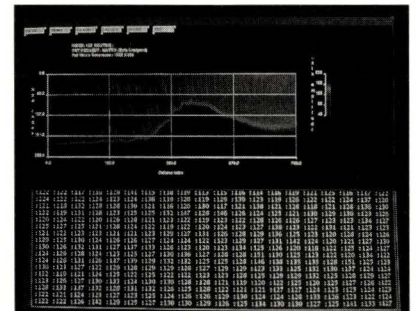
SQL<>Secure is available on UNIX and OpenVMS systems servers and both UNIX and Windows clients. Pricing begins at \$7,500.

BrainTree Technology Inc.

62 Accord Park Drive
Norwell, MA 02061-1606
Circle 108

Graphics Data Debugger

CST Images has introduced a tool that allows developers to embed programs with debugging tools and display the results on remote X11



graphics displays. Called the Data Debugging Toolset (DDT), the product provides a series of nongraphic, logic-based debugging controls that can be inserted into C and FORTRAN code at key points to view data or check for algorithm verification. These routines then generate X11 displays with which the user or developer can view program data results on a SPARC-based host or an X terminal driven by such a host.

The company says that DDT has been developed to analyze applications in such areas as data processing, signal processing, data acquisition and other scientific and technical areas. It works

with source-level debuggers. Prices begin at \$499 per library.

CST Images
5055 Viewridge Ave.
San Diego, CA 92123
Circle 109

Controlling RAID

The RUAC iX is RaidTec's host-independent SCSI RAID controller. The controller supports disk striping, mirroring, mirroring with striping, three-channel striping with parity and five-channel striping with parity modes. It is packaged in a desktop or rack-mount enclosure.

RUAC iX supports most systems that have a SCSI or SCSI II interface, including Intel Corp.-based computers, Apple Computer Inc. Macintoshes, IBM Corp. RS/6000s, Sun SPARC, Hewlett-Packard Co. HP 9000s and more. Operating systems supported include Novell Inc. NetWare, UNIX SVR4, IBM Corp. AIX, Sun Solaris and others.

The unit provides six SCSI channels, one to the host and five to the drives. Each drive channel can support up to

seven drives, meaning a maximum of 35 drives may be attached to one controller. The price is \$2,795.

RaidTec Corp.
105 Hembree Park Drive, Suite C
Roswell, GA 30076
Circle 110

LCD Projection Panels

Two LCD projection panels have been introduced by In Focus Systems. The PanelBook 750 and the PowerView 950 connect to a workstation and display 1,024-by-768 images



on a screen. The company says that the two models can be used in such applications as business presentations and training.

The PowerView uses a 10.4-inch active-matrix LCD to project more than 1.4 million colors simultaneously with 1,024-by-768 resolution. It has built-in video compatibility with NTSC, PAL and SECAM. It weighs six pounds and measures 13 by 2 by 15 inches. Pricing is \$13,999.

The PanelBook 750, meanwhile, weighs 5½ pounds and measures 9½ by 2 by 11½ inches. It can display 24,000 colors at 1,024-by-768 resolution. The company says the product would fit into a briefcase. Pricing begins at \$7,499.

In Focus Systems Inc.
7770 SW Mohawk St.
Tualatin, OR 97062
Circle 111

Client/Server Backup Software

Advanced Software Concepts has released NetArchive-Distributed Network Backup, an enterprisewide backup and recovery system using distributed client/server technology. NetArchive-DNB allows data to be securely backed up from any or all

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Santa Clara, CA 95054
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Circle No. 9 on Inquiry Card

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London, N7 8DF, U.K. Fax: (071)-226-2015

Circle No. 11 on Inquiry Card

computers within a network and stored in one central storage device or server devices distributed throughout the network. A Motif-based user interface or command line provides for easy recovery of data.

Backup files are directed to storage devices that are managed by NetArchive-Storage Vault Manager software. Backups can run manually or automatically. Auto backups are managed through configuration files and modified by a network administrator. DNB may be integrated with NetArchive DHSM, a distributed hierarchical storage management system.

NetArchive products are available for SunOS 4.1.X, Solaris 2.3, HP-UX 9.0 and Domain/OS SR10.4.

The price is \$2,000 for a single client license, plus \$3,000 for a minimum

NetArchive-Storage Vault Manager license.

Advanced Software Concepts
2430 Vineyard Ave., Suite 101
Escondido, CA 92029
Circle 112

TGX-based Accelerator Boards

Vigra has introduced a set of SBus boards that provide fast windowing and accelerate 2D/3D vector rendering for Sun and SPARClike workstations. The TiGriX and TiGriX LCD SBus boards are single-slot SBus frame buffers that support 8-bit color graphics. Both are based on the Turbo GX processor from Sun.

The machines support resolutions from 1,024-by-768 to 1,920-by-1,080, and they can switch select non-

standard Sun monitors. The TiGriX LCD supports the Sharp TFT color active matrix flat-panel display at a resolution of 1,024-by-768. In terms of vector performance, the machines offer 1.6 million vectors per second in 2D mode and 440,000 vectors per second in 3D mode. Pricing begins at \$2,250.

Vigra Inc.
6044A Cornerstone Court
San Diego, CA 92121
Circle 113

TCP/IP for Windows

WRQ has entered the TCP/IP for Windows market with a cooperative virtual device drivers/dynamic link libraries implementation of a TCP/IP stack. WRQ's new Reflection Network Series for Windows includes a set of

Upgrades, Enhancements, Additions...

- Artecon has announced a 48-volt version of its Sphinx rack-mount enclosure. Sphinx can hold a SPARCstation and more than 12 GB of disk. The 48-volt version is meant for central office environments. **Artecon Inc.**, P.O. Box 9000, Carlsbad, CA 92018-9000. **Circle 114**

- Cadre has added support for object-oriented programming to its ObjectTeam and Teamwork tool suites. **Cadre Technologies Inc.**, 222 Richmond St., Providence, RI 02903. **Circle 115**

- Megatek has a new release of software for its Esprix graphics accelerator for the Sun. The Esprix board is an 8-bit graphics accelerator capable of drawing 1 million vectors per second. The software release makes it compatible with Solaris 2.3 and OpenWindows 3.3. **Megatek Corp.**, 16868 Via Del Campo Court, San Diego, CA 92127-1714. **Circle 116**

- Version 2.0 of its SCSI Bus Management Tool (SBMT) is now available from Andataco. SBMT is a utility that allows SPARC workstation users to install, configure and analyze storage systems on their computers. The new version supports Solaris 2.0 and Motif. **Andataco**, 10149 Mesa Rim Road, San Diego, CA 92121. **Circle 117**

- Intelligent Light has introduced Version 4.1 of Fieldview, a post-processor for Computation Fluid Dynamics. This new version of the industrially oriented data visualization and modeling tool features a number of flow codes, including FIDAP, Fluent, Rampant, Flow-3D, CFDS Flow3D, Visisun, Phoenix, CFD-200 and NASA's PLOT3D. **Intelligent Light**, 1099 Wall St. West, Suite 387, Lyndhurst, NJ 07071. **Circle 118**

- Sun aftermarket supplier Falcon Systems has released its 1994-95 catalog. The offerings include disk and tape

drives, RAID devices, printers, plotters, disk arrays, SBus controllers and workstations. **Falcon Systems Inc.**, 1417 W. North Market Blvd., Sacramento, CA 95834. **Circle 119**

- Motif widget vendor KL Group has brought out a Japanese version of its XRT/3d graph product for Motif. XRT/3d is a Motif widget that allows developers to embed 3D graphics into X Window System applications. The Japanese version will include Kanji font support and Japanese documentation. **KL Group Inc.**, 260 King St. East, Third Floor, Toronto, Ontario, Canada M5A 1K3. **Circle 120**

- The GXTRA SBus graphics accelerator and GXTRAstation SBus terminals from Tech-Source are now Solaris 2.3-compatible. The GXTRA accelerator is a graphics card that customers can use to add a second monitor to their workstations. The GXTRAstation is a complete monitor, keyboard combination—in effect an X terminal—that is driven by the Sun's SBus instead of its Ethernet connection. **Tech-Source Inc.**, 442 S. North Lake Blvd., Altamonte Springs, FL 32701. **Circle 121**

- Integrix has upgraded its SPARCstation 10-compatible SPARClike to a SPARCstation 20-compatible system. The SW10+ comes with a 50-MHz processor, four SBus slots, two MBus slots and up to 512 MB of RAM. **Integrix Inc.**, 1200 Lawrence Drive, Suite 150, Newbury Park, CA 91320-1316. **Circle 122**

- Version 2 of IN3, a voice command system for Suns and compatibles, is now available from Command Corp. IN3 is a speech-origination engine for SPARCstations. The new version features a macro capability that allows users to interspace window navigation functions, pointer moves and keystrokes in a string to be executed when a command is recognized. **Command Corp. Inc.**, 3761 Venture Drive, P.O. Box 956099, Duluth, GA 30136-5598. **Circle 123**

tools for network configuration and management, drag-and-drop FTP client and server, comprehensive statistics reporting, LPR/LPD for printing and SNMP MIB II support.

Cooperative design using virtual device drivers codes runs at Ring 0 to control interrupts and scheduling to maximize throughput. The dynamic link libraries code running at Ring 3 takes advantage of the CPU's memory access authentication process, maximizing system reliability. The price is \$249.

Walker Richer & Quinn Inc.

1500 Dexter Ave.
Seattle, WA 98109
Circle 124

Tatung SPARClike

Tatung Science & Technology has introduced a new SPARClike, the micro COMPstation II-385. Based on the 85-MHz microSPARC II, the workstation is said to be a SPARCstation 5-compatible. It is rated at 64 SPARCint92 and 54.68 SPECfp92.

An entry-level version of the workstation includes an SVGA/CG3 frame buffer, a 14-inch color monitor, 16



MB of memory, three SBus expansion slots, 520 MB of hard disk and Solaris 1.1.1B, with Solaris 2.3 as an option when it becomes available from SunSoft. Pricing begins at \$4,570.

Tatung Science & Technology Inc.

1840 McCarthy Blvd.
Milpitas, CA 95035
Circle 125

Lachman Manages Storage

Lachman Technologies has announced its Open Storage Manager (OSM) line of hierarchical storage management products. OSM supports SunOS 4.1.3 and is a true client/server HSM technology that preserves standard file system media formats. Open

Storage Manager provides full HSM functionality with support for optical disk and magnetic tape libraries. OSM doesn't restrict the physical location of mass storage devices, which can be set up in disparate physical sites, yet still can be configured as part of the same logical hierarchy.

Lachman Technologies Inc.

1901 N. Naper Blvd.
Naperville, IL 60563-8895
Circle 126

Blackboard Upgrades

Blackboard Technology Group has upgraded its intelligent application development framework, GBB, to Version 3.0. The new version includes a graphics tool kit, ChalkBox, to create object-oriented GUIs that are source-code compatible with all hardware platforms GBB runs on. Other additions include enhanced tracing and metering capabilities for monitoring applications and enhanced retrieval capabilities that allow developers to create arbitrarily nested logical-query patterns for GBB's multidimensional object database.

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X Window System terminals let you view it all at once — several windows from different applications running on separate hosts. With other X terminals you are dependent on a direct connection to a network to provide fast X communication. GraphOn terminals provide complete X functionality over a *serial line*. Our special design provides unmatched speed when connected to your host through a modem. This keeps your productivity high, even when you're off-site.



How it Works

GraphOn X terminals use a technically advanced design that enables you to communicate quickly over a serial line with full X Window System capabilities. The bit-mapped display allows you to employ any graphical user interface, such as OSF/Motif or OPEN LOOK. The X Server Software resides on the host eliminating the need to transmit verbose X information over the serial line.

Only display commands are transmitted over the RS-232 line, while the server on the host communicates with clients locally or anywhere on the network. Information is compressed at the host and decompressed at the terminal for faster throughput. Backing store and save under functions further increase speed. To hear more about our X terminals or for a demonstration, call today.



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GBB is available for workstations from Sun, Silicon Graphics Inc., Hewlett-Packard Co., IBM Corp. and Digital Equipment Corp. as well as for PCs and Macintoshes. The price is \$10,000 for a single-processor workstation and \$5,000 for PCs and Macintoshes.

Blackboard Technology Group Inc.
401 Main St.
Amherst, MA 01002
Circle 127

FTP Gets into X

Connectivity vendor FTP Software has gotten into the X business. The company has introduced an X server for Windows, EntranX/32. The 32-bit X server allows users working on PCs running Microsoft Corp. Windows to access networked X applications.

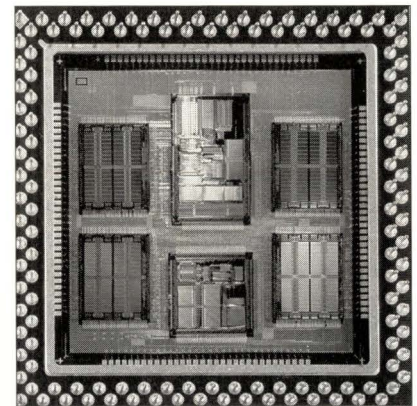
EntranX/32 is the first of what the company says will be several products resulting from a partnership with Age

Logic. The two companies have paired up to develop and sell products that take advantage of X11. EntranX/32 is priced at \$275.

FTP Software Inc.
2 High St.
North Andover, MA 01845-2620
Circle 128

Ross Shows 110-MHz hyperSPARC

As part of a 30-product introduction, Ross Technology, the SPARC-making subsidiary of Fujitsu Ltd., has introduced a SPARC processor that operates at 110 MHz. Three new hyperSPARC modules—80-, 90- and 100-MHz versions—will be available in some 30 different packaging options.



Ross says that the 110-MHz version would be in production this month.

The new processors are based on .5 μ triple-layer-metal (TLM) CMOS processes, which allows them to operate at low power—3.3V. The processors use a multi-die packaging technology that stores a 6 million-transistor chip set, plus a 256-KB cache in a 131-pin PGA package.

A single-processor 100-MHz machine offers 111 SPECint92 and 135 SPECfp92. An 80-MHz CPU costs \$2,511, the 90-MHz version is \$3,187, and the 100-MHz model is \$4,019.

Ross Technology Inc.
5316 Highway 290 West, Suite 500
Austin, TX 78735
Circle 129

AutoCAD for Suns

Autodesk has ported its AutoCAD Designer software to Sun workstations.

The tradition continues...

Sun Remanufactured Systems:
SPARC 1, SPARC 1+, SPARC 2, IPC, IPX,
630 MP, 670 MP, 690 MP
and now announcing
REMANUFACTURED SUN
SPARC 10 & LX



Look for 
the remanufactured label.
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50% OFF

SPARC 10

Model 41

List price on RMF-S10GX-41-32-P46

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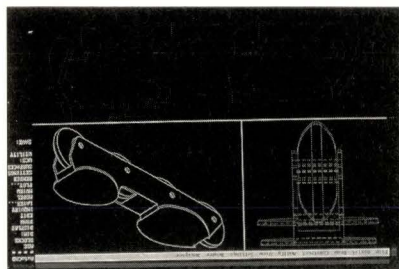
Sun Microsystems
Computer Corporation
Remanufactured
Products Reseller

Sun is a registered trademark of Sun Microsystems, Inc.

• IPC • IPX • 630 MP • 670 MP • 690 MP • SPARC 10

Circle No. 23 on Inquiry Card

The product had been available only on PCs. The Sun version will



have features such as parametric, feature-based design and drafting; coordinate-free sketching; bidirectional associativity (i.e., changes made to a solid model will be automatically reflected through associated drawings); and certain automated drafting functions (such as hidden line removal).

AutoCAD Designer for Sun runs on Solaris 2.3 with 32 MB of RAM recommended. To run Designer, the user also needs AutoCAD for Sun. Pricing begins at \$1,500.

Autodesk Inc.
2320 Marinship Way
Sausalito, CA 94965
Circle 130

StorageWorks Disk Drives

Dataram has introduced 1.06- and 2.1-GB StorageWorks-compatible disk drive canisters for SCSI environments. The 68000 Series line of disk canisters feature a 96-pin single-connector Fast SCSI-2 high-performance interface, 256- or 512-KB cache buffer and a spindle speed of 5,400 rpm.

Disk canisters are covered under a five-year warranty that includes on-site installation and service available from Digital's MultiVendor Service Organization.

The 1.06-GB model sells for \$1,199, and the 2.1-GB model is \$2,099.

Dataram Corp.
P.O. Box 7528
Princeton, NJ 08543-7528
Circle 131

Color Scanner

ANA Tech unveiled the Eagle 3640C, a large-format, production-volume color scanner. The 3640C is a 24-bit, single-pass, 400-dpi color scanner that concurrently scans, reclassifies, com-

presses and saves to disk original E/AO size color documents. Platform compatibility includes Intergraph with RISC and Intel Corp. workstations, IBM Corp., Hewlett-Packard Co., Sun and Data General Corp. The 3640C is priced at \$65,000.

ANA Tech
An Intergraph Division
10499 Bradford Road
Littleton, CO 80127
Circle 132

MasterMind for UNIX

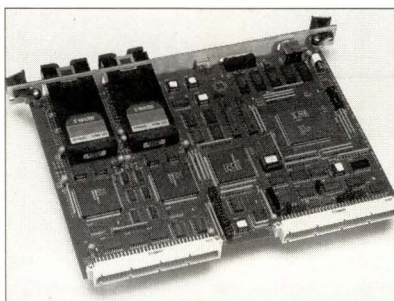
QStar has announced that its network storage management product, MasterMind, is available for the SCO UNIX operating system. Pre-existing MasterMind support includes SunOS, Solaris, Hewlett-Packard Co. HP-UX, IBM Corp. AIX and others. QStar calls its MasterMind products a main-frame-class network storage management product for heterogeneous client/server networks.

The price for the MasterMind software starts at \$2,200. Subsystems that include MasterMind start at \$5,000.

QStar Technologies Inc.
600 E. Jefferson St.
Rockville, MD 20852
Circle 133

Rockwell Shows FDDI for VME

Rockwell Network Systems, the former Communications Machinery Corp., has announced a new series of FDDI VMEbus adapters. The 1250



series comes with a DMA control processor built onto the boards, which the company says eliminates the need for an onboard CPU. The series also supports asynchronous and synchronous FDDI operations and is available with an optional Content Addressable

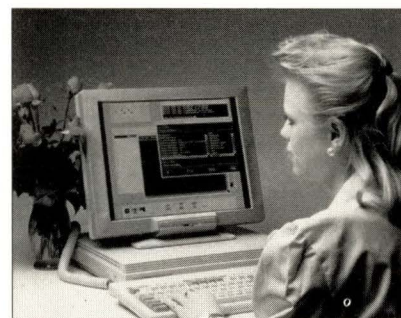
Memory (CAM) for fast network address detection.

There are fiber and unshielded twisted-pair models. Pricing on a 1250 board with fiber begins at \$4,675; a 1250 board with cable begins at \$2,995.

Rockwell Network Systems
7402 Hollister Ave.
Santa Barbara, CA 93117-2590
Circle 134

Flat-Panel X Terminal

Phase X Systems has announced POWER X-Stations, its family of X terminals using flat-panel plasma display technology. The 16FM is a 16-



inch monochrome model; the 21FM is a 21-inch monochrome model. Both offer 1,280-by-1,024 resolution and use an LSI-33020 CPU. Performance measures in excess of 120,000 Xstones.

The POWER X-stations are equipped with X server software that supports SunOS, Sun Solaris, IBM Corp. AIX, Digital Equipment Corp. Ultrix and VMS, Hewlett-Packard Co. HP-UX, Data General Corp. and other UNIX systems. The monitor's footprint is one-tenth of a traditional desktop, making it appropriate for manufacturing, financial and medical settings.

The 16FM and 21FM ship with a minimum of 4 MB of RAM and an optional 4-MB Flash PROM memory and have a built-in Ethernet adapter and TCP/IP. Remote networking over serial lines is possible using the point-to-point protocol, SLIP and compressed SLIP. The 16FM sells for \$4,500; the 21FM is \$7,500.

Phase X Systems
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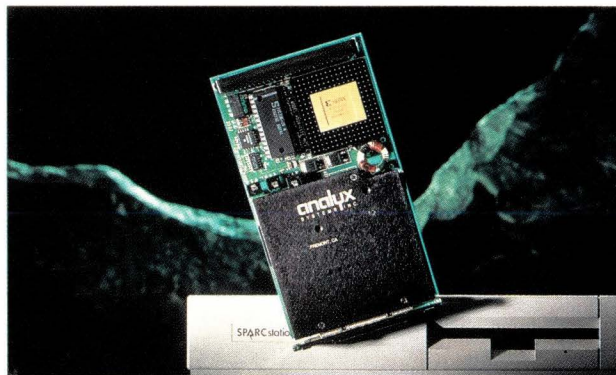
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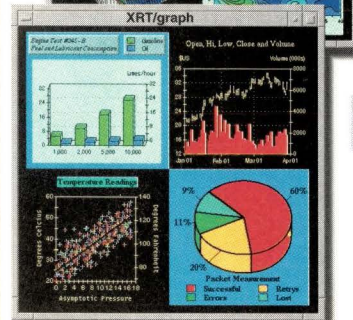
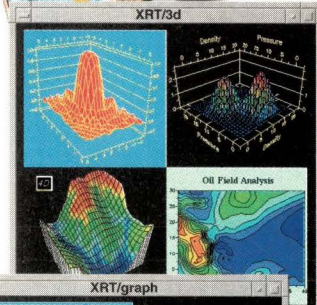
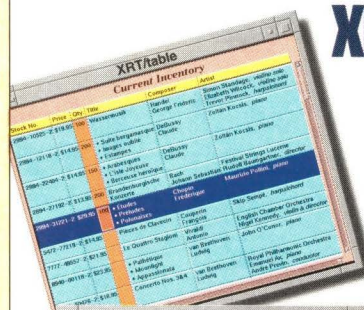
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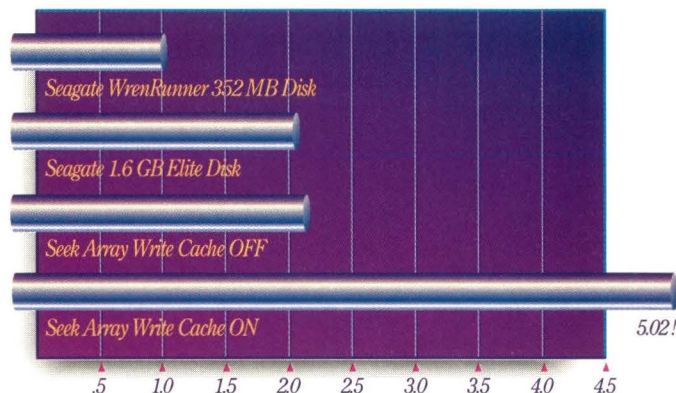
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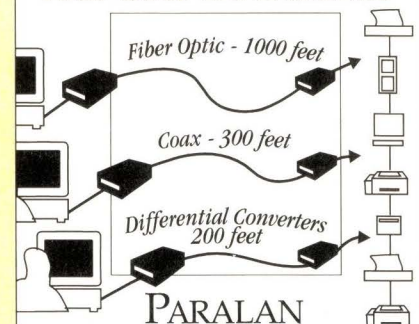
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Microsoft Windows 3.1 and MS-DOS 6.21 included	Pre-installed	No

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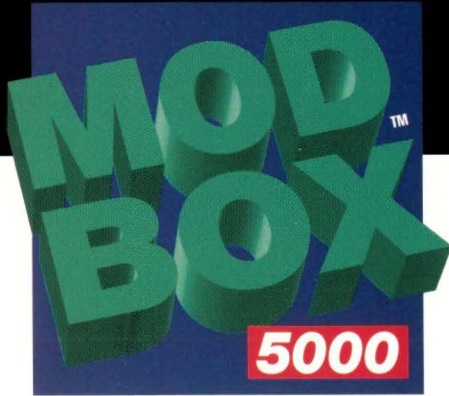
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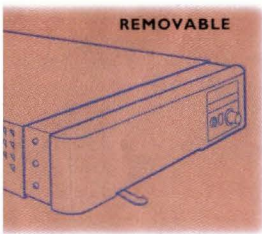
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Configure a modular storage solution to ensure continuous, 24-hour availability to your data.

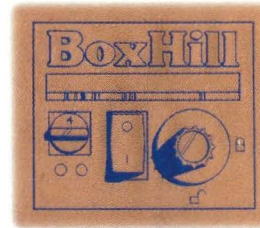
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- Front panel on/off and SCSI address switches, barcodes, optional lock and drive indicators for easy maintenance



A Wide Choice of Components

- Drive options: 5.25" and 3.5" fast-narrow or fast-wide SCSI-2 disk drives
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- The RAID Box 530: R.A.I.D. level 0, 3, or 5: dual-porting, dual controllers, hot-sparing and Super-Fast Cache: 4 GB to 216 GB
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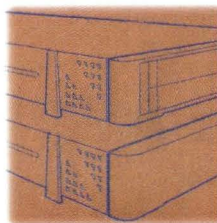


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