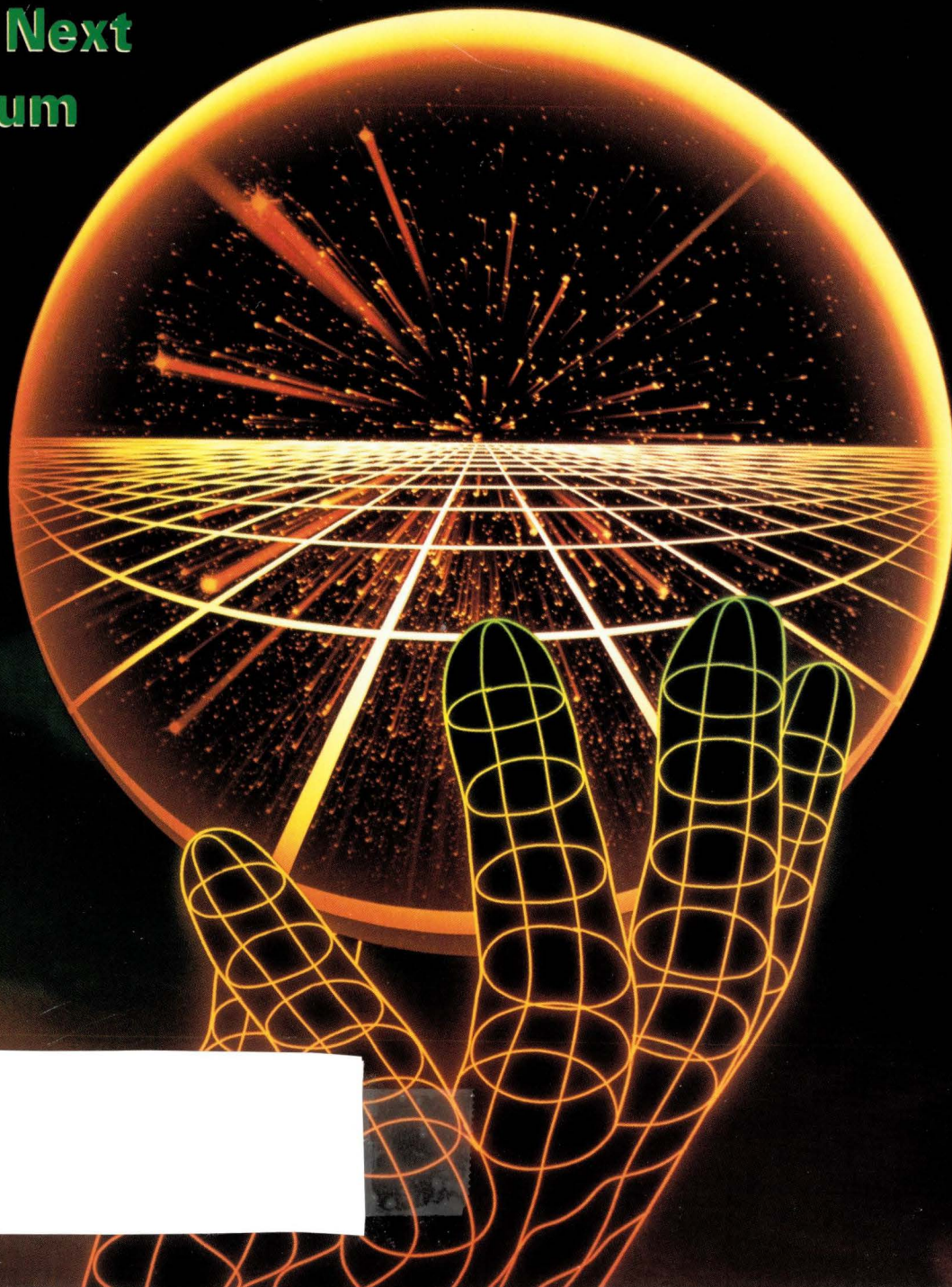


# SUN EXPERT

erving the UNIX Client/Server Network

OCTOBER 1994 Vol. 5 No. 10 \$5.50

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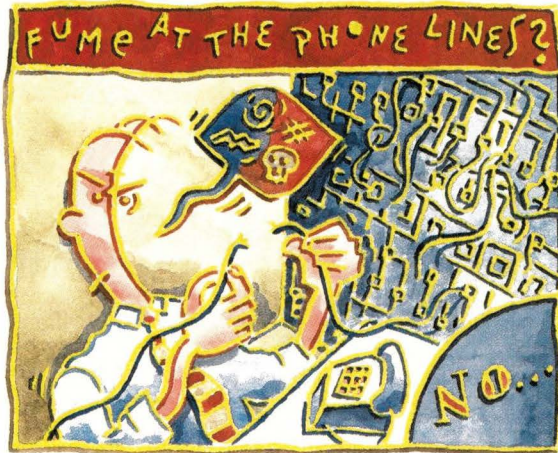
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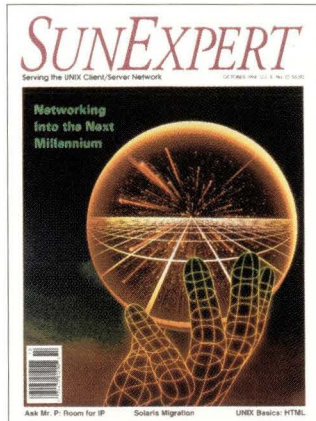


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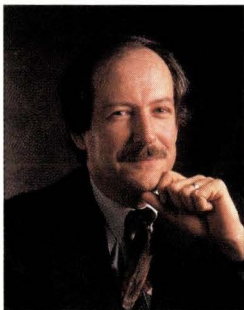
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# Editorial

## Practically Practical

This month, *SunExpert* takes a decidedly pragmatic turn. Our cover story addresses a workhorse product class—terminal servers. While these little network organizers may not have the glitz associated with



client/server networking solutions, they have become *the* access servers that make telecommuting and remote offices practical and cost-effective. At least that's one conclusion Executive Editor Michael Jay Tucker drew from his conversations with users. As part of this broader look at practical networking, Senior Editor Simson L. Garfinkel examines the question of networking media: When does it make sense to go to fiber cable? Where does Fast

Ethernet fit into the picture? Simson also looks at connecting to the Internet. In many companies, making that link is as important to operations as opening the loading dock.

Also in this issue, we begin an over-the-shoulder look at Solaris migration. As we upgrade some of our machines to 2.x, we will periodically keep you filled in on the problems we run into and the solutions and work-arounds we uncover. This month we show you how to get some compilers up and available to retrieve and use some of the public domain and redistributable software that so many of us depend on every day. Of course, the compilers are the Free Software Foundation's GNU C and GNU C++. Be sure to check out this feature if you're moving or thinking about moving to Solaris 2.x.

Another hands-on article is this month's UNIX Basics column. We have used much of what Peter Collinson has to say about HTML to make up our own World Wide Web server. It should be up and reachable at <http://www.cpg.com>—and yes, we do use our own advice to keep our systems running. If you have any suggestions about the content of our Web home page, let us know. Just remember that we can't post articles themselves in real time until we've worked out all the copyright and trademark issues.

Making a return this month after a long hiatus is SUG Notes. Alex Newman, executive director of the Sun Users Group, has agreed to keep everyone posted on what's new with SUG. After a rocky past several months, the group is on the mend and deserves our continued support.

*Doug Pryor*

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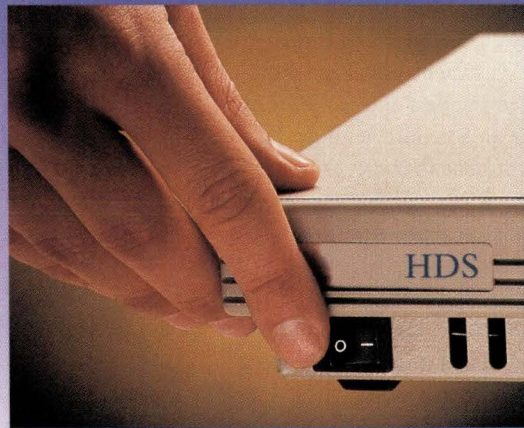
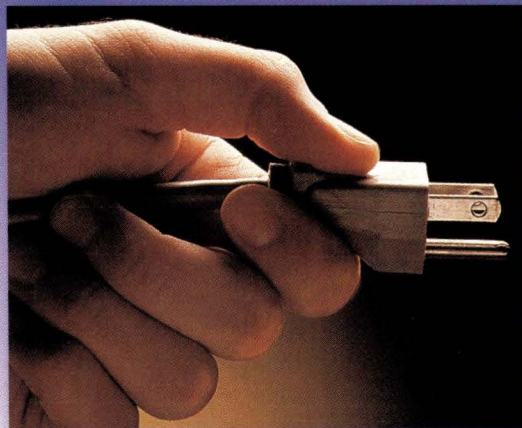
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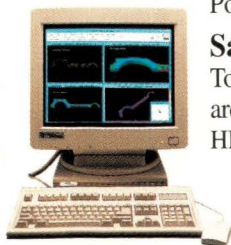
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# LETTERS

"Letters to the Editor" may be edited to conform to SUNEXPERT style-guide and space requirements. The views expressed are those of the author and not necessarily those of SUNEXPERT.

## Your Recent Article on Licensing Software

I just finished reading your article that described in some detail how FlexLM operates and as a specific example how SunPro employs that technology ("The Network Is the License!" *SunExpert*, July, Page 30). Having seen the best and worst from Sun and other software vendors, I'd have to comment that you only touched the surface of the licensing issue. Also, your representation of Sun is not entirely accurate.

Here are some specific problems:

- Ask Sun about the software they abandoned that is using their ill-fated SunNet License software.
- Ask Sun how easy it is for them to add licenses incrementally for their products—specifically for compiler products (we spent months trying to consolidate and add compiler licenses because Sun could not generate proper feature lines).
- Ask Sun why they unbundled the compiler from the debugger and licensed the debugger separately—is a compiler of real use to me if I don't have a matching debugger?
- Ask Sun how we can prepare for machine failure where license managers are hostid-based.
- Ask Sun how we can run multiple license managers for different versions of the compiler if they must use one lock file in /tmp.

Each of these things is solvable by clever systems administrators, but why do they have to get so clever for stuff they already paid for? Sure we can spoof hostid's and binary patch executables to use different lock files—but administering software (that you've paid for) shouldn't be so difficult. Ask Visual Numerics about the accounts they lost when they embedded FlexLM calls from within the IMSL library—we

rewrote every IMSL library call we had just so that we wouldn't have to administer a license manager [for them] at our client sites.

This doesn't mean we are so innocent ourselves (we use FlexLM to administer our entitlements), but there's gotta be a better way—and this ain't it.

Micky Liu  
micky@ejv.com

## License Manglers

Great article. And you didn't even get to pound Sun for the flawed installation of `lmgrd`, the one that puts symlinks in `rc3.d` (if I remember right), and that complains on bootup cuz the logic is so stupid that it tries to "stop" on bootup. I just wanted a compiler; I didn't want another Manager. Unless he's got a huge budget :-)

Doug Mildram  
uunet!xylogics.com!mildram

Oh, I'm sure you've touched quite a raw nerve with many an administrator with your article on license managers. Here's one aspect you only briefly touched on that I find aggravating above the mean level normally associated with license managers: Although several products will use the Highland License Manager (a pox on all their houses!), they often use "incompatible" versions (how can a license manager NOT be upward compatible?) so you have to have four or five versions of the Highland license manager running.

Flame on. Ugh!

I always tell my vendors that if they are paying for this so-called feature—that customers can coalesce several licenses into one manager—then they are being ripped off, as are we. Sadly, they are the customers being sold the product, while we are the customers saddled with it, and our complaints appear to fall on deaf ears. How about another nit—why aren't license managers "architecture-neutral?" Say I buy 20 licenses of a product and both Sun and HP media—why can't one manager allow any mix of platforms to be running at once as long as the total doesn't

exceed 20 and assuming they are priced the same?

Flame off.

Thanks for the nice article!

David J. Sullivan  
sullivan@bear.com

## Spam and Commercial Postings

I just read, and reread, with great interest your column on the Internet ("Mr. Protocol Goes to Market," *SunExpert*, July 1994, Page 17), which brought up interesting points regarding its regulation and commercialization. One point in particular caught my attention; you state that "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..."

As part of a group that is putting together a for-profit public access Internet site, I am very interested in some of your opinions in this area. To the best of your knowledge, has any provider to date come up with a provider agreement that comes close to being able to prevent or at least punish gross violations of Netiquette such as Canter & Seigel's Spamming of the Net?

By now you've seen my true intent, which is to try and find a good provider agreement that we can shamelessly borrow from that will spell out in clear terms that even newbies might understand the do's, don'ts and ramifications of Net behavior.

Barry Shein (bzs@world.std.com) suggested that making Spamming not illegal, but very expensive, under an up-front fee schedule, is an excellent tactic, because suing for recovery of payment for services is such well-trodden legal ground that most sleazeballs don't even try to avoid it. I don't know of anyone (including Barry) who's actually written up such an agreement and fee schedule, though.

The concept of charging a high user fee for Spamming is an intriguing one! The implementation of such a price structure is interesting; how does one enforce, or even detect, a Spamming? I



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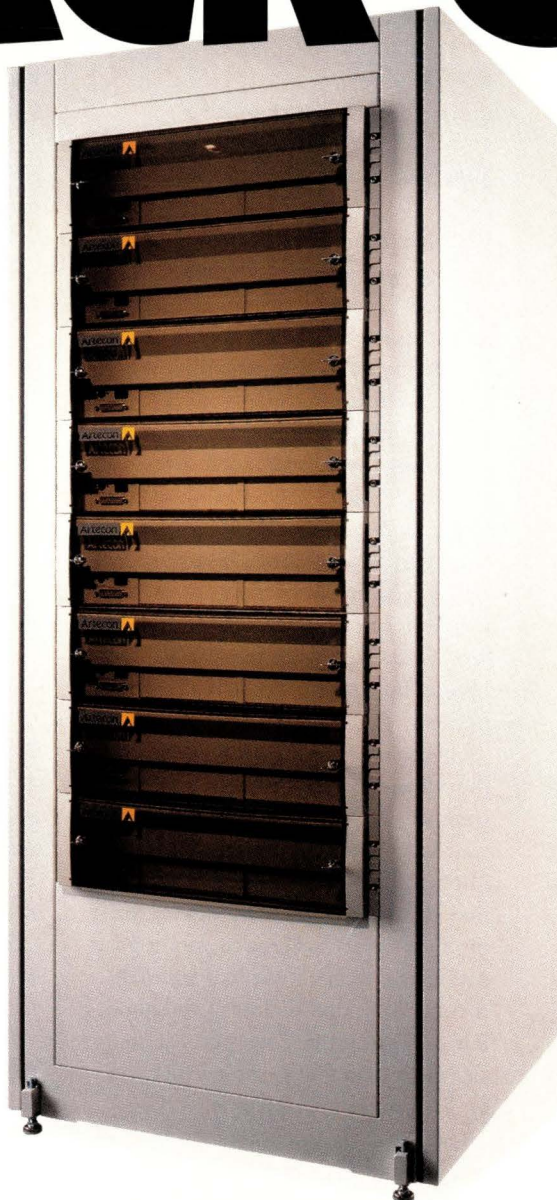
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suppose one could have a per-message fee that increases according to the number of newsgroups one posted to, but when a message is properly cross-posted, the overhead is low, since only one copy of the message exists, and links are made for the other copies.

I am of the opinion that the C&S incident would have been minor if they had properly crossposted. The real reason everyone got cranky was because there was an individual copy of the message in every single newsgroup, and newsreaders smart enough to filter out previously read messages never caught the green card messages, since each one was separate.

I'd be willing to try to put a "Spamming as service rendered" clause in our agreement, if only we can determine a way to phrase it that is not overly restrictive on the frequent but proper users, but has some (hopefully) enforceable restriction on the Spammers.

Thanks very much for the points; and wish Mr. Protocol a happy St. Swithins day for me.

Joe Hartley  
uunet!cadre.com!jh

I just read your article on massive commercial postings on the Net, and I agree that there needs to be a way to regulate these massive commercial postings, whether the originator is discourteous or just ignorant of Netiquette. Perhaps if everyone who received these postings would respond as if they were a customer, the originators would have so many leads that it wouldn't be cost-effective to trace them—especially if we gave our home addresses or phone numbers (real or fictitious).

Kevin Milewski  
uunet!sulb.ess.harris.com!  
milewski

*MOB replies:*

*There are at least two problems with this approach. 1) It requires coordinated action on the part of Usenet, which is a laughable improbability; and 2) It represents a counterattack as opposed to a solution.*

*Mr. Protocol is of the firm opinion that*

*nothing works on these boys better than a good soaking in the wallet.*

*Mike O'B. (for Mr. P).*

Dear Mr. Protocol:

Did Canter & Siegel have you so scared that you dared not mention their name in the article?

Rob Boudrie  
uunet!chpc.org!rboudrie

*Shhhhhhh, they might hear you.*

Dear Mr. Protocol:

I read your latest installment, "Mr. Protocol Goes to Market," and have a suggestion as to a better way to handle the morally impaired, economically driven Usenet super-posters such as your Arizona lawyers. Instead of mailing them uuencoded core dumps of Solaris 2.x, and simply bothering the poor defenseless network carriers, why not just send them a reply saying: Call me at (xxx) xxx-xxxx. You would not need to refer them to your local Pizza Hut, or to the White House, but instead just give them your number.

This would dilute probably one thousand- (or maybe 10K-) fold the number of useful replies, and the only way to screen them is by making a phone call to each reply. When (or if) they do call you, let them explain their product/service/scheme to you in great detail, and then 15 minutes later tell them: "Well, that is all well and good, but the reason that I wanted you to call me was so that I can instruct you on the proper use of Usenet."

Their only option at that point would be to 1) Stop using Usenet; 2) Give out their phone number instead of using email replies (ooh, that would be scary); 3) File a lawsuit (these are lawyers, you know) charging email harrasment against 457,218 people, who would then file a class action lawsuit charging Usenet harrasment and NFS policy violation. Then these issues may finally be resolved, and a mechanism for commercial network access can be worked out in Congress (another scary situation).

The only problem with this is, how

do you let everyone know about the plan? Maybe by posting it to every Usenet newsgroup? No, that's what we are trying to get rid of. Hmm... Maybe if there were someone in a public forum with a large readership that is directly interested in networks....

Yeah, they could spread the word! So please let me know if you find such a person, and I would be more than happy to send him a box of Big Stuff Ding-Dongs.

Steven Smith  
smith@nucleus.harvard.edu

P.S. I enjoy your column every month. It is the highlight of *SunExpert* and has saved my butt many times in the past.

*Mr. P. replies:*

*Unfortunately, as Mr. P. has remarked before, these solutions require something almost unimaginable: concerted action on the part of Usenet. This is about as likely as finding mosquitos flying in formation, and for a lot of the same reasons.*

*In fact, anyone reading news.admin.misc could have gotten Canter & Siegel's phone number. Someone even went digging in the Phoenix real estate records and came up with (and posted!) something that looked suspiciously like their home address. This, of course, resulted in absolutely nothing whatsoever occurring.*

*Mr. Protocol still hasn't heard anything better than the notion of a sliding-scale fee structure for commercial postings.*

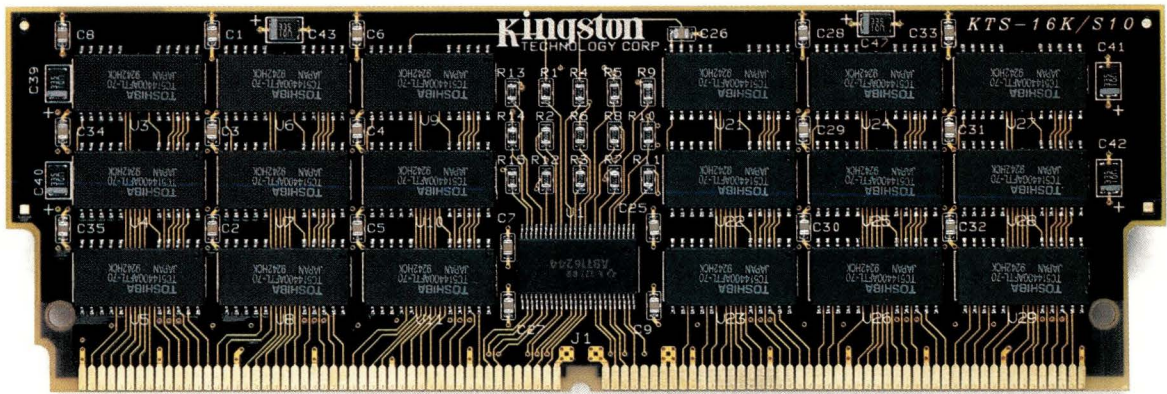
*Mike O'B. (for Mr. P.)*

*P.S. Strange that you should mention this. Mr. Protocol also finds his column to be the high point of SunExpert for him (or, at least, the check for writing it), and it has also saved his butt many times in the past (or, at least, the check for writing it has).*

Dear Editor:

THANK YOU FOR THE NEGATIVE PRESS ON C&S!

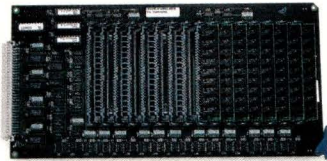
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Thank you. Thank you. Thank you.

Scott D. Yelich  
uunet!santafe.edu!scott

### Good Idea

Dear Editor:

I really enjoyed your last issue—some very well-written articles. I have a suggestion for you. In your “New Products” section, you list many new products, but they often cost thousands of dollars. I think you could really help the community by offering lists of new software that various users have written and freely distributed. One of the nice things I have found about UNIX is that many tools are available via anonymous ftp: chess games, plotting programs, CAD programs, spreadsheets, UNIX utilities, etc. It would be nice for you guys to provide a page or so of such “new releases” that people have found particularly good.

Rick Donahue  
Lawrence Berkeley Laboratory  
uunet!academic.lbl.gov!  
rdonahue

### A C and C++ Debugger

Dear Editor:

We are disappointed by your review of our integrated programming/debugging solution, DynaTrap (“A C and C++ Debugger,” *SunExpert*, August, Page 47). We want to correct the following points, which are inaccurate or misleading:

1) Mr. Shein states that “the primary features that distinguish DynaTrap, Purify and CodeCenter from their predecessors dbx and gdb are runtime error-checking and incremental execution.” Apparently Mr. Shein confuses the ubiquitous incremental linking feature with DynaTrap’s incremental execution feature. In an edit-compile-link-execution software development cycle, incremental linking shortens the link step, while incremental execution shortens the execution step. While all three products have the incremental linking capability, we believe that only DynaTrap has the incremental execution feature to allow users to re-execute a modified program from the

user-specified breakpoint.

2) Mr. Shein’s statement, “...has some distracting interface bugs,” is inaccurate. As he admitted, “perhaps I misunderstood something.” All of his misunderstanding about DynaTrap’s user interface could have been immediately resolved by simply contacting our customer support. Listed below are some examples:

- Mr. Shein’s trouble in running GUI remotely is due to our company policy of limiting a trial copy to single-user mode. To run GUI remotely as a floating license user, all Mr. Shein would need is a new password from us.
- Because he uses the Delete key as his erase character, Mr. Shein states that “...this forces me to keep doing stty commands and explicitly typing Control-H.” Various users have different setups of their environments. To set and restore the erase character to meet the user’s specific needs, Mr. Shein simply needs to slightly modify the DynaTrap scripts. Mr. Shein has trouble using the “print” command. As a matter of fact, DynaTrap’s user interface of the “print” command is the same as many other leading debuggers such as dbxtool.

• Mr. Shein states that “although the help interface is welcome inasmuch as it is better than nothing, it’s rather odd.” DynaTrap’s user interface of the “help” command with the “command-name” argument is no different from other leading debuggers. DynaTrap even provides the additional capability to allow users to view more detailed information regarding error messages, e.g., possible cause and recommended action, through the “help error-code” command. Mr. Shein seems to confuse “help command-name” with “help error-code.”

Rather than evaluating DynaTrap’s many powerful debugging features that will be beneficial to your readers, Mr. Shein chooses to devote much of his space to the highly subjective GUI style and usage model.

Moreover, Mr. Shein’s article does not address the following unique benefits users can get from DynaTrap:

- DynaTrap’s incremental execution allows users to select a breakpoint during execution to save the program state

at that particular breakpoint. When the program is re-executed after code change, the saved program state is restored automatically for the re-execution, saving the execution time from the program entry point to the user-specified breakpoint. Before the re-execution, DynaTrap also validates the program state for potential state corruption due to code change. This popular feature of DynaTrap can greatly shorten the execution step in the edit-compile-link-execution software development cycle and is particularly useful when debugging CPU-intensive applications.

- DynaTrap’s error checker can detect memory access errors even if the out-of-bound access falls into a legitimate memory block. That is, DynaTrap can detect memory errors for the back-to-back memory blocks without requiring a “void” between them.

- DynaTrap’s error checker can detect memory errors for user-defined memory managers. There is no need for users to change their user-defined memory managers to the standard `malloc()` function for memory error detection.

- DynaTrap’s error checking can be turned on or off selectively for different functions or `.o` files. This capability is useful in increasing the execution speed when there is no need to check “clean” functions or `.o` files.

3) DynaTrap’s resource map viewer displays the content of memory blocks in type-specific format. This is useful for a data review to complement the code review process.

Every debugging product, including mature products, has its strengths and limitations, as exemplified in the article “Step into Advanced Debuggers” (*SunExpert*, December 1993, Page 62). By inaccurately stating that existing products “... do about the same things,” Mr. Shein discourages your readers from using new products. We feel your readers would be better served by a review that analyzes more of DynaTrap’s advanced features.

We appreciate the opportunity to present this additional information on DynaTrap. Based on our users’

solutions

# Apunix Desktop Publishing

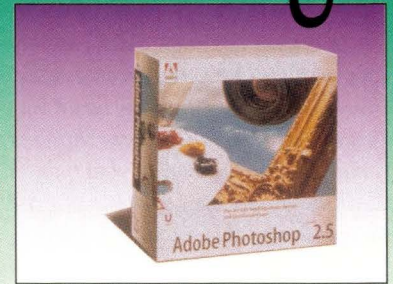
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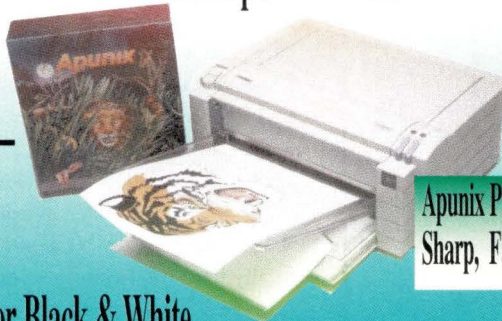
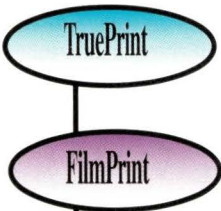
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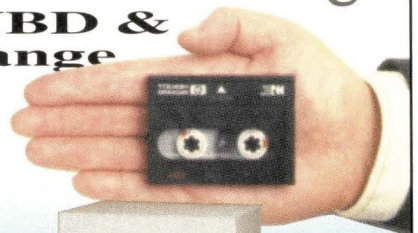


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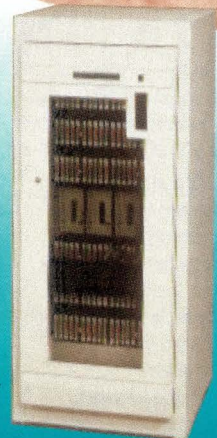
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response, DynaTrap's future is extremely promising.

Ben Cheng  
President, Dynasoft Inc.  
bc@dsoft.com

Barry Shein replies:

Overall, I think DynaTrap would get more out of this review if the company attended to the weaknesses outlined rather than become defensive. There's no reason, for example, not to just accommodate the user's choice of a Delete key versus backspace. Setting it to something different and then leaving them in that state on exit just seems sloppy even if a user can work around this. As to the company's policy on single-user licenses, one can only wonder what someone using an X terminal—which DynaTrap, configured this way, won't run on—must think of their product when it refuses to run. It's unfortunate when license considerations take precedence over usability. That the company would provide a magazine reviewer with any license does not really address the underlying issue if the product is provided to customers with this limitation. As I

said in the article, DynaTrap has promise, but I think Dynasoft needs to look at the competition a little more carefully. I know I have, and that was the perspective I was attempting to give both Dynasoft and our readers in the review article.

### Font Foibles

Editor:

I would like to point out an oversight in Simson Garfinkel's article ("Desktop Publishing Under the Sun," *SunExpert*, August, Page 34). Specifically, in the sidebar that addresses font support on SunOS and Solaris ("In Search of Font Flexibility"), Mr. Garfinkel states that, unlike their PC and Mac counterparts, UNIX users currently cannot go to a computer store, buy a floppy or CD-ROM filled with fonts, and within minutes have new fonts available to every application on the workstation. On the contrary, this functionality is available now and has been shipping since May for all UNIX platforms. The software product that enables UNIX font choice is FontTastic from Gallium Software

Inc. (Nepean, Ontario, Canada).

The FontTastic product family includes a Font Server, Font Application Programming Interface (API) and Font Manager. These products are available on all UNIX-based systems, are compatible with X11R5, can rasterize TrueType, Type 1 and SPEEDO formatted fonts, apply transformations to the fonts and return font outlines. Through its experience in porting MS-Windows applications such as CorelDraw to UNIX (which was erroneously attributed to PRIOR Data Sciences in your article), Gallium confirmed the critical importance for the operating system or windowing system to provide font support.

As your article points out, UNIX developers, like those on the Macintosh and MS-Windows platforms, have a right to expect basic font functionality from their operating system or windowing environment. However, UNIX developers have never defined a common font support solution. Whereas Macintosh and MS-Windows both integrate font support in the OS, UNIX developers until now have had to develop their own font management strategies.

The result: no easy way to manage fonts across applications, let alone across platforms. The addition of seamless access of the two major font formats for UNIX improves its position as a viable desktop publishing platform.

The availability of FontTastic allows end users to buy off-the-shelf TrueType and Type 1 font packs in any medium that is readable by their UNIX-based systems. As the number of fonts increases, so does the need for an application to manage them. The FontTastic Font Manager, an X-based application that allows the end user to view and automatically install fonts, provides the ability to create new font "suitcases," much like in the Mac environment. With FontTastic, UNIX end users finally have the freedom to choose fonts in UNIX-based applications.

Peter Hanschke  
Director of Marketing  
Gallium Software Inc.  
Nepean, Ontario  
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# NEWS

## SunSoft's New Clout

As Sun Microsystems continues its major reorganization (see "SunSoft Revamped," *SunExpert*, September 1994, Page 12), a winner in the shuffle has been SunSoft. The entire Sun Technology Group, with the exception of SunPics, has been absorbed by Sun's software-oriented planet. The former SunPro, SunConnect, SunSolutions and SunSelect have all been integrated into SunSoft.

The result is that SunSoft, headed by Edward Zander, is now responsible for Solaris (on both SPARC- and Intel Corp. microprocessor-based systems), PC connectivity, systems administration, network management software development tools and assorted software tools. To this end, SunSoft will become five independent business units, each with its own vice president.

SunPics, the Sun subgroup responsible for printing technology, will be



moved into SMCC and renamed Sun Printer Group. "SunPics is largely a hardware business," says Amy Christen, Sun Printer Group's director of marketing, "so it made sense to realign it with the system business."

Eric Schmidt, the former head of Sun Technology, is now chief technology officer and head of Sun Microsystems Labs. "[Sunlabs] is like a planet and reports directly to [Sun Microsystems CEO] Scott McNealy," explains Christen. "They don't sell products. They are more of a development group."

Was this, then, a defeat for Schmidt? "I don't think it was a demotion," says one SunSoft insider who spoke on condition of anonymity. "I do think there was some acknowledgment that he wasn't cutting it on the business side, but it wasn't a demotion. People know he is a really top-notch technical type."

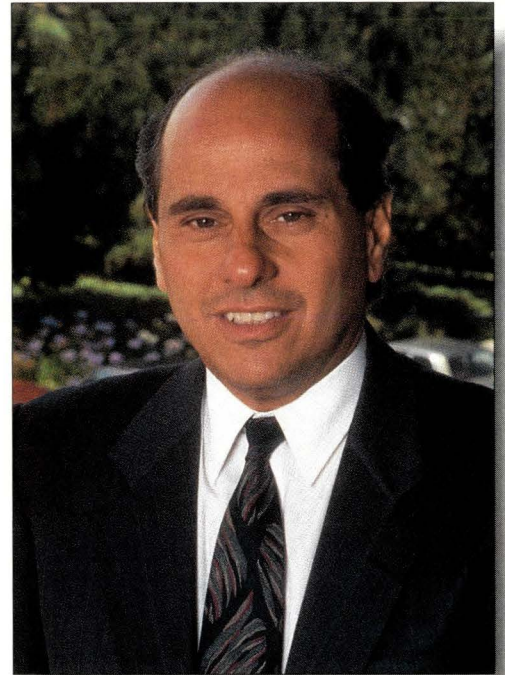
Meanwhile, the official explanation of the change was that Sun Technology was a division without a mission. Four of its subdivisions were software-oriented and therefore belonged in the SunSoft camp, while SunPics belonged with SMCC's systems people.

The various components of Sun Technology now shifting to new quarters claim that the changes will be

mostly invisible to the customer. "I think it is fundamentally a nonevent for the Sun Printer Group," says Christen. "We've changed our name; we will have to change the way we talk about ourselves, but other than that, nothing is different."

Others aren't so sure. One source at the former SunPro, speaking again on condition of

*Amy Christen, director of marketing for the Sun Printer Group (the former SunPics), says that customers will hardly notice the company reorganization. The Sun Printer Group was the one part of Sun Technology not to become part of SunSoft. Instead, it will join with SMCC.*



*Ed Zander, president of SunSoft, now commands a much-expanded organization. As a result of the demise of Sun Technologies, his planet now includes the former Sun Technology divisions responsible for software development.*

anonymity, exclaimed, "Christ! I just got all the damn planets memorized. Now we're changing everything again. I don't even know how to answer the phone any more. Do I say 'SunPro' or 'SunSoft' or what?"

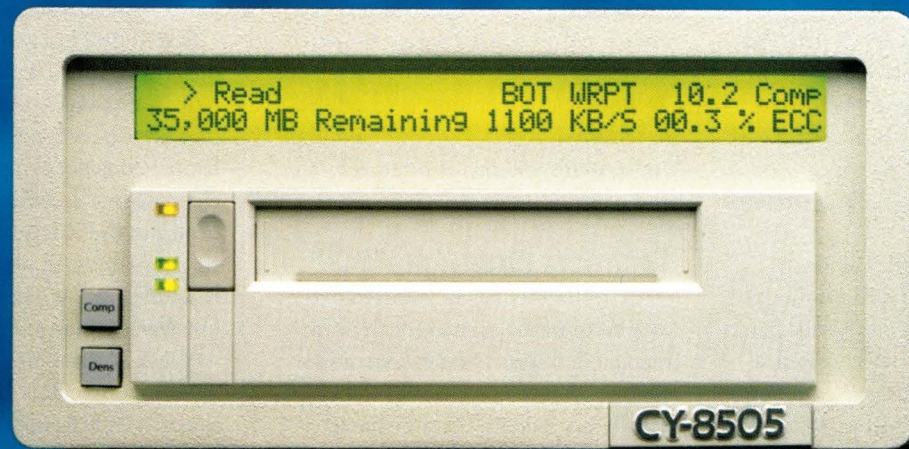
Sun customers may encounter similar problems, especially with layoffs looming large for redundant former Sun Technology personnel. "There will be about 900 corporate layoffs all total," says one SunSoft source, "with 400 to 500 coming from SunSoft."

The source insists, however, that the layoffs are not a quiet purge of Sun Technology employees. "I don't think it is political," the source says. "I know longtime SunSoft people who are going."

In general, individuals contacted by *SunExpert* seem to regard the reorganization as a good thing at best, and a necessary evil at worst. "There was a resource issue," notes one employee. "There was a lot of redundant work going on between Sun Technology and SunSoft."



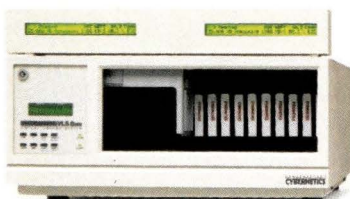
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Meanwhile, Ed Zander, whose organization is becoming one of the major Sun fiefdoms, seems to be getting better marks from both his old and new employees. Said one SunSoft worker, "He's actually sort of come around. He's a little less cavalier, a little less ballsy and a little more down to earth. I'm still not 100% confident in him as a general manager, but I feel better about him as an executive."

### **Canon object.station Makes OpenStep Evaluation Easy**

Canon Computer Systems Inc. has unveiled a new Intel Corp. chip-based computer designed from the ground up to run the NextStep object-oriented operating system.

The system, called the Canon object.station 4.1, is based on the Intel 486DX4/100 and actually yields better performance than similarly priced Pentium-based systems, say company officials. This heightened performance is due to an improved I/O system designed to deliver high-performance screen updates and Ethernet transfers.

The object.station comes with 2 MB of VRAM, allowing it to support resolutions from 800-by-600 in 32-bit color to 1,280-by-1,024 in 16-bit color. The video subsystem supports refresh rates from 72 Hz to 110 Hz. Also included in the basic system is CD-quality sound, an integrated microphone for voice mail, a 32-bit SCSI controller with a 10-Mb/s data transfer rate and 16 MB (expandable to 96 MB) of RAM. Internal expansion consists of three ISA slots and one VL/ISA slot occupied by the SCSI controller. The user "deployment configuration" list price is \$5,394 and includes a 500-MB hard disk and a NextStep user license (\$4,797 without NextStep license). An optional 17-inch color screen is priced at \$1,181.

The system has been tested with Solaris 2.1 for Intel, although it has not yet been certified. "We are looking into certification to run Solaris right now," says Bret Gutzka, director of sales. "What we are looking at is to put together a bundle of NextStep and OpenStep development tools for Sun users that want to start development in anticipation of OpenStep and a native

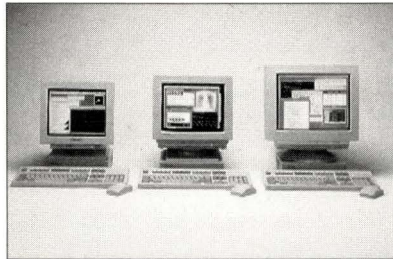
SPARC port of NextStep."

The object.station system was developed by Canon's new division, Advanced Technologies Operation. The Canon group is headed by two ex-Epson America Inc. employees who worked on the Epson NX, another Intel chip-based computer designed to run NextStep. "Now we finally have the support to do what we want to do," says one of the group's engineers.

According to the engineer, the object.station 4.1 is the first of many NextStep-based systems that Advanced Technologies Operation is scheduled to release this year. Low-end and high-end systems will be introduced by the end of 1994. —s/g

### **Tektronix Fires X at ASCII**

Tektronix Inc. has introduced a line of X terminals designed for the commercial desktop. The new terminals are intended to compete for the space usually occupied by dumb character terminals. "This product has a variety of features designed to make it attractive for ASCII terminals and as an alternative to PCs as well," says Lee Rainey, Tektronix's network displays division's product marketing group manager.



*A low-cost X terminal, Tektronix's new XP200 is designed to compete with ASCII terminals. It's also targeting users of commercial desktop PCs.*

Based on a MIPS R3000 processor, the terminals are lower cost, entry-level displays. They include the XP214M, which has a 14-inch monochrome display for \$1,095; the XP214C, which has a 14-inch color screen for \$1,495; and the XP217C, with a 17-inch color display for \$2,495. All come with 4 MB of RAM (expandable to 36 MB),

two serial ports, two PCMCIA slots and a performance level of 1.6 Xmarks.

The XP200 series is somewhat of a shift for Tektronix. Although a long-time player in the X terminal market, the company has been known most recently for X displays designed to fit into specific markets. The company was early to market, for instance, with X terminals designed to work in IBM Corp. systems-oriented networks.

The XP200 is a general-purpose machine. Rainey argues that this reflects a change in the market rather than in the company. "What's really happened is not so much that we've changed but that the industry has begun to use X terminals in different ways," he says. In particular, the machines are now being used for on-line transaction processing tasks.

PCMCIA slots are also new for Tektronix, which held out against the slots for its X terminals. As late as last year, Tektronix personnel were saying privately that such interfaces were a waste of money on X terminals.

Why did the company do an about-face on the PCMCIA slots? "Originally, most companies were offering PCMCIA as a way of putting extra flash memory into their X terminals," says Rainey. "We still think it's far cheaper to put memory on the motherboard." Where PCMCIA has a role to play, he thinks, is as "an insurance policy."

Tektronix says it is now providing the slots as a means of connecting its terminals to new and developing networking technologies. "What we think is important about PCMCIA," Rainey says, "is that it provides access to future interface technologies."

### **CenterLine Shows Software Reuse Product**

Software tool vendor CenterLine Software Inc. has introduced a product designed to help developers reuse software. ResourceCenter is described as a software reuse environment designed to work with objects. Organizations can use it to catalog, locate and retrieve reusable software assets. ResourceCenter runs in a networked environment and can be operated in

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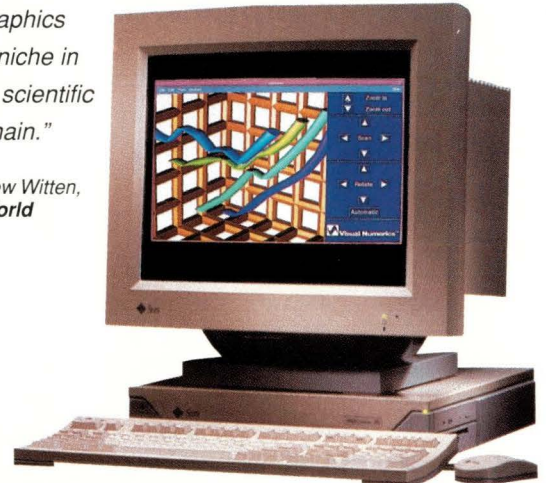
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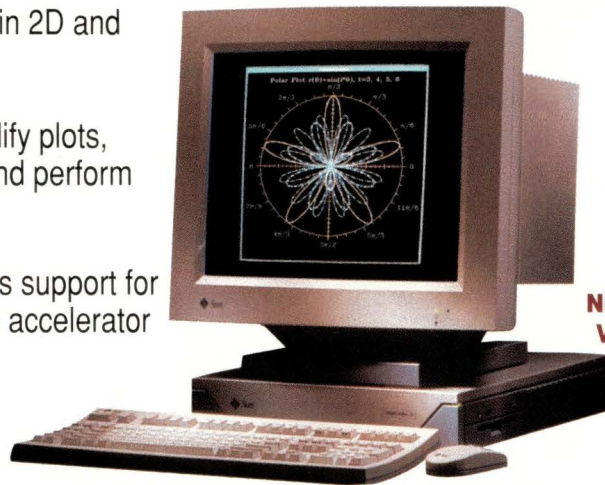
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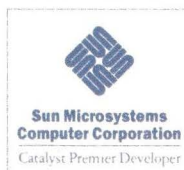


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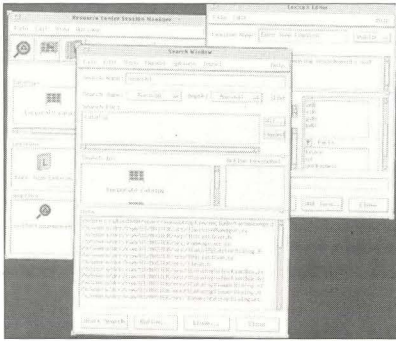
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*A tool for managing software reuse, CenterLine's ResourceCenter allows an organization to locate and retrieve software and related assets from within source and object code. It can operate in a small work group or across a corporatewide WAN.*

settings ranging from small work groups to corporatewide efforts.

CenterLine says that ResourceCenter uses lexicon-based searching technology. Users locate and retrieve software and related assets (like documentation) from within source and object code, documentation, analysis and design documents, email messages and bug-tracking reports. The product also features automatic dynamic indexing to ensure that a search yields the most up-to-date version of any assets.

Today, relatively few developers would quibble about the importance of software reuse, nor would they question the necessity of a tool to make reuse easier. One of the longest running scandals in the industry is the inability of software developers to locate, much less reuse, code once it has been written.

CenterLine's timing in bringing out the product is significant. ResourceCenter is the company's first major effort that does not spring from its existing line of debuggers and development tools. It is, in effect, a new line of business for the company.

CenterLine may very well need a new product line. Its debuggers and similar products have always been popular with developers. In recent months, however, Sun has pushed aggressively into the same market. Some analysts are suggesting, in fact, that any development tool that works with its own compiler (as CenterLine's does) may be

in for stormy weather. But ResourceCenter, of course, has no such link.

ResourceCenter links CenterLine's family of debugging and development tools. It can also connect to other companies' tools. Moreover, ResourceCenter will come with descriptions of third-party vendor class libraries including those from Third Wave and Dyad Software Co. A developer can thus quickly determine if a component is available in a commercial catalog. CenterLine is also seeking relationships with other third parties.

ResourceCenter will first be available on Sun SPARC-based systems under Solaris 2.3 and SunOS. It will later be available on the Hewlett-Packard Co. 9000 Series 700 and 800. Pricing for a resource server and five clients is \$19,995, with additional clients at \$995 each.

### **ZCode Founder Decamps**

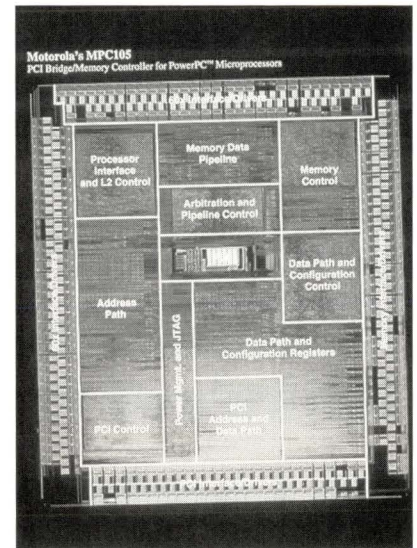
Dan Heller, founder of formerly independent email vendor ZCode and later executive vice president of the ZCode division of Network Computing Devices Inc., has left the company "to pursue other interests." He will, however, remain on NCD's board of directors.

Heller founded ZCode Software Corp. in 1990 to commercialize the email software he had developed. The company was acquired this year by Network Computing Devices, in Mountain View, CA, for a combination of stock and cash.

### **Motorola Shows PCI for PowerPC**

Motorola Inc. has announced the MPC105, a PCI Bridge/Memory Controller for PowerPC boards. The MPC105 is a board-level device that connects PowerPC 601, 603 and 604 devices with PCI local bus architecture.

The product should ease the way for developers who want to produce PCI-based systems with PowerPC chipsets. PCI, or Peripheral Component Interconnect, is one of the hottest new buses in the business. Even Sun is rumored to be considering it as an addition, or even an alternative, to the SBUS.



*A PCI-to-PowerPC interface, the MPC105 is being offered by Motorola as a quick route to integrating PCI systems.*

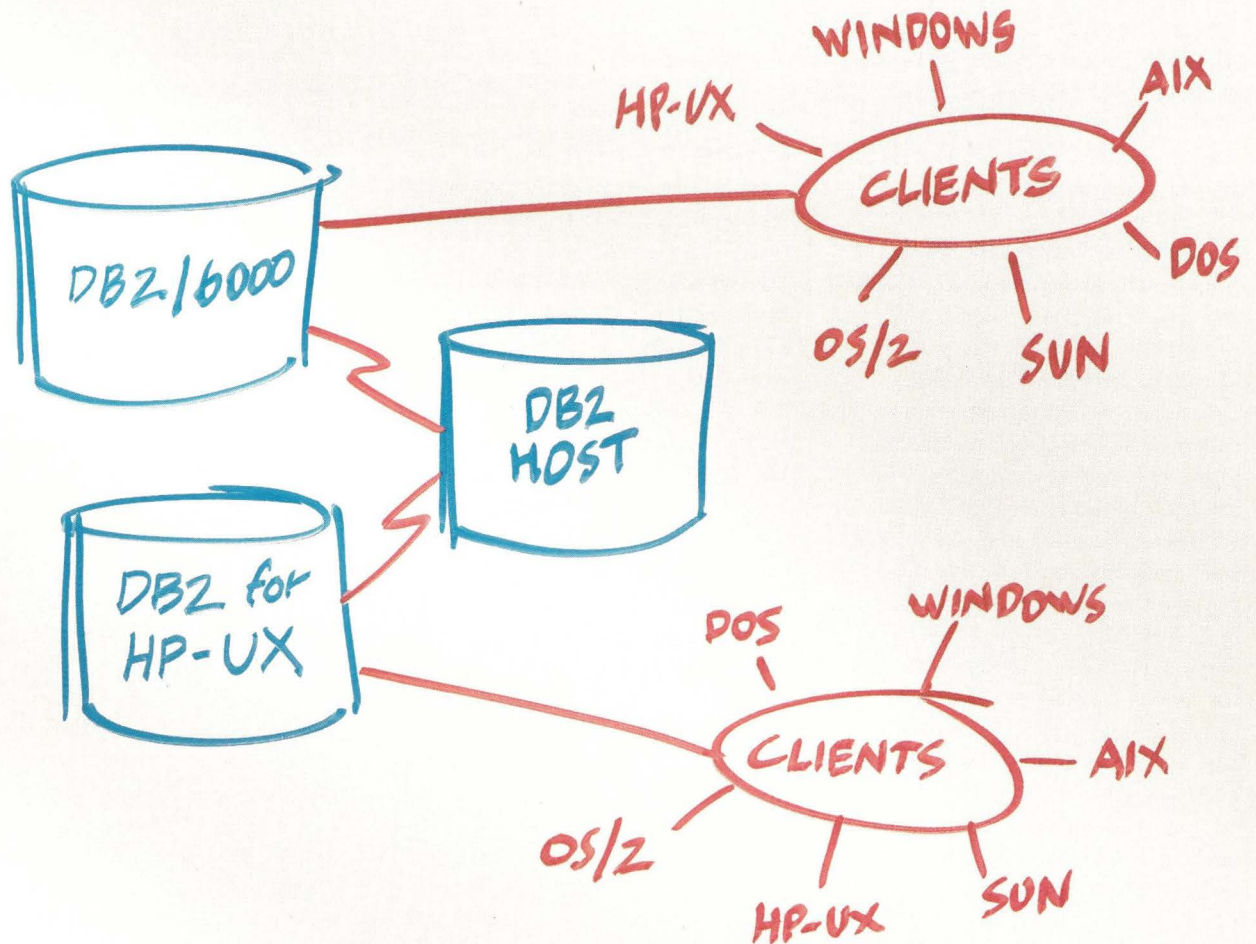
The MPC105 has a number of features to make it appealing to systems integrators. It supports a variety of system configurations for a second processor or memory cache. It has an integrated memory controller that supports DRAM or SDRAM, as well as ROM or Flash ROM configurations. It also has hardware support for four levels of power reduction—nap, doze, sleep and suspend.

But how comfortable are systems integrators with the PowerPC, either with or without the PCI? Apple Computer Inc. remains the sole major producer of desktop personal computers based on the chip. IBM Corp., which was supposed to be the chip's other major user, has not introduced PowerPC personal systems other than workstations and isn't expected to do so until late this year or early next year.

### **Xerox and Sun Sign Master VAR Agreement**

Xerox Corp. has signed a master VAR agreement with Sun. Xerox will remarket Sun equipment, including SMCC's SPARCstation and SPARCserver machines. It will also use SMCC systems and boards in various products of its own.

In return, Sun will also be a remarketer. The company will use Xerox



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products for internal purposes and resell selected Xerox products and services, including Xerox printers. Moreover, Sun will outsource all its San Francisco Bay-area reprographics and postal services to Xerox Business Services.

### Sun and Brixton Do SNA

Sun Microsystems Computer Corp. and Cambridge, MA-based CNT/Brixton Systems, a subsidiary of Computer Network Technology Corp., have signed an agreement to deliver IBM Corp. SNA connectivity products to Sun environments. Under the terms of the agreement, SMCC will license Brixton's connectivity software, including its SNA server/gateway, terminal emulation software and programming interfaces. In return, Sun will contribute its FlexLM licensing program, as well as driver interfaces that link its offerings to Sun's various token-ring and Ethernet connectivity products.

Sun will then market the products as SunLink Version 9.0 for SPARC-based systems. The company plans an Intel

Corp. chip-based version for future development.

### SunNet Manager Supports Solaris 1

SunSoft has enhanced its SunNet Manager network management product to support Solaris 1, a.k.a. SunOS. SunNet Manager 2 had previously been available only on Solaris 2 platforms; SunOS users had to be content with SunNet Manager 1. Now there is a SunNet Manager 2.2 for Solaris and a 2.2.1 for SunOS.

SunNet Manager is a cross-platform network manager and one of the leading packages in the field. A recent International Data Corp. study indicates that in 1993 it had some 31% of the network manager market.

SunNet Manager 2.2 and 2.2.1 share a number of enhancements over the former version. These include simplified installation and configuration, an upgraded Discovery feature that allows users a topological view of either a specific network segment or the entire network, a new ability to create

reusable data and event requests so that users can automate regular requests, support for SNMP Version 2 and better monitoring for lines connecting routers and hubs.

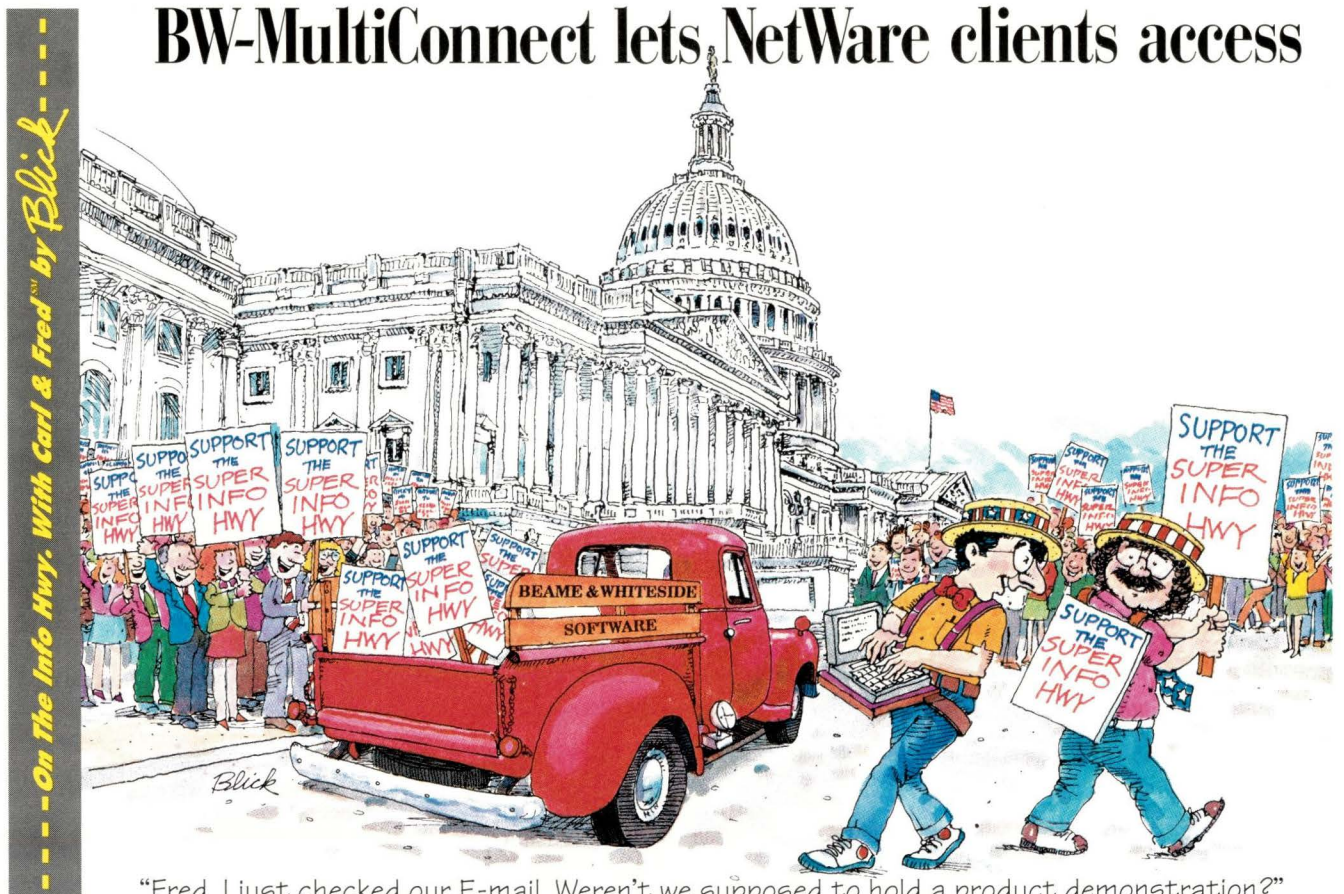
SunNet Manager 2.2 or 2.2.1 can be purchased at a retail price of \$4,995. Customers who already have SunNet Manager on SunOS can upgrade to 2.2.1 for \$1,998. Those customers who have SunManager 2 on Solaris 2 can upgrade to 2.2 for the same price.

### SunSoft's Tools Support Multiple Platforms

A frequent criticism of SunSoft's developer tools is that they are Sun-specific. SunSoft has therefore announced that its premier developer tool kit, WorkShop, is available on Hewlett-Packard Co. HP-UX systems and Novell Inc.'s UnixWare platforms.

WorkShop is available for C, C++ and FORTRAN. It includes compilers and development tools for browsing, debugging, analyzing and tuning

## BW-MultiConnect lets NetWare clients access



"Fred, I just checked our E-mail. Weren't we supposed to hold a product demonstration?"

applications. Also included are features for code management and version control.

WorkShop's introduction last year was widely seen as a direct assault on companies like CenterLine Software Inc. and Lucid Inc. (see "Tapping Client/Server Tools," *SunExpert*, June 1994, Page 50). Some analysts even suggest that companies whose development tools rely on their own compiler are in for rough sailing. The developer-tools vendors and their apologists, meanwhile, argue that SunSoft's offerings could not be taken seriously until they were genuinely cross-platform. Now they are.

### On-Line Service for Workstation Users

Peripherals and systems vendor Andataco, in San Diego, CA, has announced an Internet forum for UNIX workstation hardware, software and service information. Called On-the-Net, the forum, brought to users via a World Wide Web server, will provide information on Andataco's prod-

ucts for SPARC, Hewlett-Packard Co., Silicon Graphics Inc., IBM Corp. and Digital Equipment Corp. platforms. The service is free. Information about On-the-Net can be obtained via email from [ont.andataco.com](mailto:ont.andataco.com).

### SunService Courts Disaster-Recovery Business

SunService, the service and support organization of Sun Microsystems Inc., has entered the disaster-recovery business. In the event of a catastrophic system crash, SunService will move in to help its customers recover as much of their data as possible.

SunService is one of Sun's success stories. Less than four years ago, the organization was considered a joke. Today, it is a major competitor in the service business, giving third-party service providers a run for their money. SunService has also pioneered outsourcing service to the workstation industry; it frequently uses contractors to perform the actual repairs at customer sites.

The company's disaster-recovery program will make use of similar tech-

niques. SunService has announced an agreement with SunGard Recovery Services Inc. under which SunGard will perform the actual disaster-recovery services. In effect, SunService will be remarketing SunGard's program.

### STB Gets Distributor, Loses Director

Bell Microproducts Inc., in San Jose, CA, has been named a U.S. national distributor for Sun Microsystems Computer Corp.'s SPARC Technology Business Group, the organization within SMCC that is chartered to promote the SPARC processor and associated technology. Bell will remarket SPARC microprocessors, chip sets, modules and boards.

The Technology Business Group was created to "promote" SPARC, and being a sales center certainly wasn't one of its responsibilities. Yet now it finds itself in need of a distributor.

STB may be in need of some staff as well. Its former chief, director of SPARC marketing Derek Meyer, resigned in August. —

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TOM BARRETT

by MICHAEL O'BRIEN

*"By George, I think she's got it!"*

—G.B. Shaw, as rendered by  
Rogers & Hammerstein

*"And the Lord said, 'Behold, they are one people, and they have all one language; and this is only the beginning of what they will do; and nothing that they propose to do will now be impossible for them. Come, let us go down, and there confuse their language, that they may not understand one another's speech.'"*

—Genesis 11, 6-7

*"Oremus."*

—Anon.

## Mr. P. Enters a New Age of the World

**Q:** Saaaaayyyy, weren't you mooning on and on about how they were going to have to change the

whole Internet? And wasn't that several *months* ago? How come I never heard anything more about that? Were you just blowing smoke, or what?

A: Mr. Protocol never blows smoke. In today's climate, that's much too risky an occupation. Anyway, I don't think he has any vices, mostly because the thought has never occurred to him. Now you know another reason why I'm the only person who can stand to be around him.

But no, he wasn't fibbing in this case either. And now that the most recent meeting of the Internet Engineering Task Force (IETF) has just concluded

and has made a preliminary choice on how to upset everyone and cause untold grief for years to come, and save the world at the same time, it's probably time to give another report. The preliminary returns are in, and there's a tentative choice for the next version of IP.

So who cares?

Mr. Protocol is glad you asked. This is, after all, his lifeblood we're talking about.

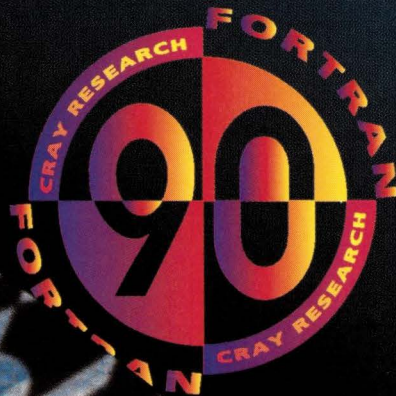
In good science fiction, large gobs of indigestible fact are so cleverly concealed in the action of the story that readers don't recognize just how much stuff they've been force-fed. Unfortunately, this isn't a science-fiction story—if it were, I'd be paid considerably less (which is one good reason why Mr. Protocol will never win a Hugo award). So, we'll have to take



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our indigestible lumps straight and make the best of it. Which is to say, we must recapitulate.

Our Story Thus Far: When we last saw our heroes, they were thrashing around in the swamp. Well, more or less. Actually, they were showing signs of having outgrown the swamp and were searching for a better piece of real estate to thrash around in.

The Internet is based on the notion of an Internet Protocol, called IP. IP was not designed to carry user-level information on its own, but to act as an encapsulating protocol, a sort of wrapper whose data portion carries any one of several higher-level protocols, each designed for a different application. Perhaps the best-known of these is the Transmission Control Protocol, TCP, upon which most of the familiar Internet applications (Telnet, FTP, Mosaic, etc.) are founded.

IP was originally designed to solve the ARPANET's grave problem, which was connecting all of the local-area networks that sprang into existence following the widespread adoption of Ethernet LAN technology. The ARPANET was wonderful at connecting individual host machines sporting a wild diversity of machine architectures, but it had no notion that independent networks existed. IP's division of what on the ARPANET had been a host address into a single field containing both host and network addresses solved this problem.

This division also solved another problem that the ARPANET never actually had to face: too many hosts. The ARPANET's host address field had to be expanded over the initial 256 hosts, of course, but the problem of connecting local nets became pressing before the ARPANET ran out of host address space, at least in the final incarnation of the ARPANET's NCP protocol. IP attempted to eliminate address space problems by providing a 32-bit field to hold the host and network address, allowing this space to be chopped up in three different ways, corresponding to Class A, B and C networks.

This method worked for years. However, chopping things up on 8-bit boundaries did tend to make things a

little rigid, as it turned out. Class B addresses are made up of 16 bits each of host and network addresses. This means that there can only be roughly 16,000 Class B networks. Unfortunately, most reasonably big organizations want a Class B network number. Really big institutions want a Class A address. There aren't many organizations big enough to justify that, but it turns out that there are a *lot* more than 16,000 midsize organizations, and they're all clamoring for Class B addresses.

There are stopgap measures, to be sure. One of them, Classless Internet Domain Routing, or CIDR, attempts to create what one might call "Mega-C" networks, by aggregating several consecutive Class C addresses (and there are a lot, as you might imagine, 24 bits' worth) into a larger pseudonet- work using a technique called subnet- ting. This technique is being applied vigorously, and it seems to be working. The pressure for Class B network num- bers is being relieved, at least according to the statistics kept by the people who hand out network numbers.

This is only an interim measure, though, and other steps have been taken. Several groups are working on different designs for the next generation of IP, called "IPng," at least during the development stage. And, at this year's IETF meeting, the IPng Steering Committee announced its tentative-choice winner—the next Internet Protocol.

YOO-HOO! LOOKY HERE! For those of you who were just skimming this column instead of trying to read all of it word for word in one sitting, this is where the boring and repetitive exe- gesis ends and we get into the good stuff. Short form: The winner is SIPP, the Simple Internet Protocol Plus. Long form: the rest of this column.

It would be useful only to those who are familiar with the candidates and the process for Mr. Protocol to discuss SIPP alone. Instead, he says, he's going to discuss all of the candidates. Well, wrong tense, really. He already dis- cussed all of the candidates. And dis- cussed. And discussed. Thanks to Mr. P., there are entire weeks of my life of which I have no clear memory. If my eyes had been any more glazed they'd have been marzipan. I'll spare you that. That's why they pay me.

By the time the effort to choose a new version of IP became well-orga- nized, there were three major candi- dates. The first is called CATNIP, which stands for Common Architec- ture for Next-Generation Internet Protocol. Its charter was given as follows: "The objective is to provide common ground between the Internet, OSI and the Novell protocols, as well as to advance the Internet technology to the scale and performance of the next generation of internetwork tech- nology."

The IPng Directorate found that the CATNIP proposal seemed both com-

plex and incomplete, yet it had the best vision. However, no one had any field experience with it.

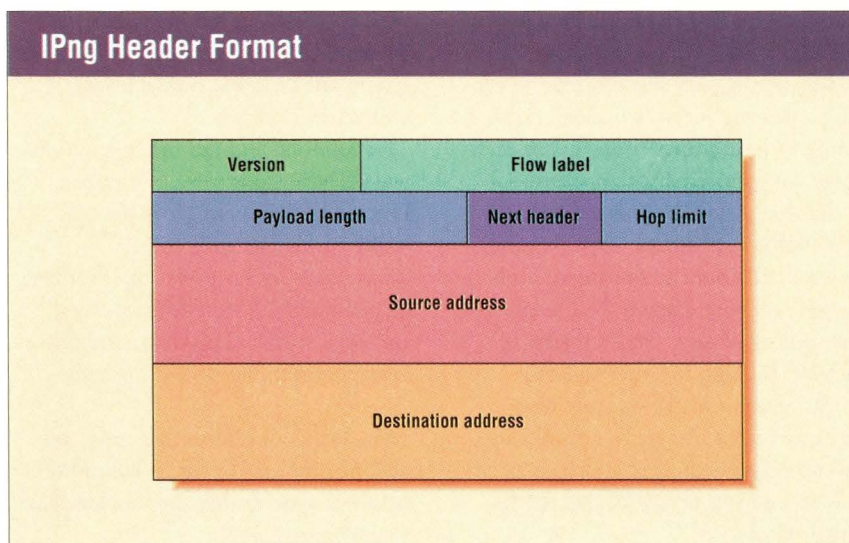
SIPP (Simple Internet Protocol Plus) was the next candidate. It had the fol- lowing charter: "SIPP is a new version of IP which is designed to be an evolu- tionary step from IPv4. It is a natural increment to IPv4. SIPP is designed to run well on high-performance net- works (e.g., ATM) and at the same time is still efficient for low bandwidth networks (e.g., wireless). In addition, it provides a platform for new Internet functionality that will be required in the near future."

SIPP, as originally proposed, had its fair share of problems. Its addressing model, IPAE (IP Address Extension), had severe operational flaws. Its extended addressing was too complex to explain easily, and its 64-bit address field was regarded as too small. Problems with authentication and support for mobility were also identified.

The third candidate, and the one that seemed to have the inside track, was called TUBA (TCP/UDP with Big Addresses, though it later took the formal name TCP/UDP Over CLNP- Addressed Networks). Its charter was: "The TUBA effort will expand the ability to route Internet packets by using addresses that support more hierarchy than the current IP address space. TUBA specifies the continued use of Internet transport protocols, in particular TCP and UDP, but specifies their encapsulation in ISO 8473 (CLNP) packets. TUBA seeks to upgrade the current system by a transi- tion from the use of IPv4 to ISO/IEC 8473 (CLNP) and the corresponding large Network Service Access Point (NSAP) address space."

This proposal had one shining advan- tage and one major flaw, and they were the same: The proposal amounted to using the closest ISO equivalent to IP. IP had a big enough address space to solve any future expansion problem (the NSAP address is extensible and can be as big as required), and was already a worldwide ISO standard. Suddenly, the proposal turned into a political football and firecracker all rolled into one. For years the IETF had, in some peoples'

Figure 1. Old Packets in New Protocols



views at least, succeeded in trouncing the ISO protocols in the marketplace simply by ignoring them and going its merry way.

Those who expected this approach to fail miserably, as most efforts to ignore major worldwide standards had expired in the past, founded their expectations on this experience alone. IP/TCP did not go away. ISO did not become ubiquitous. However, the thought of using CLNP-based addressing had wide-spread appeal because there were certainly a large number of ISO implementations and installations. This would allow the Internet and the ISO world to merge, if not seamlessly, then to a degree.

Others felt that the transition was a large mistake. First, it would amount to handing over control of the Internet's most basic protocol specifications to a body over which the IETF had no authority. Second, not everyone was enchanted with the idea of variable-length addresses. It was felt in many quarters that when truly huge networks were created, routing variable-length addresses would put impossible demands on the routers' computational speeds.

After identifying what were felt to be serious flaws in all three major contenders, the IPng Directorate eventually settled upon the use of a modified version of SIPP. The address space was expanded to 16 bytes (128 bits) and the problems with authentication and mobility were worked out or, at least, worked on.

The result is an IPng proposal that resembles SIPP with large addresses. The header format of the new protocol is shown in Figure 1. Although some of the names are different, most of the fields come straight from the current IPv4. The version number is 6, as opposed to 4 for the current IP. The Payload Length is the length of the data segment, and the Next Header field uses the same numbers as the IPv4 Protocol field. The Hop Limit is the current Time to Live field, renamed to represent the actual use of the field. In IPv4 the Time to Live was supposedly specified in seconds, but the field was universally used as a hop count.

The Flow Label field deserves special mention. This is the only truly new part of the header, and it represents an entirely new concept in internet-working—the notion of Quality of Service.

Until recently, the Internet was a highly egalitarian place. Everyone's packet could be delayed or dropped as easily as everyone else's packet. After all, if an FTP session took minutes instead of seconds, it was merely an invitation to play solitaire in another window until the damn thing finally finished. And if mail was delayed a little, who cared? It all took place in the background anyway, so no one would ever notice. Sure, Telnet got jerky and painful sometimes, but that's life. Anyway, most UNIX systems gimmicked the socket delivery mechanisms to help along interactive use.

Then disaster struck. People started doing things like audio conferences, and even live video (usually from IETF meetings, on a proud-father basis). Live video from Europe did not work. It did not work a whole big bunch. And this is supposed to be the basis for 500 channels of interactive television? (N.B. On the growth of the Net: What used to be "500 channels of interactive television" is now being touted as "1,000 channels of interactive television." This is the same as getting really good at air guitar through constant practice.)

Obviously what was needed was some sort of Quality of Service mark on the packets. And note the capitalization. This was to be a formal part of the spec.

However, it's not just a matter of setting a priority bit on a packet and then doing a "best-efforts" boosting at each stage. Unfortunately, it's not easy to avoid this. After all, IP is at base a "best-efforts" protocol. Any packet can be dropped, and the routing of each packet is theoretically independent of the routing of any other. Quality of Service, though, in order to really work, requires reserving sufficient resources at each stage to ensure end-to-end performance. It is at base an end-to-end specification, and that is antithetical to IP.

Well, not any more.

As specified in the current SIPP draft, "A flow is defined as a sequence of packets sent from a particular source to a particular (unicast or multicast) destination for which the source desires special handling by the intervening routers. The nature of that special handling might be conveyed to the routers by a control protocol...or by information within the flow's packets themselves... The details of such control protocols or options are beyond the scope of this document."

In other words, it's something like a connection, but not quite, because it doesn't actually say anything about *how* the packets are to be routed or treated. It merely provides a name space for special handling options defined in the future.

And yes, in case you hadn't noticed, there's no checksum. These days, IP is generally carried over link-layer protocols (like Ethernet) that have their own checksums, and "data transport" protocols like TCP also have their own checksums. Therefore, the draft IPng spec places requirements on upper-level protocols that treated checksums loosely, to tighten up, and has eliminated the checksum at the IP level.

Mr. Protocol hopes you won't be too exercised if he remarks that it looks like IPng is working without a net. ➡

---

**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](mailto:amp@expert.com).

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GREG HALLY

by **PETER COLLINSON**  
Hillside Systems

## HyperText Markup Language

**L**ast month, I talked about how the National Center for Supercomputing Applications' Mosaic client is used to access the World Wide Web, or WWW. I also discussed how pages are addressed using URLs, or Uniform Resource Locators. The main piece of unresolved business from that column was the idea that you should have your own home page. If you start Mosaic from your home page, it will spring into life more quickly because it will not have to make an external connection from your machine. Also, you will not contribute to overloading NCSA's machine resources by getting its home page every time.

WWW pages are written in HTML, the HyperText Markup Language. (The word "markup" here is a printing and publishing term for marks written on the raw text that tell the typesetter how the text is to be laid out on the page.) HTML is made up of text and has embedded instructions describing how the text is to look when it appears on the screen.

The HTML page is transferred into your WWW client, where it is formatted and displayed. The page adapts to the

settings you have established in your client, using your fonts and the page size that you have selected. It is this feature that makes WWW such a delight to use; the text that you see comes out looking as if it were designed to fit your screen. In turn, this makes it easier to read.

HTML provides a fairly basic level of formatting. You specify the page's title. In the main body of your text you can define things like headings, new paragraphs, line breaks and bulleted lists. You have some control over the type of font being used, so you can use bold or italic characters for emphasis, or show characters in fixed-width font for computerese. You can pull in graphics in the form of bitmaps. And, most importantly, you can specify links to other documents.

### Basics of HTML

HTML is derived from SGML, the Standard Generalized Markup Language. SGML has been under development for some time and provides a means of generating markup languages. SGML is an International Standards Organization

# Wanna Be Insignia.

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Number of compatible applications you can run	Thousands	13 ?
Networking capability	Yes — supports NetWare, LAN Manager, Banyan VINES, TCP/IP	Not yet
Number of UNIX platforms you can run them on	Sun, HP, IBM, Digital, and SGI	3 ?
Availability	Shipping	On & Off
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standard, perhaps proving that not all ISO standards are bad. It does not define a markup system; rather, it specifies a way to generate a standard set of markup languages. If you like, it specifies the syntax of how to do markup, but not the semantics of particular keywords or how the embedded instructions should be interpreted. It's a way of deriving a markup language, not a markup language itself.

**H**TML has a new specification that has been defined but is not yet in general use. Some of the new features are implemented in extant viewers, like Mosaic.

An SGML document consists of three parts. The first part is the character set to be used with the document. The second part defines the document type and specifies the syntax of the language that is embedded in the third part, the user document itself. For HTML, we only specify the user document—the other two parts are assumed. However, most of the available HTML editors are actually SGML editors and are supplied with the first two parts so they can check the syntax of the user document.

The HTML document markup is specified by using “tags.” These are sections of the text embedded in less than/greater than signs. For example

```
<TITLE>This is a title</TITLE>
```

This is a single tag because it marks an area of text. The tag name is placed inside the first half of the pair of angle-bracketed sections, the “start-tag.” The text that it marks, often called the “content,” comes next. The “end-tag” follows; it's the tag name prefixed by a slash.

Tag names are case-independent, and you will find that some people write them in lower case. I'm going to stick to upper case here for clarity. Also, HTML ignores the actual formatting of the source, so newlines in the input are just ignored. This is the same title:

```
<TITLE>
This is
a title
</TITLE>
```

You can omit the end-tag in some circumstances, at the end of a paragraph, for example. New paragraphs are introduced by `<P>` and terminated by `</P>`; you don't need the end-tag here. Also, some tags consist of just a start-tag with no content or end-tag. An example of this is `<BR>`, which forces a line break.

If you use the Mosaic “View Source” menu selection (in the “File” menu), you can see the markup used by the document you are viewing. You will find that some earlier documents use an older form of paragraph specification. The `<P>` is used to separate paragraphs and often appears at the end, rather than the start, of the section. Mosaic will accept this form.

However, it's best to avoid this usage. HTML is migrating toward a new specification that follows the SGML rules more closely. In fact, HTML has a new specification that has been defined but is not yet in general use. Some of the new features are implemented in extant viewers, like Mosaic.

## Headings and Lists

OK, so HTML can define paragraphs and line breaks. What else can it do? Well, we might want to give headings to sections of the text. HTML defines six styles of headings, with the top level being number one:

```
<H1>Heading</H1>
```

To get further levels “down,” you simply increase the number. It's up to the client how these are shown to the user. Mosaic uses smaller point sizes as the numbers increase. It's regarded as good style to only increase the numbers by one, so, for example, a sixth-level heading will only appear after a fifth-level one.

A common need is the ability to specify lists of items. An “ordered” list is marked with digits, so

- first item
- second item
- third item

Notice that the list is indented. It's generated by

```
<OL>
<LI>first item</LI>
<LI>second item</LI>
<LI>third item</LI>
</OL>
```

The whole list is enclosed in the `<OL>...</OL>` tag, and each item is inside a `<LI>...</LI>` tag. You can omit the `</LI>` end tags. This works for Mosaic. Strictly, you should not omit the last one, before the `</OL>`. Some WWW clients may enforce this standard, and your document won't be rendered correctly. I feel that it's better to use the balanced syntax.

Notice how the syntax makes it easy to place lists within lists, although you cannot guarantee that the client will get the numbering right.

If you don't want to number the elements of the list, then you can generate a bulleted list by using the `<UL>` tag. This is an “unordered list,” hence the mnemonic. If we replaced the `<OL>` with `<UL>` in the example above, we would get

- first item
- second item
- third item

Finally, there are “discursive” lists intended to deal with



situations where a textual paragraph tag is needed. For example:

```
Douglas Pryor
  Editor-in-Chief
Michael Jay Tucker
  Executive Editor
Lisa Guisbond
  Managing Editor
```

This is expressed as:

```
<DL>
<DT>Doug Pryor</DT>
<DD>Editor-in-Chief</DD>
<DT>Michael Jay Tucker</DT>
<DD>Executive Editor</DD>
<DT>Lisa Guisbond</DT>
<DD>Managing Editor</DD>
</DL>
```

You can place paragraphs inside the `<DD> . . </DD>` tags, and they should be indented correctly.

## Fonts and Characters

You can't specify what fonts the user will see when looking at your document, but you can add *emphasis*. HTML has two levels: `<EM>emphasis</EM>` will generally produce the word in italics and `<STRONG>over-emphasis</STRONG>` will print it in bold. The UNIX world seems to use bold a lot in its documents. If you look, you will find that printed material rarely uses it, except in headings. I've stopped using bold when I write things. It works well on a screen, though.

If you really want to italicize the text, then you can use the italic tag: `<I>...</I>`. Similarly, the `<B>...</B>` tag will print bold.

Authors who write on computer topics, such as myself, have a great need to specify things in a fixed-width font. I use a fixed-width font all the time in these articles. There are several ways to do this in HTML. If you want to pull in a huge chunk of text and have it displayed in a fixed-width font, then enclose the text in `<LISTING>...</LISTING>`. There is a mechanism for pulling the data from files should you not want to put the actual text in-line.

For small examples of preformatted text, you can use the preview tag `<PRE> . . </PRE>`. This will retain any line formatting you supply, so you can reproduce fixed-width text from a program source or take the output from a command without the need for any editing. It's perhaps better to use the `<XMP>...</XMP>` for program source because, unlike `<PRE>`, it starts the text and will also reproduce any angle brackets.

Finally, changing the odd word here and there is done with the `<CODE>...</CODE>` directive; you can use `<TT>...</TT>` also.

There needs to be a way of getting the `<` and `>` characters into the text. You can insert them with a generalized escape mechanism that is introduced by an ampersand. `&LT` and `&GT` create `<` and `>`. The ampersand character itself is `&AMP`. There are also a whole bunch of accented characters you can access. This escape mechanism is perhaps the one good

reason for using an HTML editor. These commands reportedly translate your character into the ampersand form.

## Links

Strangely enough, there isn't much more to HTML—I have pretty much covered the basics of the language. You are now in the position to generate creditable-looking pages of text. You will, however, want to include links to other pages. For this, you will need a URL to give the address of the page the text points to. I talked about URLs last month; if this is confusing, you should dig out the September issue of *SunExpert* and take a look.

You place links in your document by including an anchor tag, which looks something like the following:

```
<A HREF="http://somesite.dom/">
Button Text
</A>
```

The start-tag contains the URL of the remote file, in this case another HTML file on another machine. "Button text" is the area of the screen where the user points the mouse and clicks to select the URL. Button text would be part of the normal text formatting were the text not surrounded by the anchor tag. It helps if you want to include tags as part of the normal text flow.

If you place a number of URLs in a document, you don't have to specify their full addresses. You can instead use a partial URL. A remote client will use its own context to find the file on your server. For example, the link from my home page to my list of *SunExpert* articles is:

```
<A HREF="/local/sunexpert.html"> List of
<EM>Sunexpert</EM> articles </A>
```

The data is stored in a subdirectory called `local` under my server's root tree. It's always a good idea to use a partial URL since it makes your document location-independent.

What you choose as a text for the link is up to you. Remember that people expect links and know how to deal with them. Don't abuse that knowledge. I feel that it's better to say (the italics represent the link):

Here is more information on *Educational Courses for Aardvarks*.

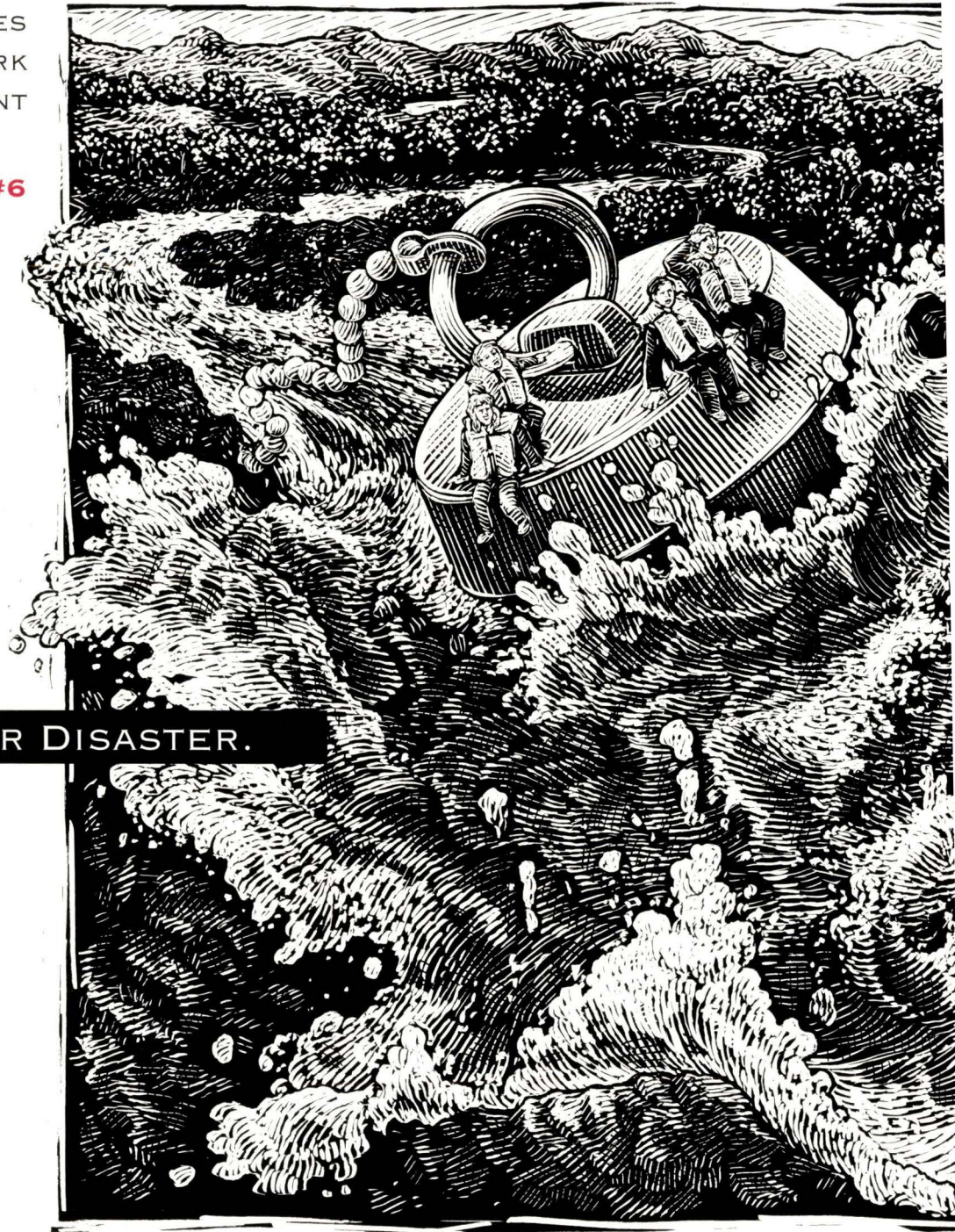
rather than

Information on Educational Courses for Aardvarks is *here*.

or worse

Click *here* for more information on Educational Courses for Aardvarks.

This latter form also assumes that the reader has a mouse-based interface, and this is by no means always the case.



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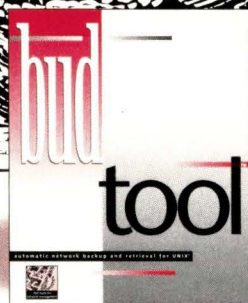
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You can use anchors to mark places within a single HTML document:

```
<A NAME="here">
```

and then give the reader a link that will position them at that label:

```
<A HREF="http://eek.com/f.html#here">
text
</A>
```

This means that you can give people choices about where they want to go in a document so they can skip to the bit they are interested in.

## Including Images

One of the good things about WWW is its ability to include graphical images in your document. The images can be stored in JPEG or GIF format. You pull them in using something like:

```
<IMG SRC="pic.gif">
```

There is no end-tag, as this will place the image as part of the normal text positioning. Images that are included one after another are placed side-by-side on the user's screen. You need to use `<BR>` or `<P>` to force "line breaks."

If you include an image and then place some text after it, you can define where the text will be placed relative to the image.

```
<IMG SRC="pic.gif" ALIGN="top"> text
```

will align the text at the top of the image. The keywords `middle` and `bottom` will align the text as you might expect. If you miss the `ALIGN` keyword, then the text will be aligned along the bottom of the image by default.

What about people who cannot display the graphical image? Well, it's more than polite to think about them. The text browser defaults to display something like `IMAGE` where your graphic would appear in the text. To show something specific to these deprived users, you can supply some alternative text:

```
<IMG SRC="blob.gif" ALIGN="top" ALT="@">
```

The `ALT` keyword is followed by some text that substitutes for the image. The image here is assumed to be a replacement for a bullet, and so it's appropriate to replace it by the `@` symbol. If you want nothing to be displayed, then you can use `ALT=""`.

You can make an image into a link by defining it in an anchor tag:

```
<A HREF="data.html">
<IMG SRC="pic.gif">
</A>
```

You'll find that many people provide small copies of bit maps that are placed in-line in the document. Clicking on the icon will pull the full image into an external viewer.

## Document Formatting

The whole HTML file should follow a standard form. I have a little template that I use, and I include that here, split into two sections. The entire document should be enclosed in a `<HTML>...</HTML>` tag. Within that the document is split into a standard header and a body. The start of the template is:

```
<HTML>
<HEAD>
<TITLE>Example HTML layout</TITLE>
<LINK REV="made"
HREF="MAILTO:pc@hillside.co.uk">
</HEAD>
more to come
```

The head of the document contains the title displayed in the top line of the Mosaic window. The title should be descriptive and stand on its own. A title like "Introduction" should be avoided; use something that describes the document ("Introduction to Aardvark Education"). It's best if the title is no more than 64 characters in length, so it will fit into the space provided by most applications.

The `LINK` line, one line down, has a bit of magic. Use the `REV="made"` statement—you should also set the mail address to point at you. It's a good idea to include this line in your document because it gives your email address, which is used by some browsers (notably on the Lynx line) to send errors when links break.

The body of the document follows. It's good practice to sign each page and place a date when the page was last changed. My HTML page template continues:

```
continued...
<BODY>
add interesting information here
<HR>
<ADDRESS>
<A HREF="/local/pcsig.html">
Peter Collinson</A>
Last change: DATE HERE
</ADDRESS>
</BODY>
</HTML>
```

The body of my documents consists of some information followed by a signature. The `HR` tag adds a horizontal rule. A "rule" is the word in printing terminology for a horizontal line. When using Mosaic on a color screen you will see a horizontal indentation in the gray background. On a monochrome screen, you will get a black line. You can use rules anywhere; I like to have one above my page signature.

My signature lives in an `<ADDRESS>...</ADDRESS>` tag. In Mosaic and some other browsers, this causes a font change. On my system, all addresses are shown in italics. The first item in the address section is a link to my personal page, which means the text *Peter Collinson* can be selected for more information about me. The second item—the date that you last changed the page—is equally important. We then wind down to the end of the document, supplying all our needed end-tags.

## Final Bits and Pieces

I have just managed to describe nearly all of today's HTML language. There are still some things missing, so don't view this description as complete. While researching this article, I found that there are several different views of what HTML does. It seems to me that the standard is not being enforced strongly enough by the browsing programs, and this is perhaps a bad thing because mortals like myself are unsure how to format pages in a way that will continue to work.

I have covered enough here for you to be able to create complex documents. If you want to fill in the missing bits, get on the Net and look at various HTML documents (see below).

As you have seen, you can create your own home page using your favorite text editor. There are some editors that automatically deal with tags for you, but I haven't found one that I like yet for UNIX. There are some emacs macros that can do this job, too.

To test your home page, it's sufficient to use

```
% xmosaic file.html
```

This will start up Mosaic with the page loaded. Mosaic caches pages, so if you edit the file "behind its back," you will need to hit the Reload button to see the new contents.

When you are happy, you can start Mosaic using your page as its home by setting the X resource

```
Mosaic*homeDocument: filename
```

to point at the page. Add this to your X resources file. It's also a good idea to make this filename a path from the root of the file system. This way, you can start Mosaic from everywhere on the system. Contrary to popular opinion, you don't need a WWW server to point at your home page.

## Further Reading

My sources for this article are both on the Net. The first of these is the *Introduction to Writing HTML* by Peter Flynn at the University College, Cork, Ireland. You can find this document at <http://www.ucc.ie/info/net/htmldoc.html>. The second is the *Style Guide on Online Hypertext*, a treatise on the style of writing HTML, by Tim Berners-Lee from CERN in Switzerland. This document can be found at <http://info.cern.ch/hypertext/WWW/Provider/Style/Overview.html>. By the way, a really good place to start looking for WWW- and HTML-related documents is the *Developer's Jump Station*, available at <http://oneworld.wa.com/htmldev/devpage/devpage.html>. If you are curious about my home page, then access <http://www.hillside.co.uk>. Thanks to Peter Flynn for perusing a draft of this article. ➔

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

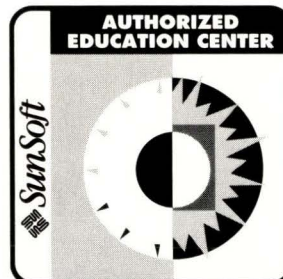
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ROBIN JAREAUX

by RICHARD MORIN  
Technical Editor

The May 1994 issue of *UNIX Review* sports the headline “Goodbye Berkeley”—and the sub-head “Tributes to BSD From Kirk McKusick, Bill Joy, Mike Karels, Dennis Ritchie.” The cover shows the famous Berkeley daemon, now sad-faced and preparing to `exit()` the scene. But if I were designing the cover, there would be a note at the bottom saying something like “Just kidding....”

Because, you see, Berkeley UNIX is far from dead. Its technology is all around us. Sit down at any current UNIX box, and you will be confronted with Berkeleyisms: long file names, symbolic links, `csh`, `sendmail`, `vi`. It's clear that Berkeley's ideas haven't gone away. Rather, they have infected the entirety of UNIX.

Nor have the developers and users departed. Many of the developers who contributed large chunks of code to BSD are alive and well and quite

## The BSD Virus

actively writing code. And the “Berkeley Bigots” in the user community are very much with us. They (we, really) are loud and persistent in demanding that assorted Berkeleyisms be retained in commercial versions of UNIX. Much of the continuing resistance to Solaris, in fact, stems from the system's non-Berkeley features and appearance. (Inefficiency and instability also play a role, to be sure.)

When Berkeley Bigots can't get a vendor to install a BSD command, they are likely to do it locally, using whatever sources are closest at hand. In the past, this has caused some legal concerns: Few hackers have UNIX licenses, but lots of them have source code. Fortunately for the institutions involved, AT&T/USL/Novell have been slow to act on these depredations.

With the release of 4.4BSD-Lite, however, even this worry is largely gone. The release contains several hundred commands in full source for all to see, hack and redistribute. Don't like the

Solaris `foo` command? Get the BSD code and hack up your own version!

### How to Get It

If you are on the Internet, you should be able to ftp 4.4 BSD-Lite quite easily. The entire distribution gzips to only 41 MB, and I expect a number of sites around the world will carry it. At this writing, Archie finds it only on `freebsd.cdrom.com` and `lth.se`, but sites like `ftp.uu.net` and `gatekeeper.dec.com` will probably have it on-line by press time.

4.4BSD-Lite will also be available in assorted CD-ROM versions. Some vendors, such as Prime Time Freeware (`ptf@cfcl.com`, [408] 433-9662), will include gzipped tar archives of the release. This conserves space on the CD-ROM and is portable, but it's not all that convenient for browsing.

Consequently, you may wish to get one of the Rock Ridge versions. Both O'Reilly & Associates Inc. (`order@ora.com`, [800] 889-8969)

and Walnut Creek CD-ROM Inc. (info@cdrom.com, [800] 786-9907) publish them.

Most of the Linux vendors mentioned in last month's column ("UNIX-related Freeware CD-ROMs [Take 2]") are likely to start incorporating code from 4.4BSD-Lite into their new releases. This is required, to a degree, by the terms of the settlement of the lawsuit. The agreement requires that Net/2-derived code be removed from distribution. Novell has already sent out letters to ensure this happens. 4.4BSD-Lite also makes sense, however, because of the release's bug fixes, improvements and new code.

In the near future, I expect to see 4.4BSD-Lite code showing up in assorted plug-and-play collections of add-on freeware for commercial UNIX variants. Prime Time Freeware will certainly be including lots of 4.4BSD-Lite code in its upcoming products, and I imagine the Sun User Group and others will, as well.

Finally, there is Berkeley Software Design Inc. (info@bsd.com, [800] 800-4BSD). BSDI provides a complete commercial operating system based on BSD, enjoys a large amount of ex-Berkeley talent and expertise on its staff and promises to deliver a system based on 4.4BSD-Lite by late November. BSDI's product, though not freeware, is available in source form for a reasonable price. If you are planning to base mission-critical applications on 4.4BSD-Lite, BSDI is an obvious candidate.

No matter how you get the bits, you should send away for Usenix and O'Reilly's new 4.4BSD-Lite manual set. At \$150, it's more expensive than the old Usenix manual sets. On the other hand, it's perfect-bound, has snazzy covers (featuring dozens of Berkeley daemons running about) and includes the complete release on a Rock Ridge CD-ROM. If you don't need the disk, you can save \$30.

### Kernel Changes

In true kernel hacker style, the 4.4BSD-Lite documentation spends little time on the release's several hundred applications. Still, the announced kernel changes look pretty tasty:

"The major new facilities available in the 4.4BSD release are a new virtual memory system, the addition of ISO/OSI networking support, a new virtual filesystem interface supporting filesystem stacking, a freely redistributable implementation of NFS, a log-structured filesystem, enhancement of the local filesystems to support files and filesystems that are up to 2<sup>63</sup> bytes in size, enhanced security and system management support and the conversion to and addition of the IEEE Std1003.1 (POSIX) facilities and many of the IEEE Std1003.2 facilities. In addition, many new utilities and additions have been made to the C-library.

"The kernel sources have been reorganized to collect all machine-dependent files for each architecture under one directory, and most of the machine-independent code is now free of code conditional on specific machines. The user structure and process structure have been reorganized to eliminate the statically mapped user structure and to make most of the process resources sharable by multiple processes. The system and include files have been converted to be compatible with ANSI C, including function prototypes for most of the exported functions. There are numerous other changes throughout the system.

"This release includes several important structural kernel changes. The kernel uses a new internal system call convention; the use of global ('u-dot') variables for parameters and error returns has been eliminated, and interrupted system calls no longer abort using non-local gotos (longjumps). A new sleep interface separates signal handling from scheduling priority, returning characteristic errors to abort or restart the current system call. This sleep call also passes a string describing the process state, which is used by the ps(1) program. The old sleep interface can be used only for non-interruptible sleeps.

"Many data structures that were previously statically allocated are now allocated dynamically. These structures include mount entries, file entries, user open file descriptors, the process entries, the vnode table, the name cache, and the quota structures."

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Sounds like a lot of good solid Berkeley-style software engineering, combined with several new features.

### Filesystem Changes

The filesystem stuff also looks pretty interesting. The expanded file and filesystem sizes are coming none too soon, considering the sizes of current and upcoming disk drives. The security aspects also look like a real winner. Here are some detailed extracts:

“The 4.4BSD distribution contains most of the interfaces specified in the IEEE Std1003.1 system interface standard. Filesystem additions include IEEE Std1003.1 FIFOs, byte-range file locking, and saved user and group identifiers.

“A new virtual filesystem interface has been added to the kernel to support multiple filesystems. In comparison with other interfaces, the Berkeley interface has been structured for more

efficient support of filesystems that maintain state (such as the local filesystem). The interface has been extended with support for stackable filesystems done at UCLA. These extensions allow for filesystems to be layered on top of each other and allow new vnode operations to be added without requiring changes to existing filesystem implementations. For example, the umap filesystem is used to mount a sub-tree of an existing filesystem that uses a different set of uids and gids than the local system. Such a filesystem could be mounted from a remote site via NFS or it could be a filesystem on removable media brought from some foreign location that uses a different password file.

“The local ‘fast filesystem’ has been enhanced to do clustering, which allows large pieces of files to be allocated contiguously resulting in near doubling of filesystem throughput. The filesystem interface has been extended to allow files and filesystems to grow to  $2^{63}$  bytes in size. The quota system has been rewritten to support both user and group quotas (simultaneously if desired). Quota expiration is based on time rather than the previous metric of number of logins over quota. This change makes quotas more useful on file servers onto which users seldom log in.

“The system security has been greatly enhanced by the addition of file flags that permit a file to be marked as immutable or append only. Once set, these flags can only be cleared by the superuser when the system is running single user. To protect against indiscriminate reading or writing of kernel memory, all writing and most reading of kernel data structures must be done using a new ‘sysctl’ interface. The information to be accessed is described through an extensible ‘Management Information Base’ (MIB).” —♦

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



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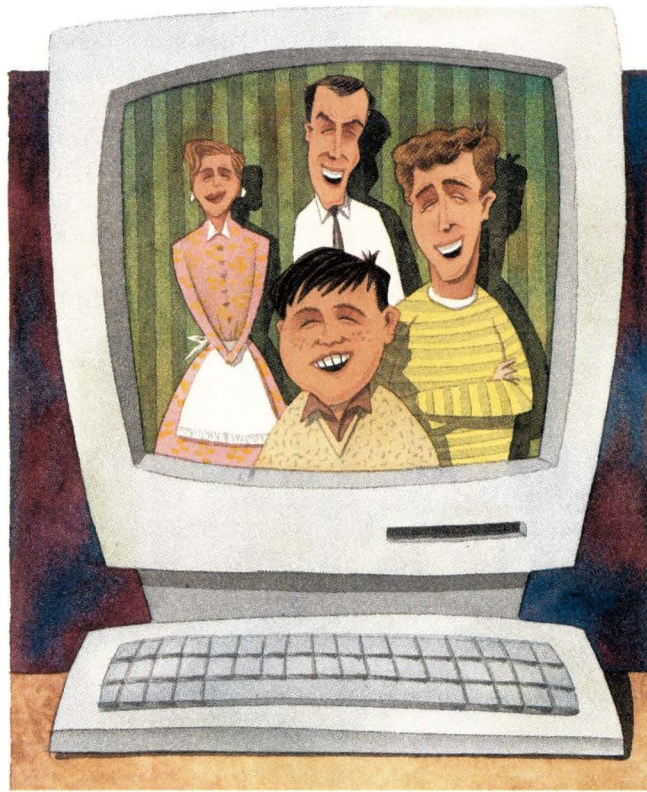


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RUSS WILLMS

## Leave It to Cleavers

by S. LEE HENRY

**T**here aren't many words in the English language that mean both a thing and its opposite. "Cleaving" is one of them. Cleaving means both to bind and to cut apart. What does this have to do with systems administration, you ask? Well, this is the role that a number of network devices play both to join networks together and to segment them into manageable chunks.

Whether you're building a network or dividing one into subnets to improve performance, it's important to have a good understanding of the role each of these "cleavers" plays.

### Repeaters

The simplest of network cleavers—repeaters—are used to connect network

segments at the physical level. Typically equipped with sufficient ports to attach two physical cables or fan out from one to eight, repeaters simply relay everything they receive. They are able to recognize frames, which they then forward from the receiving port to all other ports. They are not selective about what they forward. Consequently, they are very fast. They seldom break down or require any attention.

Repeaters can be used to connect different types of cables, like fiber optic, coaxial or twisted pair. They are fairly inexpensive, typically between \$500 and \$2,000, and dead easy to install. You just plug in the cables. The only "gotchas" to beware of when connecting repeaters are: 1) being sure that the cables you connect are legitimate net-

work segments (i.e., properly terminated); and 2) not violating the "four repeater" rule, which says you cannot use more than four repeaters in sequence without an intervening device such as a bridge or a router.

The primary function of a repeater is suggested by its name. Repeaters "repeat"—that is, they retime packets and send them out afresh. And, in doing so, they strengthen the electrical signals so that the maximum distance of a network segment is extended. Some repeaters will disable ports when they detect more than a certain number of consecutive collisions from the attached network segment. In this way, repeaters can engender some types of network problems—like jamming from an unterminated segment.

## Bridges

Bridges are more discriminating than repeaters about what they forward. Bridges examine the destination addresses of frames and forward them only if the host with that particular address is not on the segment from which the frame was generated.

Just about every bridge in use today is a "learning" bridge. These bridges learn where hosts are located based on observed network traffic. They exam-

ine the source and destination addresses in packets and store this information in tables.

Bridges sometimes get confused when a host is moved from one network segment to another. Some may "unlearn" the old location fairly quickly, but it is a good idea to reset a bridge when this happens to make sure that the correct packets will be forwarded.

Like repeaters, bridges can be used to connect dissimilar media and, like

repeaters, bridges extend the limits of a network segment. However, the main function of a bridge, unlike that of a repeater, is to reduce traffic on the attached segments by passing only those frames addressed to hosts on the other side of the connection.

Bridges also isolate network segments from a number of problems. Malformed frames will not be transmitted. Problems like "giant packets," for example, are not propagated.

Bridges today are often "managed" devices. This means they collect statistics on the traffic they observe and can be queried by the network management software (e.g., SunNet Manager).

Bridges are also clever about detecting loops in networks and will shut down a network segment if a loop is detected. Negotiation between the attached bridges usually determines which leg of the network is to be shut down in order to break the loop and prevent continuous recirculation of the same frames.

## Ethernet Switches

Ethernet switches are newer devices that act as multiport learning bridges. These devices simultaneously connect sets of ports, providing greater throughput than Ethernet's 10 Mb/s. Of course, this ability depends on which segments are sending frames to which other segments at any particular time, but the theoretical maximum is half the number of ports times 10 Mb/s.

Ethernet switches, like the Kalpana, are much faster than bridges. They start forwarding a frame after reading into it only far enough to decipher the destination address. They are, consequently, somewhat less thorough than bridges at isolating network faults.

## Routers

Unlike bridges, which dynamically learn the location of hosts on your network, routers must be told how to learn. They forward frames based on subnetwork addresses. Because of this, they are more difficult to configure and play quite a different role than bridges. Bridges can be installed just about anywhere with some advantage and no particular attention to which hosts appear on both sides (actually, to gain the most advantage, you want

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to keep workstations that share a lot of data on one side of a bridge). Routers need to have all the hosts with a particular subnet address on one port and those with other subnet addresses on other ports. In other words, routers do not accommodate organizations with fixed wiring and a very mobile staff.

Though bridges are more "forgiving" than routers, routers have a number of advantages over bridges. For one thing, routers discard the outer layers of frames and repackage them before sending them on their way. This results in smaller frames being transmitted over intervening connections, creating less load.

Because of the sophisticated routing schemes that routers employ, they can be used to set up firewalls between subnetworks. And since they are not required to replicate broadcast frames, routers offer good protection against broadcast storms. When certain network paths cannot handle large packets, routers can also fragment and reassemble them.

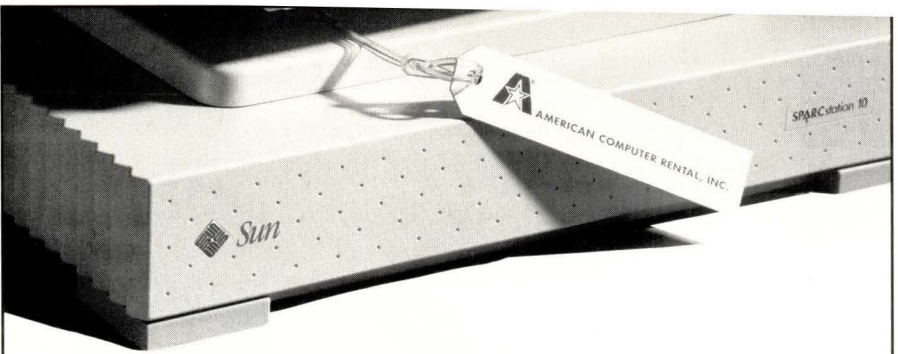
Some routers also use fairly complex algorithms to determine the shortest paths to destinations where more than one path is possible. Routers that use dynamic routing pull routing information from frames received from other routers and network devices. Those that use static routing require this information to be entered manually.

Routers are designed for specific protocols, like TCP/IP and IPX, but can be built to accommodate multiple protocols.

### Which is Best?

Bridges and routers provide some of the same functions but have different advantages. On the other hand, both are changing to incorporate some of the other's benefits. Bridges are beginning to offer more sophisticated frame control, and routers are becoming easier to set up. Bridge/routers, or "brouters," a relatively recent arrival on the clever scene, combine the benefits of bridges and routers by routing for a single protocol and acting as a bridge for others.

Routers are a better choice when you have mixed network types running different protocols and when you require



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a fairly tight routing control for security reasons—like when you're building firewalls.

Bridges are a better choice if you want a large, transparently segmented network without having to keep track of where particular addresses are used.

The purely bridged network is easier to maintain than a routed one. All you need to do with the former is connect the bridges and they do what they can to reduce traffic and isolate network segments from problems. The latter, however, is more efficient; it's smarter about routing and adds less load to connecting network segments. Routers also offer significantly more control and protection against network problems like broadcast storms and are more recommended as the size and complexity of networks increase. "Brouters" should also be considered when multiple protocols heighten this complexity.

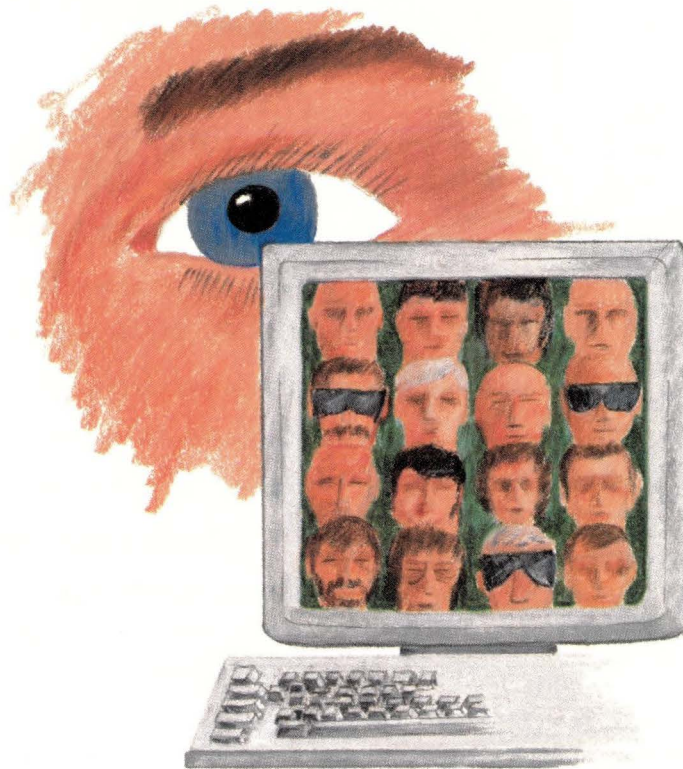
The "gateway," another category of network clever you will hear about, enables connections between dissimilar networks. By operating at higher levels in the networking protocols, gateways translate data formats and move data between networks that use vastly dif-

ferent formats. Strictly speaking, gateways are routers designed to accommodate multiple protocols. But since their main function is to translate at the higher levels of the protocol stack, they are often called "protocol converters" and have a more specific function than general-purpose routers.

Most large "campus" networks will employ both bridges and routers in different capacities. Departments or divisions might be separated from one another by a router, while more mobile groups on a single floor of a building might use bridges to connect.

Though some network devices are more troublesome to configure, the difficulty of configuring them is small compared with the advantages of using the right approach for your network. ➡

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 email to [slee@expert.com](mailto:slee@expert.com).



JOHN W. KELLEY JR.

## The Information Superboogeyman

by ALEX NEWMAN

**A**utumn has blown in with the crackle of fallen leaves and scent of spiced cider. Halloween is right around the corner, and I can't help thinking of ghoulies and ghosties and things that go bump in the night. What scares you? Is it vampires? The dark? Snakes? Insects? How about this for a seasonal scary thought: There's nothing on your computer that someone else can't look at, copy or trash.

UNIX security is improving all the time, but so are the crackers. And these days it's not just crackers that you need to worry about. As the Internet becomes more heavily traveled, every shade of morality and ethics gets an on-line representative.

Even if 999,999 out of every million people are completely honest, that still means that one in a million people will rob you blind if given the opportunity. There is some disagreement on exactly how many millions of people surf the Net, but everyone agrees that number is growing all the time. Traffic on the NSF backbone jumped nearly two terabytes during March 1994, the largest single increase in the history of the Internet and, according to *Investor's Business Daily*, by the end of the year, nearly four million households will have signed on with one of the Big Three on-line services.

Computers and the Internet began as the playground of the technically

proficient, and it wasn't so long ago that the UNIX world was victimized by The Legion of Doom, a group of high-tech terrorists with a comic-book-inspired name. Under the leadership of Lex Luthor, legionnaires like Dead Lord and Lord Digital hacked networks, pirated code, planted bombs and broke into private, government and educational sites with ease and reckless abandon. Eventually, they were caught. Some were prosecuted. Many of the ex-Legion of Doom members now work with or for law enforcement agencies.

Just because the Legion is defunct doesn't mean that computer crime is decreasing. Seven universities, includ-

ing Harvard and the University of California at Berkeley, have reported attacks on their systems in recent months, and Kenneth Rosenblatt, the deputy district attorney for Santa Clara, CA, predicts grim times ahead. "Our society is about to feel the impact of the first generation of children who have grown up using computers. The increasing sophistication of hackers suggests that computer crime will soar as members of this new generation are tempted to commit more serious offenses."

Some of the nastier crimes starting to haunt the Internet, however, aren't always the technical ones. A financial scammer created a fake mutual fund deal and hyped his "money managing" skills through an on-line computer service. His victims included a retiree from Austin, TX, who was defrauded out of \$10,000. In other parts of the country, securities regulators have filed court orders against alleged con artists who have used the Internet to promote and even transact fraudulent deals.

Texas Securities Commissioner Denise Voigt Crawford is afraid this sort of activity will drive people away from the Internet's benefits. "The danger here is that cyberspace, which could be a beneficial way for consumers to do a better job of informing themselves, will instead be discredited as a haven for fast-buck artists," she says. Crawford does not consider herself a computer expert. But she will be a keynote speaker at November's "UNIX & the Law" symposium, sponsored by the Sun User Group, addressing the issue of financial fraud on the Internet. "We're trying to tell people to be careful," explains Crawford. "There is a new fraud on the horizon. Computer users may be sophisticated in some ways; they still are attractive targets because they tend to have discretionary income and are frequently looking for ways to invest their money."

All this gets me thinking. It's a good thing we've got the government to protect us from people who want to use the Net for unethical or illegal purposes—except that's not really true, either.

Depending on whom you talk to, the United States Government might be the biggest, baddest boogeyman of all.

### Organizations Mentioned in this Article

#### CERT

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The Cerplex Group, Inc. has acquired Apex Computer Company, Inc. (Apex) of Redmond, Washington. Apex provides parts, technical training and repair services for UNIX based hardware including Sun, Silicon Graphics, and IBM RISC 6000 systems.

For Cerplex, this acquisition opens the large and rapidly growing market for UNIX. Additionally, it provides Cerplex with a strategic presence in the Pacific Northwest.



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The Escrowed Encryption Standard (EES), which uses the Skipjack algorithm and includes the Clipper and Capstone microchips, is a Federal Information Processing Standard (FIPS) designed by the National Security Agency and approved by the National Institute of Standards and Technology (NIST). Public outcry against the key "escrow" system has been loud and getting louder since the first announcement of Clipper about a year ago. Recently, however, the Clinton administration seems to have backed down on its efforts to push Clipper technology. No less a technologist than Vice President Al Gore has gone on record as saying that future standards will be voluntary and, perhaps more important, exportable. No moves to tighten export controls are planned, and the Clipper chip has been tabled, pending a five-month presidential study.

So it looks like our government agencies were the good guys, then the bad

guys, and now the good guys again. But you can entrust your electronic security to the federal government-sponsored CERT (which used to be short for Computer Emergency Response Team).

CERT was formed in 1988 in the wake of the Internet worm incident. According to its charter, CERT was



**CERT has been criticized for not publicizing security holes as quickly as it knows about them.**

established to work with Internet users and providers "to facilitate its response to computer security events involving Internet hosts, to take proactive steps to raise the community's awareness of computer security issues and to con-

duct research targeted at improving the security of existing systems." CERT provides 24-hour emergency response to computer security incidents, product-vulnerability assistance and seminars and CERT advisories, or bulletins on how to fix known security problems. (CERT advisories are publicized in the `comp.security.announce` newsgroup and are available via anonymous ftp from `cert.org` (192.88.209.5) in the `/pub/cert_advisories` directory. Archives of previous advisories are also kept in this directory.)

CERT has been criticized for not publicizing security holes as quickly as it knows about them. The organization, however, often keeps quiet for fear that crackers would take advantage of publicized holes faster than systems administrators could patch them. And while it is still one of the best sources for computer security information and resources, CERT does not provide source-level patches, instead referring

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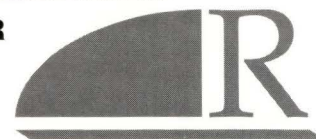
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concerned sites to the appropriate vendor. Unfortunately, only a few vendors make source-level patches available to their source customers; most just distribute binary patches, if they take any steps at all.

CERT's limitations are reflected in its charter and original name. CERT is a response organization, and as such can take only limited action in preventing or predicting computer crime. But what group is taking proactive steps in the cracker crackdown? The answers led me, surprisingly, home.

**T**he Internet is just like any other highway: Remember to drive carefully.

As I mentioned earlier in this column, next month the Sun User Group will be holding a technical conference, called "UNIX & the Law." The message of this conference is clear: As computers are used in more and more aspects of everyday life, lines between technology, legislation and law enforcement begin to blur. "UNIX & the Law" will provide a forum in which members of these three fields can share experiences and ideas. The four-day technical program (two days of talks sandwiched between two days of tutorials) was designed to provide technical, legal and law enforcement attendees with essential knowledge about the other fields.

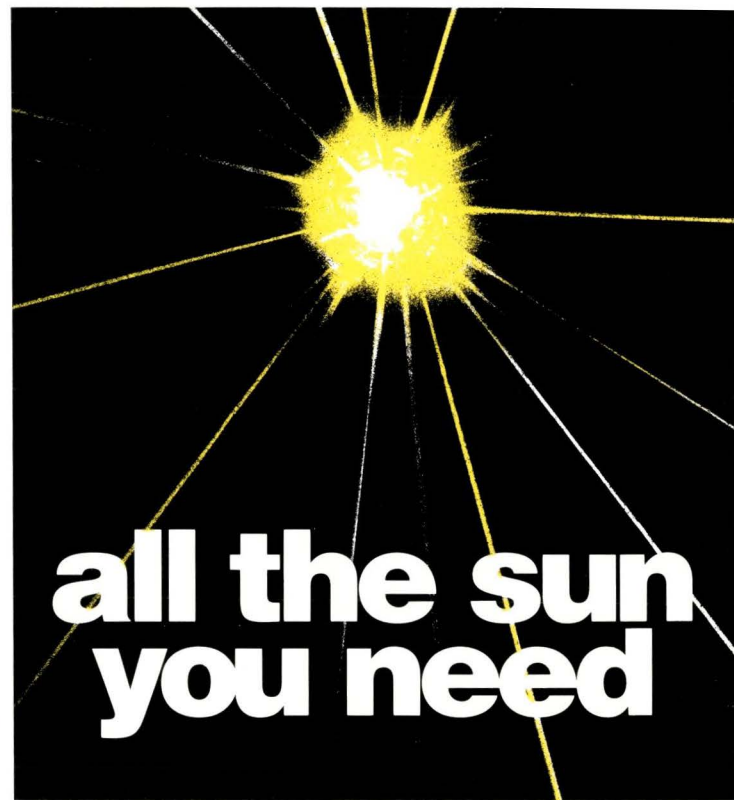
The conference's speaker lineup comes, both literally and figuratively, from all over the map. Some standouts include keynote speakers Crawford and Steve Jackson, president of Steve Jackson Games. Aficionados of the weird may recall that back in 1990, the U.S. Secret Service invaded Steve Jackson's office as part of a confused "hacker hunt," seizing equipment (including an active BBS) and manuscripts of then-upcoming products. SJG sued the Secret Service and the U.S. government and won more than \$50,000 in damages.

The "UNIX & the Law" symposium won't limit itself to examining past and present computer uses and abuses, though. One of the conference's high points is sure to be futurist Bruce Sterling's panel on "The Future of High-Tech Crime." Sterling will be joined by a group of experts—law enforcement professionals *and* convicted computer criminals—who will try to come to a consensus on the direction in which computer crime is headed. Who knows what evil lurks in the hearts of men? You might want to ask these guys.

With all the ways to get held up on the information superhighway, I'm sometimes tempted to just turn off my computer on October 31 and take my chances with the goblins who ring my doorbell. They may take me for all the candy I've got, but they won't ruin my credit rating. On the other hand, when I think about all the treats that I can get on-line, I'm willing to risk it. The Internet is just like any other highway: Remember to drive carefully. →

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Alex Newman is the executive director of the Sun User Group and the editor of its newsletter, "Readme." Email: troll@sug.org.



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The image features a large, glowing orange and yellow sphere that dominates the upper half of the frame. Inside the sphere, a complex network of lines and points is visible, resembling a fiber optic network or a data visualization. A hand, rendered in a wireframe style with glowing orange and yellow lines, reaches up from the bottom left towards the sphere. The background is dark, making the glowing elements stand out. The title 'Networking into' is written in a bold, green, sans-serif font across the middle of the sphere.

# Networking into

**Networking is not a single technology but rather a host of different skills and techniques. This month, *SunExpert* looks at a number of issues that make communications both complex and rewarding.**



# the Next Millennium

---

**N**etworking has never been simple. The choices that network administrators confront today, however, can be maddeningly complex. People who maintain or establish networks now have to make choices that will support their organizations into the next century.

In this month's special section on Networking and Media, *SunExpert* examines three areas where these choices can be particularly difficult.

Executive Editor Michael Jay Tucker looks at what used to be called terminal servers. In conversations with users, he discovers that these devices have gone far beyond the mundane

business of providing serial connections. Increasingly, they are the remote access servers that make telecommuting and remote offices possible.

Senior Editor Simson L. Garfinkel confronts the question of networking media: When does it make sense to go to fiber cable? Where does Fast Ethernet fit into the picture? In a separate piece, Garfinkel examines connecting to the Internet. What was once an academic toy is now part of many companies' daily business. Making the link to the Net can be as important, and as much a part of daily business life, as opening the loading dock.

# The Server Is Dead— Long Live the Server

by MICHAEL JAY TUCKER, Executive Editor

**T**here was a time, not so long ago, when it was easy to figure out what terminal servers did. They served terminals, by gum! They sat on a network and provided a bunch of serial line connections so you could hang dumb terminals off of 'em. On rare occasions, when they got really daring, they might also support a modem pool.

Nowadays, "we don't even call them terminal servers anymore," says Bob Fasano, director of marketing for Livingston Enterprises Inc., which markets the PortMaster line of...well, call them terminal servers for the moment, anyway. "The word is almost dead. People are saying, 'Gee, a terminal server is OK, but I want to hang

my modems off my network and get remote access.'"

"Remote access" can mean a variety of things, ranging from telecommuting to mobile computer communications, as in the case of AT&T Credit Corp., the Parsippany, NJ-based finance and credit division of the communications giant. "We have remote users," explains George Valentini, who describes his title as "permanent consultant" and network engineer to AT&T Credit. "Mostly they are marketing types. They are out with clients and need to check a signature or a contract."

They need, in other words, to dial in from their laptops to check the corporate database. Valentini

*Terminal servers like this Annex Three from Xylogics increasingly provide both local and remote access. Corporations use them to support everything from mobile communications to telecommuting.*



## Copper or Fiber

by SIMSON L. GARFINKEL, Senior Editor

**A** few years ago, installing a workstation network through a set of offices was a simple matter. You'd drill holes in the wall and pull through a piece of Ethernet from desk to desk. Then you'd snap a bunch of Ethernet transceivers on the back of your SPARC workstations, snap a terminator on each end and—zowie!—instant network, running at 10 Mb/s. Indeed, the promise of easy, fast networking was one of the selling points of early Sun Microsystems Computer Corp. workstations.

Today, though, thinwire Ethernet has become the bane of many network administrators. That's because, for all of its wonders, Ethernet has a fundamental problem: Just one break in the cable, the result of either an electrical short or a careless user, and the entire network ceases to function. Another problem is Ethernet's speed. While 10 Mb/s is fast enough for reading mail, simple word processing and developing programs, it's a tad slow when the art department starts throwing around 15-MB TIFF files, and becomes all but unusable when more than a few people on the network want to engage in a real-time videoconference.

Vendors have been quick to respond to users' needs for faster networks. Within the last year, two network standards have emerged: Category 5 Unshielded Twisted Pair and Multi-Mode fiber optics.

### Category 5 Unshielded Twisted Pair (UTP)

"Twisted pair" is a vague term that can be applied to any two wires wound together. Category 5 Twisted Pair, on the other hand, is a stringent industry standard that defines the diameter of the copper wire, the number of twists per inch, the

impedance of the plastic insulation and other electrical and mechanical characteristics. Unlike Ethernet, which runs in a ring from workstation to workstation, UTP is wired in a star, with a pair of wires connecting each workstation to a central wiring closet.

UTP is the basis for 10BaseT, an Ethernet-compatible network that relays Ethernet signals from workstation to workstation on the star. And, like Ethernet, 10BaseT runs at 10 Mb/s.

This fall, the network industry is putting the finishing touches on its Fast Ethernet specification, which runs at 100 Mb/s over UTP, and Sun has already begun shipping its SunFastEthernet adapter. The SBus adapter card supports both 10- and 100-Mb/s connections and comes

Continued on Page 50

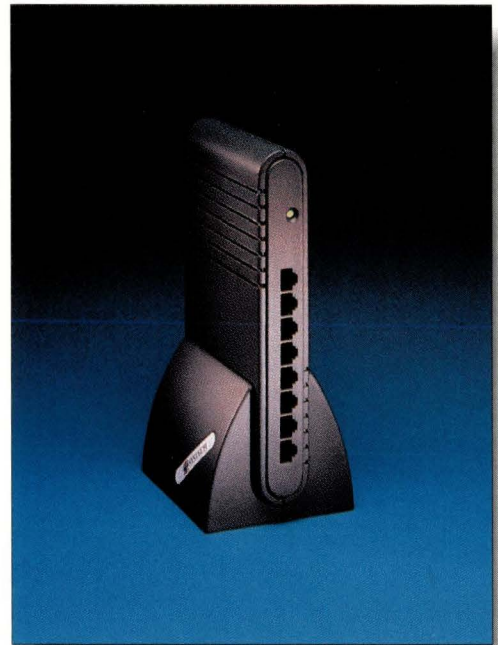
*Parallex from Systech attaches to a host system's parallel port. For some users, there are significant security advantages to not putting a terminal server and its modem pool directly onto a network.*

supports them via Annex terminal servers from Xylogics Inc., the Burlington, MA-based maker of communications equipment. From the terminal servers, they enter the company's Ethernet.

Right now, Valentini is working with SLIP, but he's also bringing PPP into the system. "We are rolling out some client/server applications that will use PPP as a communications facility," he says. "These will be switched through the Annex servers and go to resident applications on different servers in the network." Valentini thinks these appli-

cations will eventually let him support telecommuting. "It looks like this will be one of the ways that this corporation will be able to meet federal requirements for cutting down on commuting," he notes.

What advice does Valentini have for anyone planning similar restructuring? First, he warns, don't think it's simple. "The technology is fairly well understood by anyone who is trained in communications," he says, "[but] I think people tend to trivial-



ize this sort of thing, and it is rather detailed work. I mean, I can talk about it in 25 words or less, but there is a lot going on. There are a hundred different options in the setup of a single port."

The real kicker, though, Valentini thinks, is in the business end of things, and in the long-term service and support of the device. "The thing I would suggest is to put everything in writing," he says.

Dennis David, vice president of operations for Netcom On-Line Communications Services Inc., an Internet service provider based in San Jose, CA, has similar thoughts. David's company offers Internet access to large sites across the country. For that sort of connectivity, Netcom uses routers from Livingston Enterprises. But Netcom also supports "low-end, dial-up, shell-only customers," says David. "And for those customers, we use terminal servers, which also come from Livingston."

David, too, stresses that while terminal service technology is fairly mundane, it shouldn't be underestimated. "We have some very special requirements for accounting and verification for login," he notes. "That has to be coded into the terminal server itself."

## A Sampling of Fast Ethernet Vendors

**Sun Microsystems  
Computer Corp.**  
2550 Garcia Ave.  
Mountain View, CA  
94043-1100  
**Circle 140**

**SynOptics  
Communications Inc.**  
4401 Great America Pkwy.  
P.O. Box 58165  
Santa Clara, CA  
95052-8185  
**Circle 141**

**Standard  
Microsystems Corp.**  
350 Kennedy Drive  
Hauppauge, NY 11788  
**Circle 142**

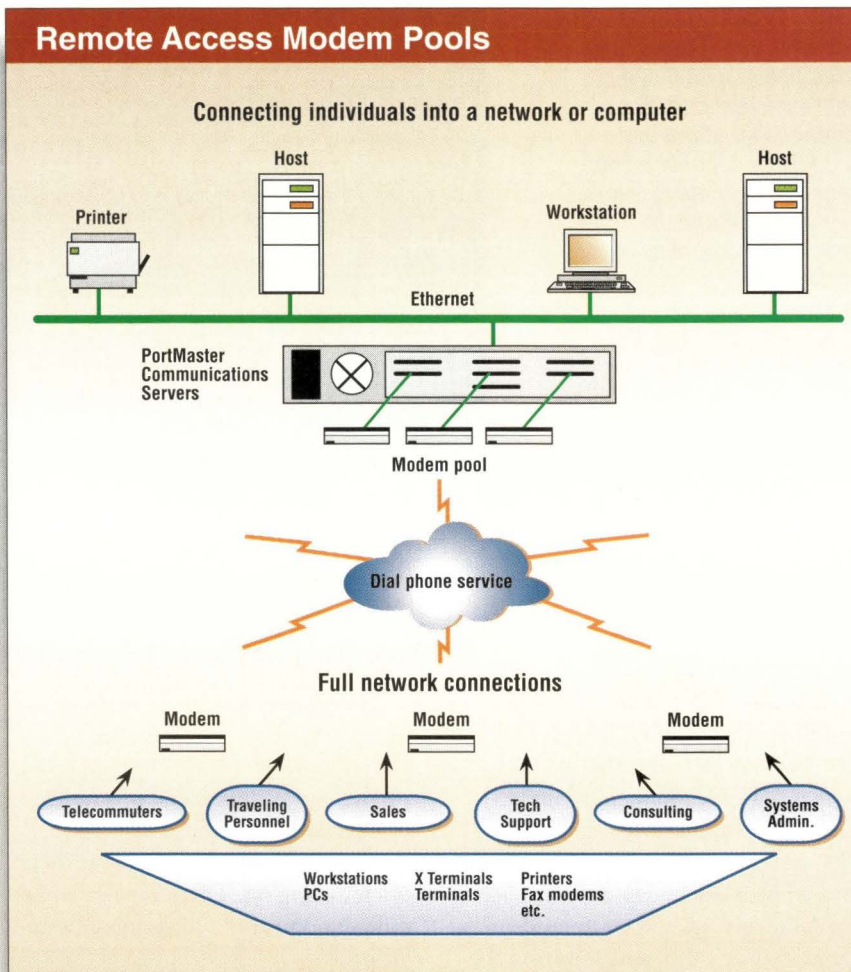
**Hewlett-Packard Co.**  
3000 Hanover St.  
Palo Alto, CA 94304  
**Circle 143**

**Optical Data Systems Inc.**  
1101 E. Arapaho Road  
Richardson, TX 75081-2336  
**Circle 144**

**Proteon Inc.**  
9 Technology Drive  
Westborough, MA  
01581-1799  
**Circle 145**

**Racore Computer  
Products Inc.**  
170 Knowles Drive  
Suite 204  
Los Gatos, CA 95030  
**Circle 146**

**Thomas-Conrad Corp.**  
1908-R Kramer Lane  
Austin, TX 78758  
**Circle 147**



Remote access is becoming the name of the game for terminal servers. This chart, from terminal server vendor Livingston Enterprises, shows how a terminal-serving PortMaster provides a link between a company's Ethernet and remote users. Notice—there isn't a terminal in the picture.

But again, it's business—and service and support—that matters. "I would say, number one, before you buy any terminal server, check the reliability of the company," he warns. "Check the responsiveness of its technical team." After that, "remote management capacity is the most important." Netcom supplies services to a distributed customer base via "points of presence, or POPs," scattered across the country. David must support, manage and deal with those POPs, preferably without having to travel to any of them whenever something breaks. "Yesterday, for instance, we lost a router at one of my POPs," he says. "We were able to route around, remotely, and ultimately fix it."

David thinks that, in the long run, terminal servers could emerge as one of the key elements of network management, that they might function as network organizers for large-scale WANs. "You need remote management, not just for the sake of reconfiguration," he says, "but also to have the box report up to the central management area—where you would have a global management system able to receive these unsolicited messages and deal with them."

But by becoming remote access servers, terminal servers have inherited a number of new problems. One of them is security. Where before they only had to host a dumb display, terminals are increasingly

### Copper or Fiber?, continued from Page 49

with a Media-Independent Interface that allows users to attach new kinds of cable types as they are standardized and made readily available.

### Multi-Mode Fiber

Fiber optics carry your organization's information via light pulses traveling down a glass strand. Fiber is faster than copper. Your data literally moves at the speed of light—the universal speed limit, according to Einstein's Law of Relativity. (Signals in wire move considerably slower—approximately 60% of the speed of light.) More importantly, fiber-optic cables are immune to radio interference from other pieces of equipment, power lines or other optical cables. This allows incredibly high data rates. Fiber optics can also be strung farther than copper lines—up to a mile—without the need for repeaters or a bridge.

Like Twisted Pair, fiber optics are wired in a star configuration. Two fibers—one to transmit, one to receive—are required for each workstation.

### Wireless

Some organizations with difficult cabling problems are considering a solution even more exotic than fiber optics: wireless networks. Wireless networks involve infrared systems sending network traffic between IR transmitters and receivers mounted on posts around the office, or bouncing data off the ceiling. Xircom Inc., in Calabasas, CA, sells a set of wireless network adapters for laptop computers that transmit up to 50 feet in an office. And Persoft Inc., in Madison, WI, has developed a wireless bridge that can connect two Ethernets or token-ring LANs separated by up to two miles in the city at 2 Mb/s, although the price (more than \$12,000 for the complete system) may be prohibitive for most organizations.

# Connecting to the Internet

by SIMSON L. GARFINKEL, Senior Editor

**W**ith all the excitement over the nation's burgeoning information superhighway, more and more administrators are being asked to prepare to connect their entire organization's network to the Internet.

In order to connect to the Internet, you'll need two things: an Internet service provider to connect you to the information infrastructure (the data highway), and a data link on which to send the information (think of it as an on-ramp).

## Picking a Service Provider

The four things to consider when choosing an Internet provider are cost, reliability, support and range of services. Your organization might want the security that comes with an established, nationwide provider like Narnet, PSI or Uunet. On the other hand, you might try to cut costs (and possibly get more personalized service) by going with one of the smaller regional providers.

It's impossible to print a comprehensive list of Internet providers; new regional ones are coming into existence literally every week. We've listed a few national ones at the end of this article. Hopefully, next year you'll be able to look in the Yellow Pages under "Internet" to get a list of the providers in your area.

## Picking Your On-Ramp

- **Dial-up connections with high-speed modems.** For UNIX systems, dial-up connections have traditionally meant exchanging electronic mail and Netnews with UUCP. To have a full Internet connection, you'll want to use either Serial Line Internet Protocol (SLIP) or Point-to-Point Protocol (PPP), which allows your computer to run TCP/IP over a serial connection.

Running SLIP or PPP gives you mail, Netnews and a whole lot more:

finger (for information on remote users), FTP (to transfer files from remote sites), Gopher (a menu-based version of FTP, which allows

Continued on Page 52

## Security: Beware of Being Too "Open"

**A**fter you make the jump and put your company's network on the Internet, you'll have an open system like never before. You'll be able to send electronic mail around the world instantly, access files and browse the World Wide Web and other information sources without regard to national borders—even NFS mount directories from Greece to Maui.

There's just one problem: Unless you take adequate security measures, people all over the Net will be able to access your company's system. And while your interest in your neighbors' information may be honest and ethical, the Internet is quickly becoming a none-too-friendly environment, like a small town beset by rapid growth and its first crime wave.

Sun users should beef up their systems' computer security. Today, many organizations are protecting their company networks behind "firewalls," computers that give people inside the organization access to machines on the Internet, but which carefully limit the access of machines coming in from an outside network. Many new routers can be configured as firewalls; check with your vendor.

Even without a firewall, there are many things you can do to secure your system:

- Every account on your computer should have a password.
- Your computer should not have NFS export directories indiscriminately across the Internet.
- Access by ftp should be limited to a few boot configurations or turned off completely.
- Run the most up-to-date version of sendmail.

For more information, check out these books:

William R. Cheswick and Steven M. Bellovin, *Firewalls and Internet Security*. Addison-Wesley Professional Computing Series, 1994. ISBN 0-201-63357-4

David A. Curry, *UNIX System Security: A Guide for Users and System Administrators*. Addison-Wesley Professional Computing Series, 1992. ISBN 0-201-56327-4

Simson Garfinkel and Gene Spafford, *Practical UNIX Security*. O'Reilly & Associates Inc., 1991. ISBN 0-937175-72-2

the front line, where hackers, malicious or otherwise, could enter a corporation.

That's one of the reasons why Hanz Johannsson, a senior engineer with Ericsson North America Inc., in Richardson, TX, selected a terminal server that isn't a terminal server. "We make telephone switchers," he says. "And our user interface runs through a V.24 link."

Ericsson North America's customers run their switches via an RS-232-C

port on a PC or other desktop system. The company also needs to be able to talk to its switches, both before they are shipped and when they are in the field. Rather than fill a room with PCs, the system uses a number of Central Data Corp.'s SCSI terminal servers to provide the necessary ports.

A conventional terminal server resides directly on a network. The Central Data product, however, fits onto a workstation's SCSI port. "We have them attached to some old Sun SLCs," says Johannsson, "and they work just fine." Johannsson himself handles six SLCs with three terminal servers apiece, each terminal server providing 16 ports.

Why did Johannsson go this route rather than use a conventional Ethernet terminal server? "Security," he notes. "With a normal terminal server, anyone could get at [the network] if they

know the IP address. With the SCSI terminal server, you have to go through the workstation first.”

Indeed, terminal servers are springing up in odd places—specifically, off the ports of host systems. Systech Corp., in San Diego, CA, for instance, recently introduced Paralex, a terminal server that attaches to a system via its parallel port. “The advantage of a non-Ethernet server is that you have lower cost per port,” says John Stafford, Systech’s director of marketing. “And the advantage of going off the parallel port is that you have bus independence.” Bus architectures may change, he notes, and even Ethernet is starting to show its age, but parallel ports are probably going to be around for decades to come. “As those architectures change, you still have your terminal service.”

In fact, products like Systech’s, which Stafford says aren’t particularly good for remote access, may be taking over the traditional role of the older Ethernet-based terminal servers: locally supporting a number of devices off a finite amount of CPU. “We see a lot of opportunity for point-of-sale systems, for example,” explains Stafford. “We can support things like cash registers, card swipe machines and so on.”

Meanwhile, both old and new vendors, ranging from Aurora Technologies Inc., in Waltham, MA, to Wyse

### Connecting to the Internet, continued from Page 51

links to remote systems) and Mosaic (a program that lets you browse World Wide Web servers with a friendly graphical user interface). SLIP and PPP also let several users or services share a single line at the same time. Beware, though: While dial-up connections may be fine for email, they can be painfully slow for downloading large databases or images.

Be sure to get a fast modem. Although you may currently be using an outmoded 1,200- or 2,400-baud modem, with V.32/V.42 modems priced at under \$150, there is no reason to use modems that are any slower.

- **56-Kb/s leased lines.** A leased line is a telephone line that doesn’t have a dial tone: When you order the leased line from the phone company, you specify both ends. Once it is installed, you are always connected. To use a leased line, you’ll need a pair of CSU/DSU units and a router (or workstation) with an asynchronous interface.

- **64-Kb/s ISDN.** ISDN, short for Integrated Services Digital Network, is a means of sending digital information over conventional copper telephone lines. ISDN was overhyped and undervalued in the 1980s; now it’s available in most metropolitan areas, but getting little attention. Tariffs (which are approved by state public utility commissions) vary widely. Basic Rate ISDN supports two 64-Kb/s B channels and one switched 16-Kb/s D channel. Basic Rate is ideal for a home/small business that wants to extend its local-area network from one side of town to

another. Primary Rate ISDN delivers a 1.5-Mb/s data pipe that can be divided into up to 23 B channels and one D channel. Primary Rate is ideal for high-speed applications or for corporate servers that are designed to accept multiple connections from Basic Rate users.

In some states, ISDN is considerably cheaper than the leased lines it is designed to replace; in others, it costs significantly more. And, as an added wrinkle, although the two B channels are functionally identical, the first channel is designed to be used with voice and the second with data. Consequently, most states have approved telephone rates that charge more for information sent over the second B channel than the first. And, as a result, many ISDN vendors now make equipment that sends data over the ISDN “voice” channel.

- **T1 leased lines.** Speeding along at 1.5 Mb/s, T1 is the gold standard for most Internet providers. Although it offers less than one-sixth the speed of Ethernet, T1 lines still provide ample throughput for most multimedia applications, from surfing around the Internet with Mosaic to two-way teleconferencing. One reason for T1’s efficiency is that, unlike Ethernet, which is a broadcast technology, T1 is a point-to-point transport media. The full 1.5-Mb/s bandwidth is available to move information from one end of the T1 connection to the other.

Most companies that sell T1 network connections offer several tiers of service; prices are lower if your average data rate never goes above 384 to 500 Kb/s. These alternatives are especially attractive since few of today’s Internet applications require the full bandwidth of a T1 connection.

Prices for these systems range all over the map, depending on the speed of your connection, the provider you choose and the other services that your provider supplies. Most Internet providers have made arrangements with communi-

### Speed Trap

**H**ow long does it take to move a 4-by-6-inch black-and-white photograph (150 KB) over the Internet? Here are some of the times you can expect while working at various speeds:

Mode	Time
UUCP at 2,400 baud	14 minutes*
UUCP at 14,400 baud	3 minutes
SLIP at 14,400 baud	2 minutes
56-Kb/s leased line	2.7 seconds
ISDN	2.3 seconds
T1	.09 seconds

\* Note: UUCP is a very inefficient protocol that only uses between 50% and 80% of the connection’s available bandwidth.

## Companies Mentioned in this Article

**Wireless LAN  
Product Vendors****Persoft Inc.**

465 Science Drive  
P.O. Box 44953  
Madison, WI 53744-4953  
**Circle 148**

**Xircom Inc.**

26025 Mureau Road  
Calabasas, CA 91302  
**Circle 149**

**Terminal and  
Communication  
Server Vendors****Aurora Technologies Inc.**

176 Second Ave.  
Waltham, MA 02154  
**Circle 150**

**Central Data Corp.**

1602 Newton Drive  
Champaign, IL 61821  
**Circle 151**

**Livingston Enterprises Inc.**

6920 Koll Center Pkwy.  
#220  
Pleasanton, CA 94566  
**Circle 152**

**Systech Corp.**

6465 Nancy Ridge Drive  
San Diego, CA 92121  
**Circle 153**

**Wyse Technology Inc.**

3471 N. First St.  
San Jose, CA 95134  
**Circle 154**

**Xylogics Inc.**

53 Third Ave.  
Burlington, MA 01803  
**Circle 155**

**Xyplex Inc.**

330 Codman Hill Road  
Boxboro, MA 01719-1708  
**Circle 156**

**National  
Internet Providers****Unnet Communications Co.**

3110 Fairview Park Ctr.  
Suite 570  
Falls Church, VA 22042  
**Circle 157**

**Performance Systems  
International Inc.**

P.O. Box 592  
Herndon, VA 22070  
**Circle 158**

**Netnet (BBN)**

10 Moulton St.  
Cambridge, MA 02138  
**Circle 159**

cations equipment vendors and will sell you all of the equipment you need to get going, but shop around—you can often get a better deal by going with a simpler router than your Internet provider might recommend.

And remember, whatever speed connection you buy today, it probably won't be fast enough tomorrow. As more of your users take advantage of the Internet, the single shared connection will naturally become more and more sluggish. And with the move to Internet-based sound, video and multimedia, you are only going to need to increase your connectivity speed in the coming years.

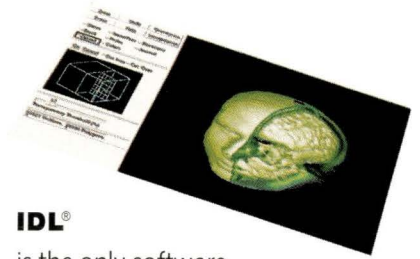
want to work from home."

The trend toward working at home may eventually eradicate the distinction between terminal servers and routers, particularly as more and more homes and offices are equipped with ISDN connections. "ISDN will come in on routers as an option," says Netcom's David. "It won't play a role in the traditional terminal server."

In the short run, David says, other distinctions will disappear as well—particularly the distinction between terminal servers and the modem pools they once supported. "When you have two products, and one always interfaces to the other," he says, "it would make sense for them to inter-

twine." →  
Technology Inc., in San Jose, CA, continue to offer network-based terminal servers. Their products seem to be moving into the space usually occupied by low-end routers and hubs. And, increasingly, the purpose of these servers is to support remote users and systems. Notes Michael Hennessy, product manager for remote access at Xyplex Inc., a LAN manufacturer based in Boxboro, MA, "There is a fairly big transition under way. People are going from terminal servers to remote transaction servers. Today, there are 40 million PCs being shipped a year—10 million of those are going into LANs, but a huge fraction of the rest are going into people's homes—and people

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# Moving to Solaris 2.x

by SIMSON L. GARFINKEL, Senior Editor

*"Second to the right and straight on 'til morning."*

*—James Barrie,  
Peter Pan*

**E**ditors' Note: Despite the fact that Solaris 2.x is now Sun's "official" operating system (and has been for some time), we at SunExpert have been slow to embrace it. In holding back, we've been following the lead of many of Sun's largest customers.

But the times are a' changin'. As more and more new systems are announced for Sun Solaris, fewer and fewer of them are being back-ported to Sun's ancient SunOS. These days, if you want to run Microsoft Corp.'s Windows applications with Wabi, or Macintosh applications with Apple Computer Inc.'s Macintosh Application Environment, or if you want to exploit your new multiprocessor SPARCstation 10 or SPARCcenter 2000, you've simply got to be running Solaris.

Over the next few months, SunExpert will be making the transition to Solaris 2.x and sharing the experience with our readers. In this first installment, we'll describe how to get your Solaris workstation running on your network and how to overcome Solaris 2's most obvious flaw: the lack of a development environment.

In future issues of SunExpert, we'll discuss how to set up Solaris as a server, how to configure NIS+ and how to network with the rest of your enterprise. We will also review how the Solaris emulation environments stack up and explore ways to keep your users from revolting during the transition.

## Plug and Play

Solaris 2.x is different. If you've been using SunOS 4 or any other Berkeley UNIX variant, you'll feel downright confused the first time you sit down at a Solaris machine and become superuser. The problem isn't just that commands have different names, different syntax and have been put in different directories: Much of UNIX has been fundamentally changed with this new edition.

Basic functions, like the `/etc/rc` startup scripts and exporting NFS volumes with `/etc/exports`, have disappeared. Count on spending a week for every year's worth of UNIX experience you've got before Solaris feels like "home."

Here are some hints for getting your Solaris box up and running on your existing network:

1. **Set up your files.** When Solaris boots, a complicated set of startup files look for the presence or absence of files to determine which network services to offer. Some of these files get configured by the elaborate Solaris installation procedure. Nevertheless, be sure these files (the first two will be familiar to SunOS users) are set up on your computer:



<code>/etc/hostname.le0</code>	This is your computer's Internet name. Solaris will automatically determine the computer's IP address by looking in the file <code>/etc/hosts</code> or by checking NIS or NIS+ (depending on which you have configured).
<code>/etc/hostname.le1</code>	If you have a second Ethernet port, that port should have its own name in the host's database. Be sure the name that corresponds to the interface is in this file.
<code>/etc/nsswitch.conf</code>	By default, Solaris workstations do not use the Internet Domain Name System (DNS) to resolve host names. To turn on DNS, you will need to edit the <code>/etc/nsswitch.conf</code> file and set the line that begins "hosts" to read as follows:
<code>hosts: nisplus dns</code>	<code>[NOTFOUND=return] files</code>
<code>/etc/resolv.conf</code>	The second part of getting DNS to work is setting up this file with the name of your DNS nameserver. At Computer Publishing Group, we use the following:
<code>domain</code>	<code>cpg.com</code>
<code>nameserver</code>	<code>198.3.5.1</code>
<code>/var/mail</code>	Solaris puts incoming electronic mail in <code>/var/mail</code> . Unfortunately, many of your existing programs may have the mail directory <code>/usr/spool/mail</code> hard-coded. The easiest thing to do is make <code>/usr/spool/mail</code> a symbolic link to <code>/var/mail</code> by typing the command <code>ln -s /var/mail /usr/spool/mail</code> .

**2. File sharing.** Solaris 2.x has eliminated `/etc/exports`. If you want to make your computer into an NFS server, you will need to turn on "file sharing." The directory to check out is `/etc/dfs`. The file `fstypes` contains a list of network filesystems currently supported on your computer. (NFS is standard, but watch for Novell Inc.'s NetWare, Microsoft's LAN Manager, and Apple's Appleshare.) `sharetab` is a list of filesystems that are currently being shared (or "exported," in oldspak). If you want to specify that directories be shared at startup, you'll need to add the appropriate `share` commands to the file `dfstab`. CPG uses the following line to export the directory `/cpg` to our hosts charm, up, down and top:

```
share -F nfs -o rw=charm:up:down:top -d "cpg files" /cpg
```

**3. Get your man pages working.** Sexist names aside, you'll probably want to use the UNIX man system's nifty "apropos" feature, which lets you search for the documentation of any program that has a specialword in its name by typing `man -k specialword`. Like a lot of other UNIXy things, Solaris 2.3 comes with `man -k` disabled. To enable it, become root and type `catman -w 12345679`.

## Developer Tools under Solaris 2.3

If you are a programmer, Solaris has a surprise for you: The C compiler has been removed from the standard operating system distribution. Sun's compilers will set you back \$695 for the SPARC C compiler and \$995 for the C++ compiler. (If you complain about the prices, Sun will tell you that the prices aren't really as high as they seem—they're for a *floating* license.)

Sun's reasoning is understandable: Most users are not programmers, and compilers are expensive to develop. By unbundling its developer tools, Sun turns language development into a profit center. If more people buy Sun's compilers, Sun will be able to hire more compiler writers, and its compilers will get even better. On the other hand, if third parties develop better compilers, people will buy those and Sun will fire its programmers, but Solaris will be a lower-priced operating system. At least, that's the theory.

In practice, many UNIX users who aren't programmers need a C compiler. The flaw in Sun's reasoning is the Internet. There are a jillion computers on the Internet, and each one is running a different flavor of UNIX. People on the global network who distribute programs (often free of charge), distribute them in source-code form and assume that anybody who picks up the programs will have a C compiler to compile them. Thus, if you want PGP encryption, or the latest World Wide Web server or even the perl programming language, you'll need a C compiler to compile the source code you pull down from the Internet into object code you can actually run.

It's always difficult to get people to pay for something that used to be free. For Sun, the transition to a pay-per-seat development environment has been complicated by an annoying thorn: a suite of free, publicly available C and C++ compilers that many people feel outperform Sun's finest offerings. The compilers we are referring to, of course, are the Free Software Foundation Inc.'s GNU C and GNU C++ compilers.

## The Story of GNU

Even though Project GNU is now more than 10 years old, the UNIX world is still confused about the project's goal—and its purpose. GNU was started by Richard Stallman at the Massachusetts Institute of Technology's Artificial Intelligence Laboratory. Stallman, accepted by many as one of the world's best programmers, had spent more than a decade developing software for MIT's Lisp Machine project. To hear Stallman tell it, the AI Lab was a hotbed of hackers, with researchers developing their own applications, sharing code and building on each other's work. But then opposing factions at the Lab spun off two com-

peting companies to commercialize the Lisp Machine. One of the companies, Symbolics, decided that the road to success was paved with proprietary software. MIT was informed by Symbolics that its version of the Lisp Machine operating system was proprietary—bug fixes and enhancements could no longer be shared with its competitor, Lisp Machines Inc. It was a painful experience in the AI Lab's history.

Nowadays, the battle between Symbolics and LMI is largely a historical footnote. Both companies eventually failed, unable to compete with the manufacturers of low-priced UNIX workstations. But there was one positive result: Project GNU.

Stallman was incensed when Symbolics told MIT that the Lisp Machine operating system had become a proprietary program. He felt that the company was trying to destroy the community of hackers that had been the best family he had ever known. For a few years, he continued the MIT project singlehandedly, which meant fighting Symbolics, rewriting every programming advance they made and handing it to Symbolics' competitor, LMI. Eventually Stallman thought that Symbolics had been punished enough. He decided to start a new project: writing a free operating system from scratch and create a worldwide community of people working to further its existence.

In the early 1980s, a new operating system, called UNIX, was gaining popularity among academic computer users. Stallman decided to clone it. But the operating system would not be UNIX, because unlike UNIX, people would be free to look at the source code, make improvements and share the operating system with their friends. Hence the name, GNU, which stands for GNU's Not UNIX!

## Freedom Software

The biggest mistake people make about free software, says Stallman, the founder and president of the Free Software Foundation, is the organization's definition of the word "free." Invariably, people think that the word "free" refers to the program's price—especially since all GNU software can be freely ftped over the Internet from the GNU anonymous ftp server, `prep.ai.mit.edu`. But the word "free" here really refers to the concept of freedom. People who get GNU software are free to do whatever they want with it—they can even sell it—with one exception: They cannot turn it into proprietary software, as Symbolics did with the Lisp Machine OS.

All GNU software is distributed under a special license agreement called a Copyleft, which basically requires two things. First, the Copyleft forbids companies from distributing GNU software without its source code. And second, although companies are allowed to sell free software, they are not allowed to prevent their customers from making all the copies they want and giving it away.

The emacs text editor was Stallman's first GNU program. Today, emacs is a staple on many UNIX systems, although it took years for the UNIX community to fully accept it. (Some people still don't.) The C compiler GCC was Stallman's second project. This undertaking took years longer than expected; the current shipping version of GCC is Version 2.6. The Foundation is now putting the finishing

touches on the operating system's kernel, "the hurd."

Free software is frequently better than proprietary software for a simple reason: The programs are distributed with their source code. Programmers who discover bugs often fix the problems for themselves and send in the patches. Hundreds of people around the world have worked on the GNU C compiler. They have ported it to different platforms, found thousands of bugs, and developed dozens of programmers' tools that make it a complete application development environment. Today, many people consider GCC to be one of the best C compilers in the world. It is so good that when companies quote their performance ratings for their new workstations, they quote the numbers of benchmark programs compiled with GCC, rather than with their own bundled compilers.

## Getting Started with GCC

Because GCC is freely available over the Internet, it makes a wonderful replacement for Sun's unbundled C compiler. If you've got a connection to the Internet and a copy of Solaris, you can just follow the steps below and be compiling programs in less than three hours. (If you don't have Internet access, read on anyway! For \$60, you can buy a CD-ROM containing a pre-compiled version of the GCC compiler directly from the FSF.)

Because all FSF software comes in source-code form, and because Solaris lacks a C compiler, you'll need to bootstrap yourself into the world of GNU. In other words, you need a compiler to compile the compiler. To do that, follow these directions:

1. Load up your Solaris 2.3 CD-ROM and make sure that you have the following packages installed: SUNWhea, SUNWbtool, SUNWarc and SUNWtoo. This will give you Sun's `/usr/include` files, a few binary tools and programs you'll need to build object-code libraries.
2. FTP to the computer `prep.ai.mit.edu`. (The GNU software is available at `gatekeeper.dec.com` and many other sites around the world.) Change your directory to `pub/gnu`.
3. In the `gnu` directory you'll find files for many of FSF's most popular distributions. Usually, several versions are present, as well as diff files between the most recent versions. For example, the files for flex (FSF's version of lex) might look like this:

In this example, the most recent version of flex is Version 2.4.6. It is compressed with the `gzip` algorithm (more efficient than UNIX `compress`).

4. Get the most recent version of the following programs: `gcc` (the compiler), `binutils` (the binary utilities), `bison` (GNU's version of `yacc`) and `make` (a program for making other programs). You might want to get other programs as well.

5. You'll need a working compiler to get going. Fortunately, there's one (albeit an old one) prebuilt in the directory `sparc-sun-solaris2`. Change into that directory and get the most recent version of `gzip`-binaries and `gcc`-binaries. (When we logged on, we found the programs `gzip-binaries-1.2.2.tar` and `gcc-binaries-`

```

-rw-r--r-- 1 4910 9368 Dec 4 1993 flex-2.4.2-2.4.3.diff.gz
-rw-r--r-- 1 14910 1097 Dec 9 1993 flex-2.4.3-2.4.4.diff.gz
-rw-r--r-- 1 14910 6083 Dec 12 1993 flex-2.4.4-2.4.5.diff.gz
-rw-r--r-- 1 14910 283738 Jan 5 1994 flex-2.4.6.tar.gz

```

open market. One company that has been successful offering support on the GNU compilers is Cygnus Support. For organizations with

2.5.6.tar.gz).

6. Untar the programs in `gzip-binaries` and install them in `/usr/local/bin`.

7. Use `gunzip` to uncompress the `gcc` binary. Untar the file from the root directory as superuser. It will install itself in `/opt/gnu`.

8. Make sure that the directories `/usr/local/bin`, `/opt/gnu/bin` and `/usr/ccs/bin` are in your `PATH`.

9. As they are distributed, Sun's `/usr/include` files won't work with an ANSI-C compiler like GCC. Because of Sun's copyright, the Free Software Foundation can't distribute fixed versions of Sun's include files. Instead, FSF has written a program that will fix the include files for you. The program is called `fixinc.svr4`. You'll find it in the directory `/opt/gnu/lib/gcc-lib/sparc-sun-solaris2/2.5.7`. Run it (as superuser).

Congratulations! You now have a working (but very old) C compiler. Now let's use that compiler to build a more up-to-date one.

10. Type `ln -s gcc /opt/gn/bin/cc` to create a symbolic link from `cc` to `gcc` in the GNU binaries directory. This way, you'll be able to run the GNU C compiler by typing `gcc` or `cc`. This is important because some of the GNU makefiles call the compiler one thing, and some call it another.

11. Untar the `make` program. Type this in `make`'s top-level directory to configure it:

```
env CC='gcc -traditional' ./configure
```

12. Since you don't have `make`, type `sh build.sh` to compile it.

13. We couldn't get `make install` to work, so we copied the program `make` into `/usr/local/bin`.

14. Next, you want to compile `bison`, then `gcc`, then `binutils` (in that order). For each of these programs, type `./configure` in its top-level directory to configure the program. Then type `make` in order to get it to compile.

After an afternoon's work, you should have the entire GNU development system up and running on your computer.

## What to Do if You Need Help

Free software has a catch: It's totally unsupported. If you have problems, you can ask for help on Usenet, but nobody is obligated to give you any. Remember, programmer support is expensive—this was one of the reasons why Sun unbundled its compiler in the first place. Programmers need support, and many of them are willing to pay for it.

The beauty of free software is that you don't have to get support from the people that make it—support is truly an

deep enough pockets, Cygnus will provide prebuilt copies of GNU C compiler for either SunOS or Solaris, at prices ranging from \$3,000 (C support for two developers) up to \$35,000 (C and C++ support for 25 users with quarterly updates) per year. That money isn't for the compilers—it's for the support. You make as many copies of the software as you'd like. (Cygnus used to put the GCC compiler on the Sun Catalyst CD-ROM as an advertising gimmick, but stopped when the price became prohibitive.)

For organizations that want the GNU software but don't have a direct connection to the Internet, the Free Software Foundation sells a variety of CD-ROMs containing its software. The Source Code CD-ROM is \$60 for individuals, \$240 for organizations. FSF also sells a CD-ROM with binaries prebuilt for SunOS 4.1, Solaris, Hewlett-Packard Co.'s HP-UX Version 9 and Intel Corp.'s 386-based computers. For real enthusiasts, FSF's Delux Distribution comes with a copy of everything the organization sells, including a set of each of its tapes, a T-shirt, a compiled copy of every GNU program that has been ported to your machine, manuals and 10 reference cards. The cost of the Delux Distribution is \$5,000, \$4,000 of which is a charitable donation. (The Free Software Foundation is an Internal Revenue Service-recognized 501(c) charitable corporation that makes its money from the sales of manuals, CD-ROMs, computer tapes and gifts from individuals and corporations. With the money, FSF is able to hire programmers and continue producing software.)

You can also get a copy of the GCC compiler, built for Solaris, from the Sun User Group. Version 2.4.5 (both source and binaries) is on SUG's 1994 CD-ROM, which SUG members can purchase for \$95 (plus \$10 postage in the United States and Canada). SUG charges \$50 for a one-year membership (\$65 for international). ➡

## For More Information

### Cygnus Support

1937 Landings Drive  
Mountain View, CA 94043  
(415) 903-1400  
info@cygnus.com  
<http://www.cygnus.com/>

### Free Software Foundation Inc.

675 Massachusetts Ave.  
Cambridge, MA 02139  
(617) 876-3296  
gnu@prep.ai.mit.edu

### Sun User Group

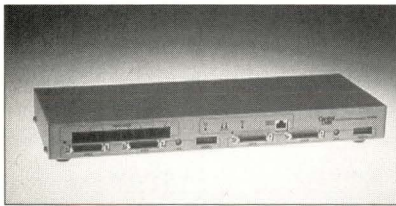
1330 Beacon St., Ste. 315  
Brookline, MA 02146  
(617) 232-0514

# 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.

## Redundant SCSI Terminal Server

Central Data has introduced what it calls the Redundant SCSI Terminal Server, a terminal-serving device for applications that can't afford down-



time, such as semiconductor clean-room control, financial trading and point-of-sale.

The Redundant SCSI Terminal Server (ST-8008) provides eight redundant serial ports for connecting modems, printers, terminals or other RS-232 devices. It connects to the UNIX host via the SCSI bus without consuming any system card slots.

The ST-8008's internal design includes two eight-port SCSI terminal

servers joined by an A-B switch. Separate power supplies, SCSI buses, processors and RS-232 circuitry provide redundancy in case of component or host system failure.

The ST-8008 can connect to two UNIX hosts. If one host fails, the second can take control of all eight ports. The ST-8008 also provides a power fail switch-over mode in case one of its SCSI Terminal Servers loses power. If more than eight redundant serial ports are required, users can stack multiple ST-8008 units, daisy-chaining them together on the SCSI bus.

Pricing for a single ST-8008 is \$2,995.

### Central Data

1602 Newton Drive  
Champaign, IL 61821-1098,  
Circle 101

## Tribe Announces Remote Networking Server

Tribe Computer Works has introduced TribeLink, a remote networking

product. TribeLink gives remote Macintosh, PC and UNIX users eight ports of high-speed access to AppleTalk and TCP/IP networks over standard phone lines. TribeLink is based on Point-to-Point Protocol (PPP) and offers security features and SNMP management.

The product uses four Zilog Z8 microprocessors to handle serial I/O duties, leaving the Motorola Inc. 68340 CPU free for protocol processing. This parallel architecture allows eight simultaneous dial-in sessions at speeds up to 57.6 Kb/s.

TribeLink offers a number of security features that are built on its use of PPP, for instance, Challenge Handshake Authentication Protocol (CHAP) and the Password Authentication Protocol (PAP). Moreover, the product supports filtering, so that zones or individual network devices may be hidden from users on a per-user basis. TribeLink's included management software shows who is connected to the server and

## Ethernet Switches

Xedia has introduced a suite of stackable Ethernet switches that provide six 10BaseT Ethernet ports. The MADway (Media Access Device) Series allows users to provide extra ports to their existing Ethernet LANs.

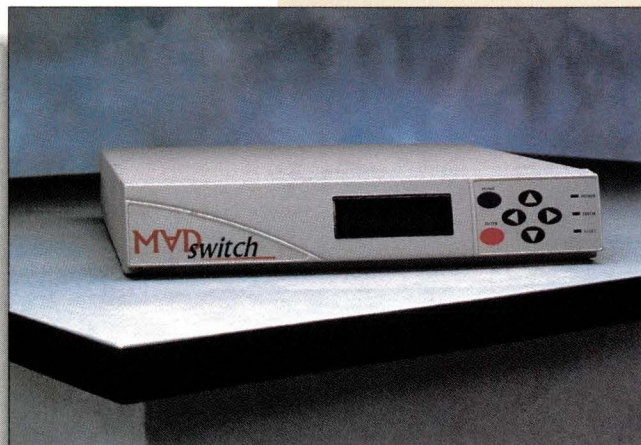
The series has three components. The first is the MADswitch, a stackable Ethernet switch that contains six ports, each of which offers speeds of 10 Mb/s, plus an additional 100+-Mb/s expansion slot. Pricing on the MADswitch is \$2,995.

The second component is the MADswitch/PC. This is a PC card that provides six ports at 10 Mb/s as well as a 60-Mb/s ISA interface port. Pricing on this product is \$2,695.

Finally there's MADremote, an ISDN remote Ethernet switch with up to 4 ISDN B channels for wide-area network connectivity. Pricing on MADremote is \$2,995.

### Xedia Corp.

301 Ballardvale St.  
Wilmington, MA 01887  
Circle 100



allows the administrator to disconnect a user if necessary. The identity of all callers is recorded in a log.

TribeLink has a suggested retail price of \$1,995.

**Tribe Computer Works**  
960 Atlantic Ave., Ste. 101  
Alameda, CA 94501  
Circle 102

### Cisco Shows ATM Switch

Cisco Systems has introduced an Asynchronous Transfer Mode (ATM) switch, the HyperSwitch A100. The product will support the Phase O PNNI (Private Network Node Interface) protocol recently adopted by the ATM Forum standards group. The HyperSwitch will be used with Cisco's existing ATM Interface Process (AIP), which has been shipping since May.

The HyperSwitch supports up to 16 155-Mb/s ATM interfaces. There are two interfaces currently available—the TAXI 4B/5B (100 Mb/s) and the SONET/SDH STS3C/STM1 (155 Mb/s) interfaces. The HyperSwitch is also designed to support up to 2,000

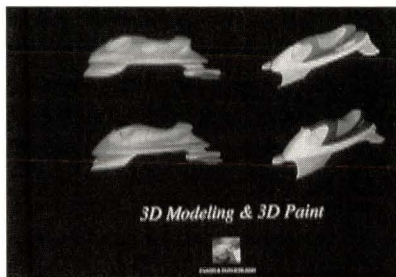
cells of buffering per port. The products come bundled with SNMP-based network management facilities.

The HyperSwitch chassis is \$21,900. The SONET ATM interface is \$1,250. The TAXI interface, meanwhile, is \$1,050. Up to 16 such interface cards can reside on a single chassis.

**Cisco Systems Inc.**  
170 West Tasman Drive  
San Jose, CA 95134-1706  
Circle 103

### Real-Time 3D Paint Software

Software that allows designers and artists to apply color, texture and artwork directly to the surface of a 3D computer model, in real time, has



been introduced by Evans & Sutherland's Design Software Group. Called Evans & Sutherland 3D Paint, the product allows users to interact with their computer models as they would with a physical model, and to paint and shade them with on-screen brushes.

The 3D Paint product was designed for a variety of applications, including CAD, and for users with little or no training in computer-based systems. The product is available on Sun SPARC-based systems as well as a number of other UNIX platforms. Pricing begins at \$15,000.

**Evans & Sutherland Computer Corp.**  
580 Arapeen Drive  
Salt Lake City, Utah 84108  
Circle 104

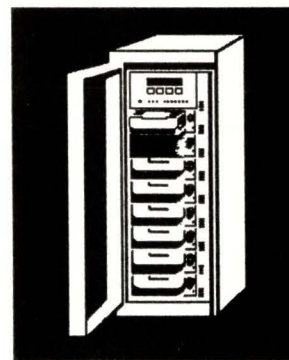
### Modem/Port Sharing Device

A product that allows up to four computers or terminals to share a single high-end modem, multiplexer, front-end processor or DDS circuit has been introduced by Telebyte Technology. The Model 330 Modem/Port Sharing Device can pass data to

## RAID SUBSYSTEM FROM UNI SOLUTION, INC.

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## DTK SPARC WORKSTATION

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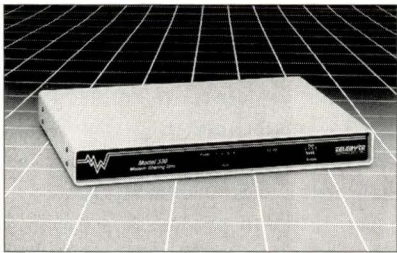
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and from a single communication device (known as the master) to terminals or computers, either asynchronously or synchronously. In synchronous mode, the 330 can pass data at speeds of 1.2, 2.4, 4.8, 9.6, 19.2 and 38.4 Kb/s. In asynchronous mode, it can pass data at speeds up to 64 Kb/s.

Model 330s can also be attached to other Model 330s. By "cascading" the devices, a single master can support up to 16 ports. All ports are DB-25 female and support RS-232/V.24 signals. The connector to the master can be configured as DCE or DTE.

The Model 330 is 1.65 inches high by 12.75 inches wide and 9.5 inches deep. It weighs four pounds. Pricing begins at \$495.

**Telebyte Technology Inc.**  
270 Pulaski Road  
Greenlawn, NY 11740-1616  
Circle 105

### Dial-In Security System

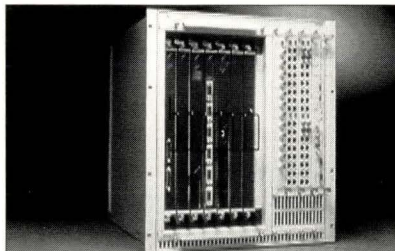
Cylink has introduced the CIDECC-MILS Network Security System, a device that provides secure access control and data encryption for host and server-based information systems. The product provides encryption via up to 12 encryption plug-in cards, each supporting the federally approved DES standard as well as the company's own algorithms, and each supporting communication speeds ranging from 300 b/s to 768 Kb/s. Each card can secure a communications link, whether that link be dial-up, point-to-point, synchronous or asynchronous. Thus, a single CIDECC-MLS can secure up to 12 separate links at any one time.

Pricing begins at \$525.

**Cylink Corp.**  
310 North Mary Ave.  
Sunnyvale, CA 94086  
Circle 106

### Combined Hub and Router

Optical Data Systems has merged its ODS Infinity Intelligent Hub with the Cisco Systems Inc. 7000 router. The resulting hybrid, the Infinity Hub



with a 7000+ module, allows a customer to deploy Cisco 2500, 4000 and 7000 products in a single chassis. The same chassis also supports ATM switching, FDDI concentrators, Fast Ethernet, Ethernet, token-ring and terminal servers.

Pricing on the Infinity Hub starts at \$6,700. The 7000+ module, which includes the Cisco 7000 route-and-switch processors, begins at \$19,900. The hub will support five Cisco Interface processors.

**Optical Data Systems Inc.**  
1101 East Arapaho Road  
Richardson, TX 75081  
Circle 107

### HDS Shows New X

HDS has introduced a line of X terminals designed to compete in the price space traditionally occupied by character displays. Called the ViewStation LX line, the products range in price from \$749 to \$2,399. All the machines are based on Intel Corp's i960 embedded processor and run the company's X server software. The machines also have an option for PCMCIA slots.

The line's low end begins with the monitorless LX Color base, which drives a display at a resolution of 1,024-by-768 pixels and costs \$749. The 14-inch LX14C has the same resolution as LX, at a price of \$1,099. The LX15C has a 1,024-by-768 15-inch monitor for \$1,199, and the LX17C has a 17-inch display at the same resolution for \$1,599. The LX19C, with a 19-inch color display

and a resolution of 1,280-by-1,024 pixels, sells for \$2,399.

**Human Designed Systems Inc.**  
421 Feheley Drive  
King of Prussia, PA 19406  
Circle 108

### Eight-Port Intelligent Serial Connector

Corollary has introduced an entry-level serial multiport device called the 8x1DC Host Adapter. The product has eight serial ports with RJ-11 modular phone jacks. These allow a UNIX multiuser system to support such devices as terminals, printers and modems. The 8x1DC Host Adapter can fit into an ISA or EISA slot in a PC-compatible system running SunSoft's 386/ix.

The product can also support hosts running The Santa Cruz Operation Inc.'s XENIX, SCO UNIX, SVR3, SVR4 and Novell Inc.'s UNIXWare. Pricing begins at \$525.

**Corollary Inc.**  
2802 Kelvin  
Irvine, CA 92714  
Circle 109

### ISDN Modem

Telebyte Technology has brought to market an ISDN Modem that transfers data over 6 kilometers (3.6 miles) on a single twisted-pair line. The



Model 431 Synchronous High Speed Short-Haul Modem connects isolated LANs via twisted-pair cabling. It uses ISDN and associated 2B+D signaling to provide full-duplex operation at up to 128 Kb/s. This rate is also switch-selectable down to 2.4 Kb/s. RTS/CTS delay, likewise, is switchable between 0, 7 and 60 milliseconds.

The Model 431 measures 6.75 inches wide by 2 inches high by 9 inches deep. Pricing begins at \$625.

**Telebyte Technology Inc.**

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270 E. Pulaski Road  
Greenlawn, NY 11740  
Circle 110

### Ethernet LAN Expansion

Perlan Networking Products has introduced a compact, five-port Ethernet transceiver. The PTT-4000 provides Ethernet LAN expansion by



enabling network owners to save the callings from backbone to DTE devices such as workstations, routers and terminal servers.

The PTT-4000 includes four DB15 Attachment Unit Interface (AUI) connections. These connect to DTE devices as if each device were connected to its own transceiver. The product also provides one 10BaseT (RJ45) port for connection to the backbone hub.

The PTT-4000 is \$225 for volume purchases, which include free technical support.

**Perlan Networking Products Inc.**  
1181 N. 4th St.  
San Jose, CA 95112  
Circle 113

### SBus Product Directory

Novation Data Services has compiled the latest edition of the *SBus Product Directory*, a complete guide to SPARC-based systems and add-in products. The *Directory* serves end users, resellers and systems integrators. This edition

contains profiles of 140 manufacturers and more than 240 SPARC-based systems from board level to desktop to servers. Nearly 400 add-in products are also listed.

The price of the *Directory* is \$79 plus \$6 for shipping and handling.

**Novation Data Services Inc.**  
425 Sherman Ave., Ste. 330  
Palo Alto, CA 94306  
Circle 114

### Project Management Tool

Endevor/Workflow Manager for UNIX, a tool introduced by Legent, enables software project managers to standardize and control software development. The product provides on-line approval for greater control and integrity in the software production process. This software also controls the promotion process through a system of checks

## Upgrades, Enhancements, Additions...

- Axis Communications has added 10Base2 connectivity to its network print server, the NPS 532. The server supports network printing at up to 1,200 Kb/s. **Axis Communications Inc.**, 99 Rosewood Drive, Ste. 170, Danvers, MA 01923. **Circle 115**

- Socket Communications has reduced the price of its PCMCIA Ethernet adapters. The EA 10BaseT adapter has been reduced from \$299 to \$249, while the EA+ 10BaseT and 10Base2 adapters have been reduced from \$369 to \$299. **Socket Communications Inc.**, 2501 Technology Drive, Hayward, CA 94545. **Circle 116**

- Memory leak plugger Pure Software has added support for multithreaded applications on Solaris 2.x to its Purify product. Pure Software says this support will allow developers to identify individual thread memory leaks and runtime errors during coding. **Pure Software Inc.**, 1309 S. May Ave., Sunnyvale, CA 94087. **Circle 117**

- Weitek has announced that it will reduce the price of its Power up CPU upgrade kit for Sun SPARCstation 2 and IPX machines. Originally \$1,500, the kit is now \$1,200. **Weitek Corp.**, 1060 East Arques Ave., Sunnyvale, CA 94086. **Circle 118**

- Network Applications Technology has reduced the price of its EtherMeter Ethernet probes. These two stand-alone probes monitor the activity of a single Ethernet LAN segment. The EtherMeter/250 has been reduced from \$2,195 to \$1,495, and the EtherMeter/450 has been reduced from \$2,595 to \$1,995. **Network Applications Technology**, 1686 Dell Ave., Campbell, CA 95008. **Circle 119**

- Bristol Technology has released Version 4 of HyperHelp, an on-line help system for UNIX applications.

HyperHelp has been enhanced to support the formatting capabilities of FrameMaker and Interleaf. **Bristol Technology Inc.**, 241 Ethan Allen Hwy., Ridgefield, CT 06877. **Circle 120**

- Need security for your Synoptics Hub? Security Dynamics has announced that its SecurID is now available for SynOptics Lattis System 5000 and 3000 Hubs. The SecurID is a credit-card-size token that displays a randomly generated access code that changes every 60 seconds. **Security Dynamics Inc.**, One Alewife Center, Cambridge, MA 02140-2312. **Circle 121**

- Tech-Source has announced a 50-MHz version of the GXTRA/1 Turbo. The GXTRA/1 is a graphics coprocessor that allows a single Sun workstation to support a second monitor, and thus a second user. **Tech-Source Inc.**, 442 S. North Lake Blvd., Ste. 1008, Altamonte Springs, FL 32701. **Circle 122**

- For those who need to merge UNIX and DOS, Locus Computing Corp.'s Merge product has been one of the few options around. Now the company has announced Merge 3.2, which also supports Windows 3.11 enhanced mode applications. **Locus Computing Corp.**, 9800 La Cienega Blvd., Inglewood, CA 90301-4440. **Circle 123**

- Aurora Technologies has announced that it will bundle a suite of user productivity software tools with its line of SBus products. Tools include Transparent Print, which allows ASCII terminal users to print from their terminals; PPP Accelerator, which speeds PPP links up to 115.2 Kb/s async and 128 Kb/s sync; and the Screens terminal multitasking utility, which turns single-tasking ASCII terminals into multitasking devices. **Aurora Technologies Inc.**, 176 Second Ave., Waltham, MA 02154. **Circle 124**



and balances to ensure that only the appropriate changes will be promoted.

Endevor/Workflow allows changes in code to be reversed or, once approved, made permanent. With the capability to assign a designated approver during the review cycle, managers can standardize the approval process and prevent unauthorized code from going into production.

Endevor/Workflow Manager's price is \$725 per workstation.

**Legent Corp.**

575 Herndon Pkwy.  
Herndon, VA 22070

Circle 125

## Parallel Software Development Tool

Atria Software has created a UNIX product that automatically supports parallel development and software reuse across geographically distributed project teams. ClearCase MultiSite's scalable, flexible architecture is designed to support large and small project teams across networked and nonnetworked sites.

ClearCase MultiSite extends the software configuration management capabilities of Atria's ClearCase product. These capabilities include version control, workspace management, build management and process control. Developers can use familiar ClearCase and UNIX tools and commands without modification.

The MultiSite product will be available on the Hewlett-Packard Co. HP 9000 series, HP-UX 9.0, Sun SPARC, Silicon Graphics Inc. IRIS and Digital Equipment Corp. Alpha platforms.

ClearCase MultiSite's price is \$1,500 for the first concurrent user license. Quantity discounts are available.

**Atria Software Inc.**

24 Prime Park Way  
Natick, MA 01760

Circle 126

## Switchable Adapter

SMCC has announced the first switchable 10/100 Mb/s 100BaseT Fast Ethernet adapter. SunFastEthernet is 10 times as fast as existing 10BaseT Ethernet, providing a simple, affordable upgrade for high-speed networking. The SunFastEthernet adapter

enables different parts of the network to run at different speeds by automatically sensing when to adjust to 10 or 100 Mb/s. Customers can then choose when to migrate each piece of the network over to the higher speed.

The single-wide card uses the core Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol. The SunFastEthernet conforms to the specifications defined by the Fast Ethernet Alliance and ensures interoperability with all alliance members' switch/hub products.

The Ethernet adapter's price is \$795.

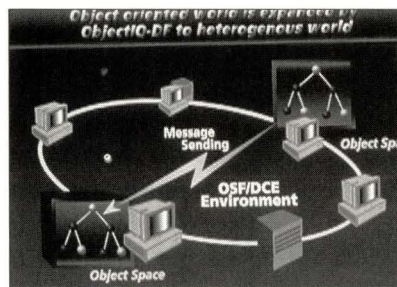
**Sun Microsystems Computer Corp.**  
2550 Garcia Ave.

Mountain View, CA 94043

Circle 127

## Hitachi Does Object-Oriented

Hitachi America has launched its three-module ObjectIQ series, object-oriented tools designed for advanced application development. ObjectIQ is



a software development system that combines object-oriented and rules-based programming with delivery of applications across multiple platforms. ObjectReuser is a reusable object librarian. ObjectIQ-DF is an object-oriented tool for developing distributed client/server applications.

ObjectIQ's application language supports all three paradigms in common use today: object-oriented, rules-based and procedural. Also included are interfaces that permit ObjectIQ applications to be embedded in existing C/C++ applications and vice versa. A general DBMS interface allows applications to interact with Oracle, Sybase, Ingres, Informix and other databases.

ObjectIQ operates on Sun SPARC workstations, Hewlett-Packard Co.

HP-9000s, IBM Corp. RS/6000s and PCs running MS-Windows 3.1.

Pricing starts at \$10,000 for a development system; runtime licenses sell for \$1,500.

**Hitachi America Ltd.**

437 Madison Ave.  
New York, NY 10022

Circle 128

## Print Server Solution

Built for simultaneous support of a variety of Novell Inc.'s NetWare and UNIX environments, Castelle's LANpress 2P EXTRA boasts fast data throughput, bidirectional parallel ports, SNMP and simultaneous 802.2 and 802.3 Ethernet protocol support.

Two high-speed bidirectional Centronics Inc. parallel ports allow network users to obtain printer status information from their workstations. The LANpress 2P EXTRA gives users the ability to connect two print servers to two high-speed parallel ports without performance degradation.

The Ethernet version of the LANpress 2P EXTRA is \$499, and the token-ring version is \$599.

**Castelle Inc.**

3255-3 Scott Blvd.  
Santa Clara, CA 95054

Circle 129

## Secure Remote X Terminal

GraphOn has designed an X Window terminal for easy access to remotely situated secure computer networks. The 19E allows access to secure networks by eliminating the need for outgoing TCP/IP connections to travel to the terminal site. All TCP/IP connections occur on the network inside the secure gateway. One telnet or rlogin session is required for access.

The terminal comes ready to go without downloading the server or adding RAM. The 19E features a 19-inch CRT with 1,280-by-1,024-pixel resolution. Refresh rate is 70 Hz. VT 100/220 emulation is built in for fast and simple session startup.

The 19E's price is \$1,895.

**GraphOn Corp.**

544 Division St.  
Campbell, CA 95008

Circle 130

# Advertiser's Index

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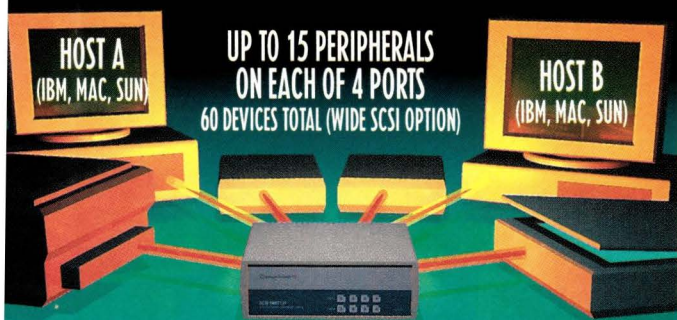
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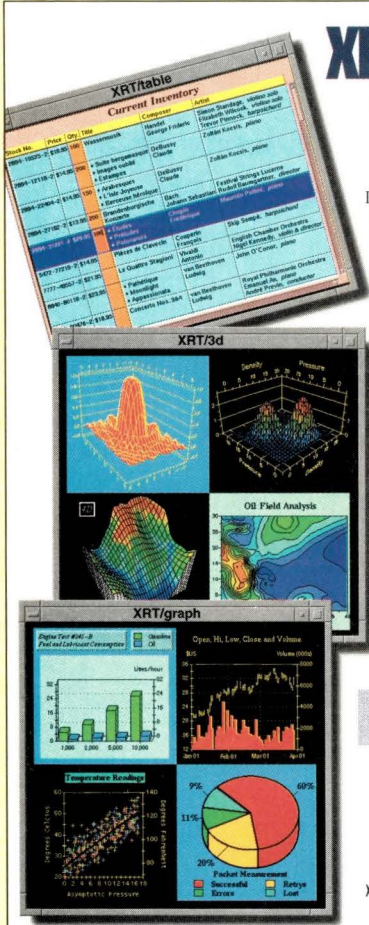
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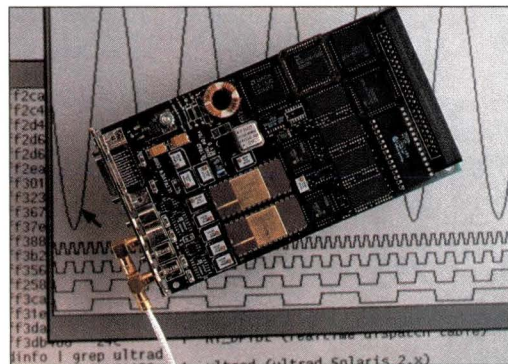
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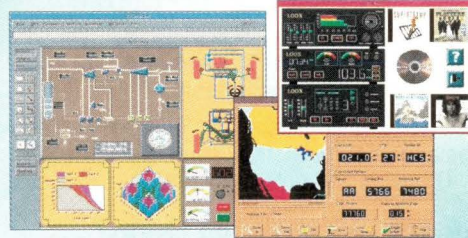
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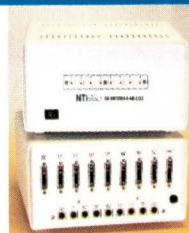
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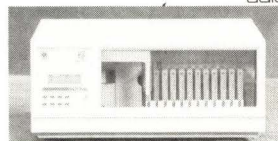
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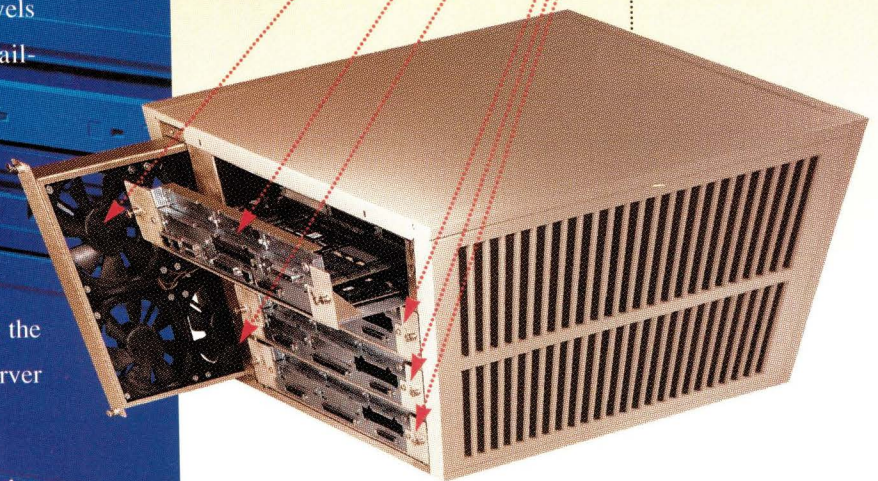
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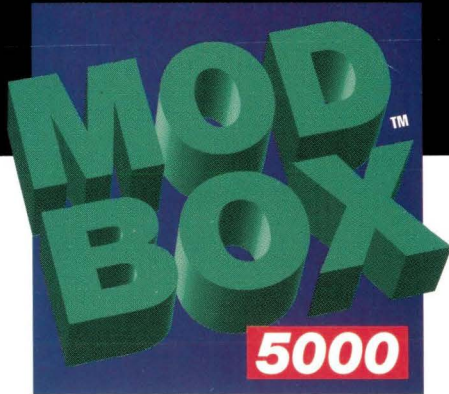
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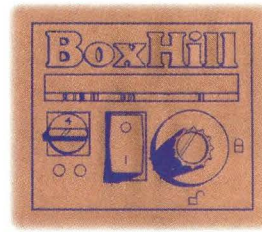
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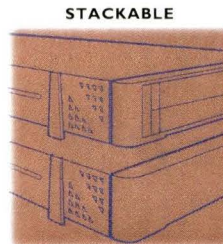
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