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YOUR GUIDE TO THE FUTURE OF MULTIUSER COMPUTING

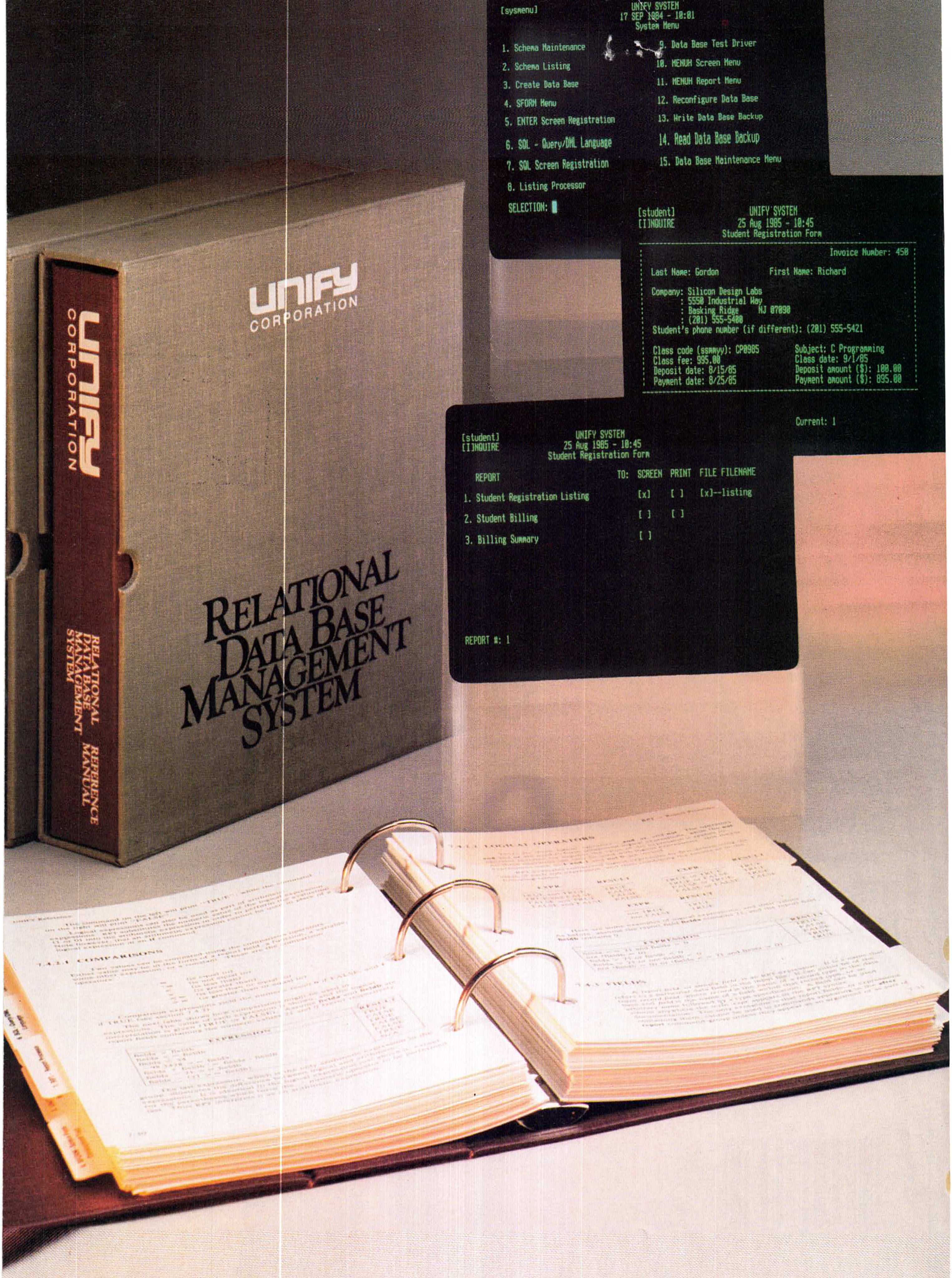
APRIL 1985 $3 IN USA UK £2.20 A TECH VALLEY PUBLICATION

THE UNIX SYSTEM IN THE FORTUNE 1000

TAKING THE PLEXUS CHALLENGE

Putting Unix, Xenix Systems To Work

UTS: Amdahl's (And AT&T's) Mainframe Unix System


[sysmenu]
UNIFY SYSTEM
17 SEP 1984 - 10:01
System Menu
1. Schema Maintenance
2. Schema Listing
3. Create Data Base
4. SFORM Menu
5. ENTER Screen Registration
6. SQL - Query/DML Language
7. SQL Screen Registration
8. Listing Processor
9. Data Base Test Driver
10. MENUH Screen Menu
11. MENUH Report Menu
12. Reconfigure Data Base
13. Write Data Base Backup
14. Read Data Base Backup
15. Data Base Maintenance Menu
SELECTION:
[student]
[I]NQUIRE
UNIFY SYSTEM
25 Aug 1985 - 10:45
Student Registration Form
Invoice Number: 450
Last Name: Gordon
First Name: Richard
Company: Silicon Design Labs
: 5550 Industrial Way
: Basking Ridge NJ 07090
: (201) 555-5400
Student's phone number (if different): (201) 555-5421
Class code (ssmmyy): CP0985
Class fee: 995.00
Deposit date: 8/15/85
Payment date: 8/25/85
Subject: C Programming
Class date: 9/1/85
Deposit amount ($): 100.00
Payment amount ($): 895.00
Current: 1
[student]
[I]NQUIRE
UNIFY SYSTEM
25 Aug 1985 - 10:45
Student Registration Form
REPORT
TO: SCREEN PRINT FILE FILENAME
1. Student Registration Listing [x] [ ] [x]--listing
2. Student Billing [ ] [ ]
3. Billing Summary [ ]
REPORT #: 1
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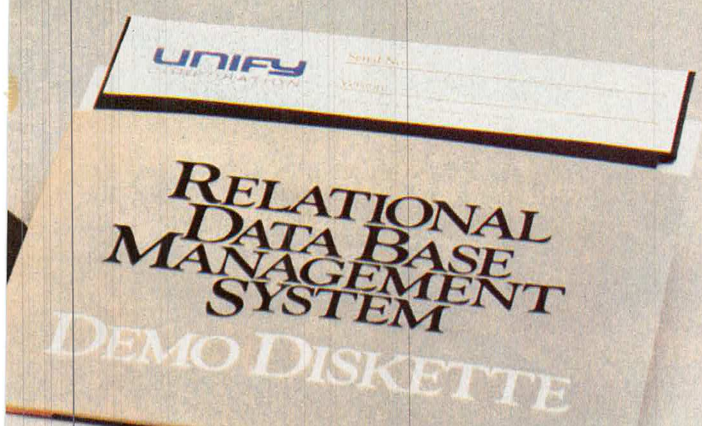

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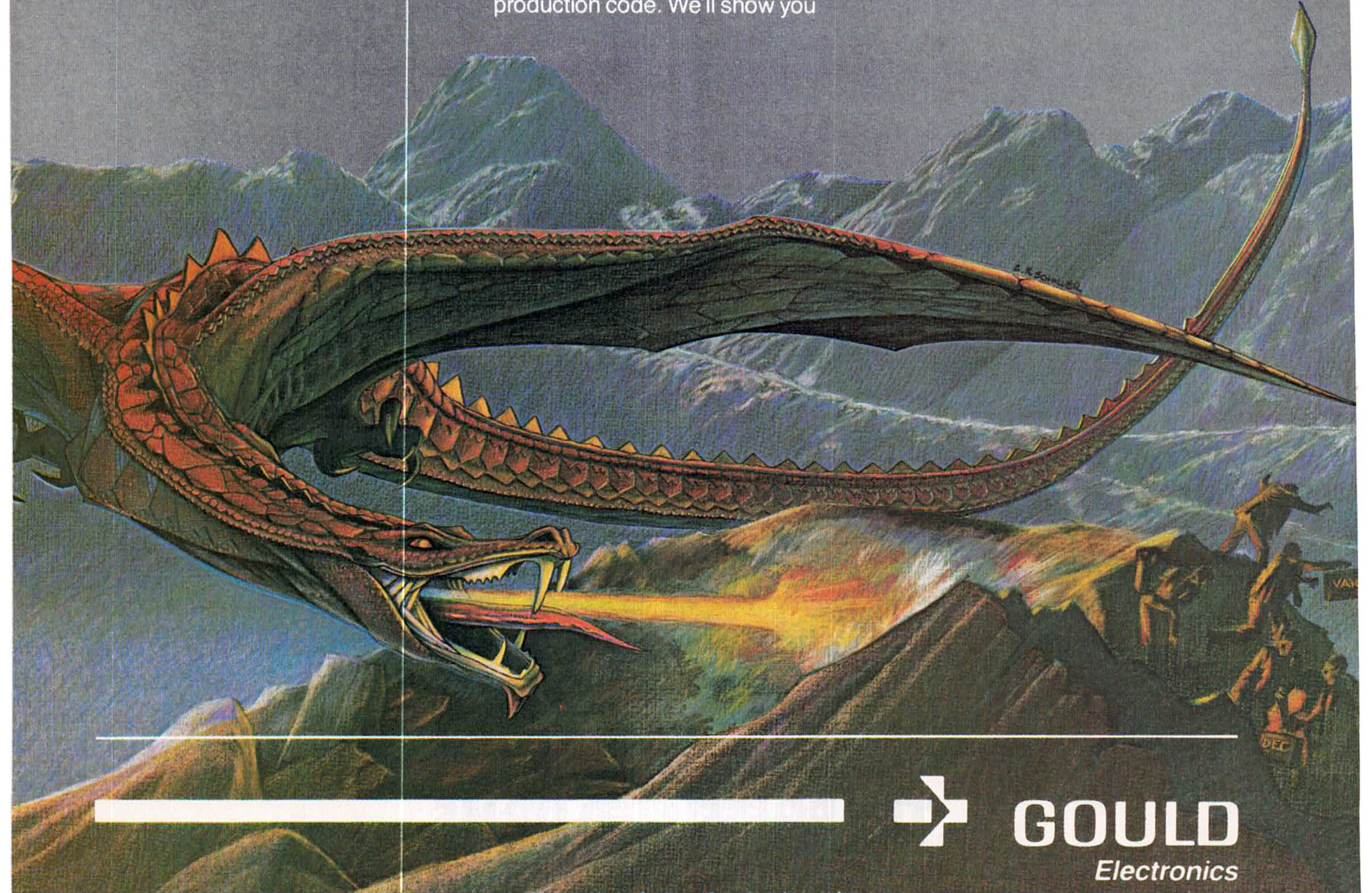

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VOLUME II, NUMBER 3 — A TECH VALLEY PUBLICATION

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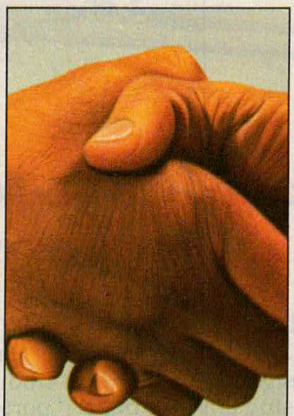
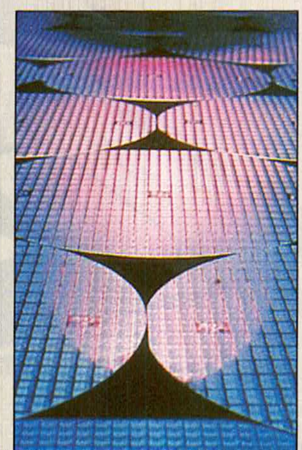
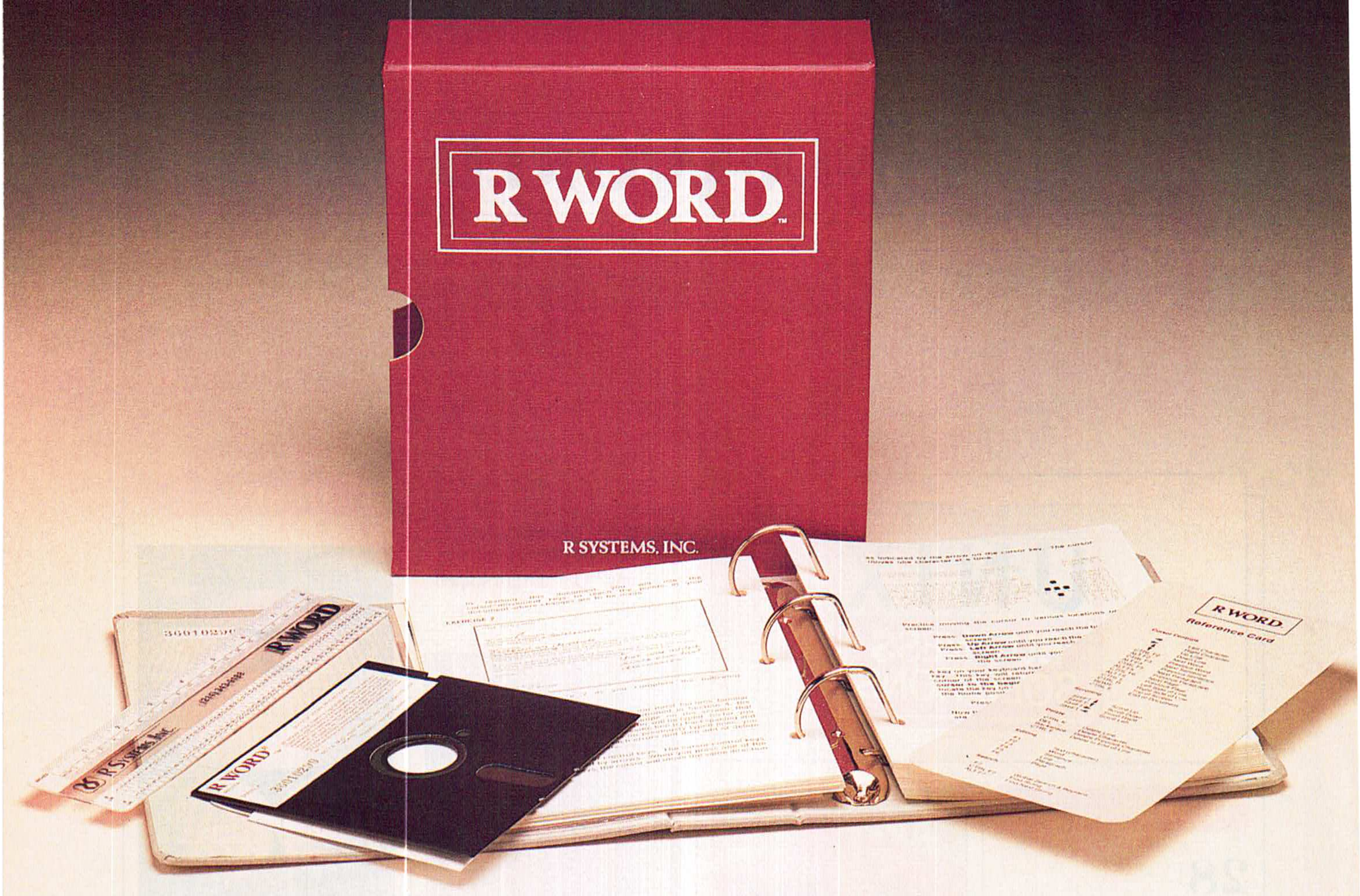


FEATURES





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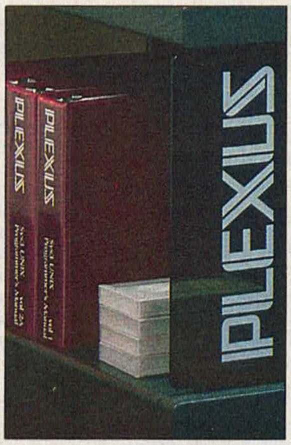
by Bruce Hunter

If you can't beat Big Blue, join 'em. That's precisely what Amdahl and AT&T are doing with UTS, a mainframe product. *Includes a first look at UTS/V, a System V port for IBM 370-compatible mainframes*.



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THE PLEXUS CHALLENGE: THE P/35 REVIEWED

by Bruce Mackinlay

This month our crazed reviewer takes the Plexus benchmarking challenge—something akin to the Pepsi challenge for colas—and wins himself a watch. . . . Well, maybe, then again, maybe not.

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THE SHELL GAME: THE C VERSUS THE BOURNE SHELL, PART 2

by Bill Tuthill

Despite their differences, the C and Bourne shells are alike in more ways than you might think. This concluding installment of a two-part series by a popular Unix system authority tells all.

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C TUTORIAL: `squeeze` PROGRAM BUG REPORT AND CONTEST WINNER

by Dr. Rebecca A. Thomas

Dr. Thomas returns this month with the first installment of an all new C Tutorial series and names the long-awaited winner of our `squeeze` program bug report contest. The envelope please!

TRENDS

TRAINING

/etc

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FROM THE PUBLISHER'S DESK

Healing the rifts in the computer industry is a task worthy of some ancient hero. Ironically, just when we have hardware solutions for the single user to the multinational corporation, we are at each other's throats again. PC users are pitted against DP management; computer wizards speak incantations that occasional users can no longer decipher; the MIS Director and the Chief Financial Officer are out sharpening knives for use on each other's budgets.

How can we balance the power user's need for brute force on spreadsheet engines and graphics applications with the corporation's need for data security, shared (reliable) information, and low costs per workstation? How can any company afford the horrendous costs, monetary and human (training), of software "hits" that top the charts for only a few months? (Imagine if you had to retrain your accounting staff every 18 months, rather than deal with procedures that have remained stable for the last 300 to 400 years.) And what could possibly play more havoc with depreciation and amortization schedules than a state of permanent revolution in computer technology that requires trashing millions of dollars of "antiquated" equipment every 18 months?

The Unix system is like oil on troubled waters. Snuck into corporate offices as the Trojan horse that solves a single problem (typically software development), the Unix system has survived and conquered. By offering an operating environment that functions on everything from a PC to a Cray II, the needs of the power and occasional user are met in a single environment. And the Unix system offers shared resources and information today while LANs remain IBM's Star Wars bargaining chip to maintain control on a market it barely understands. And as a side benefit, the Unix system offers a single training environment that allows users to move from task to task focusing on the work to be performed, not learning a new technical syntax to accomplish skills they've had most of their professional lives.

Naturally, even if we solve the purely human concerns that plague our industry (and the Unix system will play a large part), future problems remain. Some problems, in fact, impact the nature of 20th Century society: for instance, the rift between the analog and digital information flows that feed our culture. But then again, isn't it interesting that the phone company's Unix system is already there? □

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EDITOR'S CONSOLE

Watch out IBM! The Unix system is coming into use at many *Fortune* 1000 companies, like it or not. I don't think that just a few short years ago even the greediest supermicro entrepreneur would have thought the Unix system would be of interest to mainstream, commercial computing departments. But today this is indeed the case, and it extends far beyond the engineering and R&D departments.

In fact, some members of the Amdahl group that markets UTS, Amdahl's System III and System V ports (which are both the subject of this month's lead review, by the way) for IBM 370-type mainframes, report having been quite busy the last year fielding questions about the Unix system from some of the same prestigious *Fortune* 1000 companies that buy their IBM-compatible mainframes.

And this year they should see even more of the same, as Amdahl and AT&T Information Systems join forces to push Unix System V (primarily, Amdahl's forthcoming UTS 5.2) into Big Blue mainframe shops across the country.

Well, Blue, for your part, you have acknowledged the interest in the Unix system among your bread-and-butter clients, the *Fortune* 1000, with last summer's introduction of VM/IX. You've also come out with PC/IX, really a development system for PC-DOS applications, and with Xenix 3.0 on the PC/AT. However, we can't give you an A for effort, at least not yet.

The corporate MIS director at an Exxon or General Electric has the same reasons for being interested in the Unix system as does the head partner in the small law office down the street—vendor independence, protection of your investment in software and databases, and software portability.

This last item, portability, is probably the most critical to *Fortune* 1000 firms. The Unix system holds out the promise of substantive micro-to-mainframe links far beyond what is currently available from today's communications methods.

As bands of isolated PCs in the outer offices of great corporations clamor ever louder for access to departmental, divisional, and even corporate databases, the old ways of tying together all that incompatible gear fall down. Users will need applications that run substantially unchanged on different machines, distributed databases, virtual file systems, etc., etc. Sound familiar?

The other issues are important as well, especially when put in context. The small law office down the street may have invested a few thousand dollars in software, not a substantial sum in the great way of things, yet substantial enough to matter to that firm. Imagine the investment an order of magnitude greater for a *Fortune* 1000 company; its software investments amount to tens of millions and perhaps hundreds of millions of dollars.

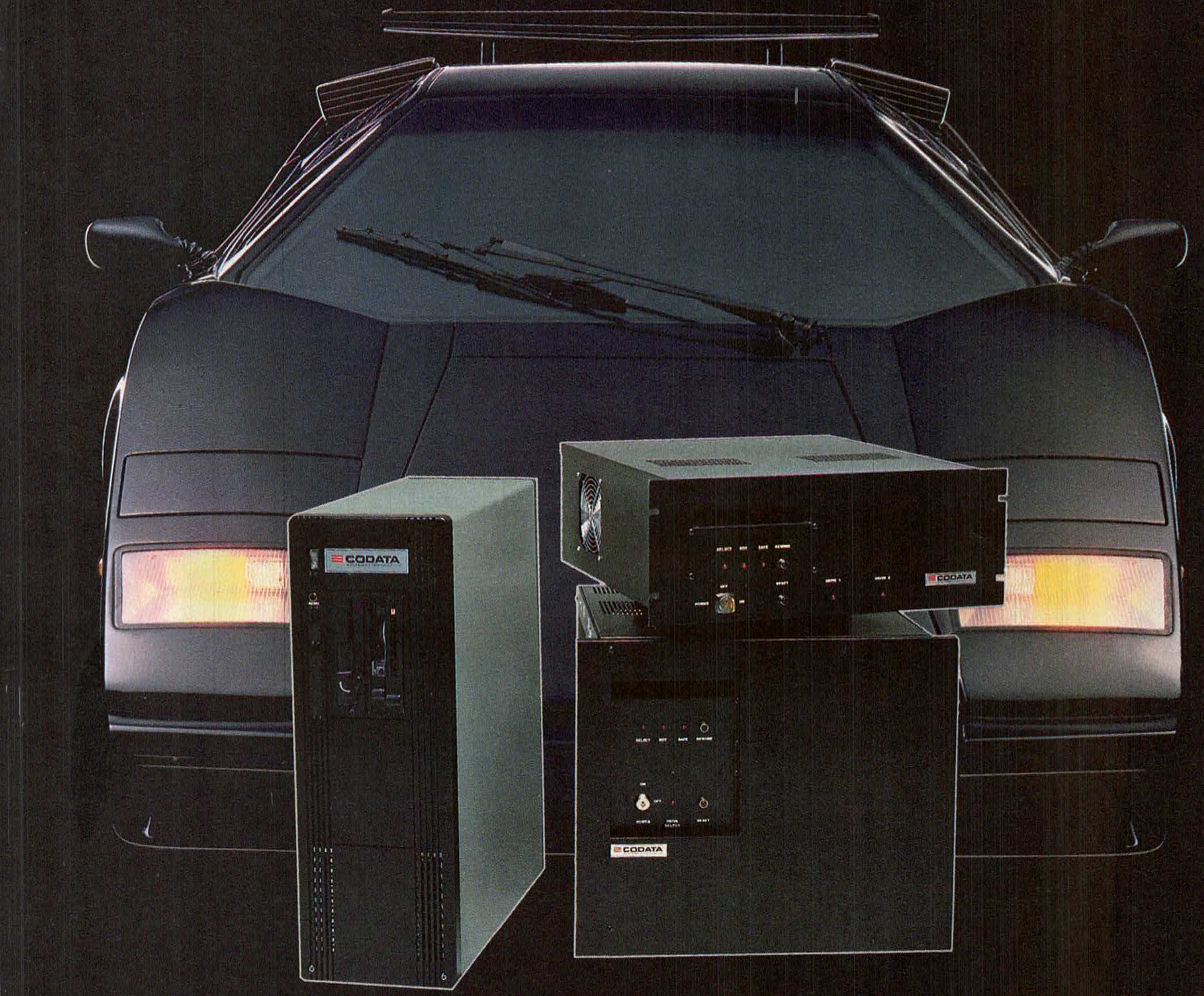
One should also consider one of IBM's more costly family traditions. That is, once every couple of years the computer vendor forces upon its installed base a major operating system upgrade, usually to a highly incompatible new version. IBM's MVS-to-MVS/XA push is just one of the latest, and most questionable, examples. These conversions usually involve a substantial investment in manpower and dollars to complete.

You begin to get the picture. In some cases it becomes a struggle for survival, pitting the corporate MIS manager against his IBM salesman.

Now don't get me wrong. IBM is not the only computer vendor that does this. Today, however, as we ask ourselves whether IBM is the defender of our worldwide technological leadership or a ruthless, marauding pirate looking for the next market niche to plunder, it is important to remember that the Unix system holds forth the biggest threat yet to IBM's thirst for hegemony over the computer industry.

Perhaps this is why IBM has not yet supported with all its strength a Unix system on any of its processors. Many say that IBM will endorse any and all brands of the Unix system, but that it will never push any brand of the Unix system simply for this reason. I'd like to remind those same people, however, that the Unix system has never been a product that needed official backing to succeed. Despite some of the best efforts of this industry's largest companies, the Unix system today is alive, thriving, and, more to the point of this discussion, beginning to live in corporate America. □

Philip J. Gill
Editor-in-Chief



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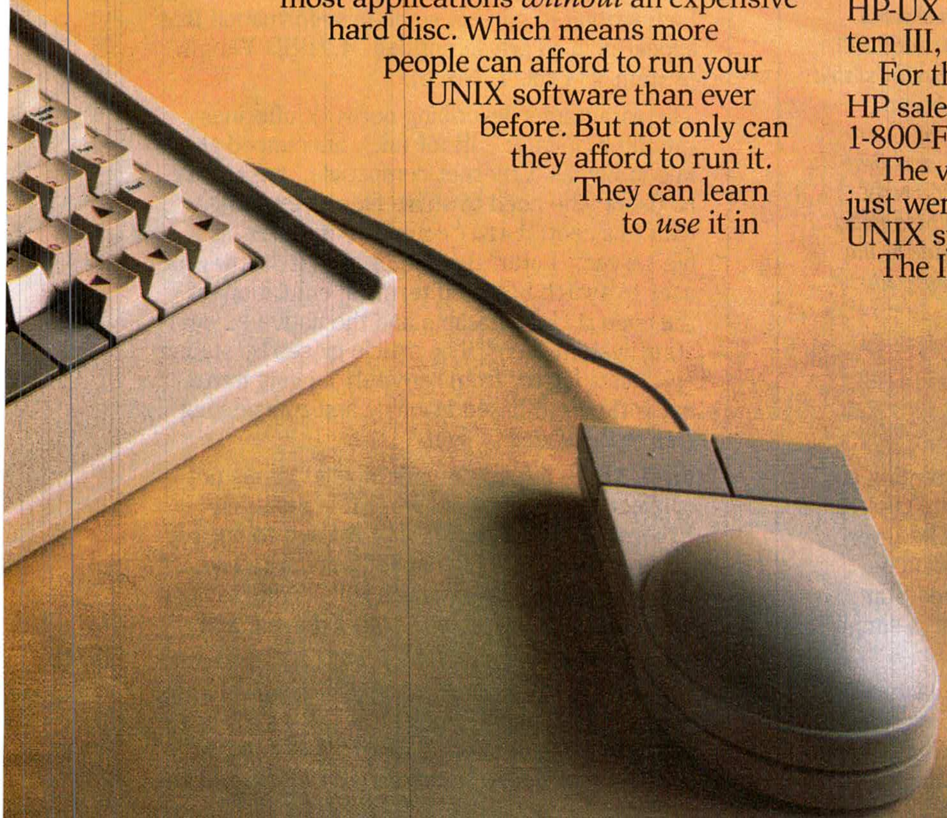

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This space is yours. Tell us what we're doing right—or wrong. Raise issues and ideas that other readers may respond to. Propose projects. Reject market trends. Take a stand.

SORRY FOR THE CONFUSION

Dear Editor:

I contacted Omri Serlin when I read his "Inside Edge" column in Vol. 1, No. 5 because I felt that he was quite negative and that he confused the reader by implying that the Power 6/32, "Introduced in May," is "an upgrade of the 5/20." The article goes on to say that the main difference is the number of boards in the M68000-based units.

This, of course, is not the case because the Power 6/32 is not an M68000-based machine.

Sincerely,

Paula J. Mellon
Marketing Support Manager
Commercial Products Group
Computer Consoles Inc.
Irvine, Calif.

Editor's Reply: You are quite correct in stating that the Power 6/32 is not based on an M68000 chip. In his original manuscript, Mr. Serlin stated that the 6/32 was based on a "new, 5-board 'Tahoe' processor, said to be optimized for C programs and the Unix operating system" and that it uses a "2901 bit-sliced ALU." We incorrectly edited Mr. Serlin's copy. However, it is also valid to see the 6/32 as a performance upgrade to the Power 5 family, if not an actual hardware upgrade.—Philip J. Gill

ALIVE AND WELL

Dear Editor:

We would appreciate your help in correcting an error that was published in UNIX/WORLD (Vol. 1, No. 5, p. 94). In an article entitled "The Interleaf Publishing System," the author, Bruce Mackinlay, writes that "Xerox removed Star from the market. . . ." This statement is simply not true.

The Xerox Star system is being manufactured and shipped at record rates, and Star systems are the featured performers in more than 1000 Ethernet customer networks around the world. As you know, the Star system pioneered most of the industry's popular user-friendly interfaces, such as the "mouse" pointing device, multiple windows on display screens, icons, and bit-mapped displays. It also is the only system on the market that allows users to create documents and freely intermix text in any combination of more than 20 of the world's major languages.

The Xerox Star system is very much alive and well, thank you. And we'd like the readers of UNIX/WORLD to know that.

Best Regards,

Don Ramsay
Manager of Public Relations
Western Operations
Xerox Corp.

4.2BSD v. SYSTEM V

Dear Editor:

I am writing to correct some misinformation that appeared in an article entitled "4.2BSD Versus System V" (Vol. 1, No. 6).

The paragraphs describing network offerings (pp. 56-57) state: "3Bnet (sic), announced at NCC in July as 'Ethernet-compatible,' links AT&T PC users who need to share files or exchange data to a central AT&T computer that acts as a file server." Later, the author says it "allows the user to switch between terminal emulation on the central Unix machine and the native PC operating system, DOS." The article closes by stating ". . . it's a far cry from remotely logging into a networked 4.2-based machine and transferring files at the speed of light."

First, 3BNET (a trademark of AT&T) does not connect PCs to servers. While it is definitely Ethernet compatible, 3BNET is used to network 3B processors in a high-speed network. The product offering Ms. Wallace is referring to is PC Interface. It is available in both Ethernet and RS-232 versions.

PC Interface does much more than terminal emulation. In fact, the Terminal Emulator itself is a separate product offering that happens to take advantage of the PC Interface environment. The

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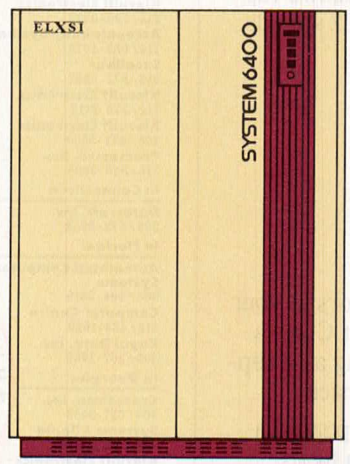

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DOS directories it uses reside on the DOS machine (not on the 3B).

Programs running in the DOS environment do utilize files resident on the 3B. They access them as though they were a local hard disk on the PC. Files may be copied from the DOS machine to the 3B, or vice versa, at 10 Mbytes/second (Ethernet rates). This may not quite be the "speed of light" that the author says is available on a 4.2-based machine, but most experts will agree that this is fast enough for most user applications.

In addition, remote log-in is a capability of the RS-232 version of PC Interface, which allows the same data-transfer capabilities at RS-232 speeds.

Sincerely,

Douglas Host
PC Interface Product Manager
AT&T Information Systems

MORE ON ULTRIX-32

Dear Editor:

I am writing to correct a couple of errors in your magazine relating to Digital Equipment Corp.'s Unix system products. I am not writing as a representative of DEC or in any official capacity.

In UNIX/WORLD Vol. 1, No. 5, there appeared a review of Ultrix-32. On page 70 was a figure depicting the utility commands found under Ultrix-32. The diagram is in error in that some of the utilities flagged as missing are indeed there under Ultrix-32—but they have been moved to different directories. (In general, things that are normally "system manager-type" utilities have been moved to /etc, and a couple of utilities that seem to logically fit under games have been moved to that directory.)

To be specific, the following utilities are, in fact, part of Ultrix-32: /etc/fsck, /etc/restore, /etc/ac, /etc/chown, /etc/clri, /etc/dcheck, /etc/dump, /etc/icheck, /etc/ncheck, /etc/pstat, /etc/quot, /etc/sa, /usr/games/factor, and /usr/games/banner.

In addition, it was not really clear from your diagrams that the complete Berkeley utility set is available under Ultrix-32, which it is.

Thank you for allowing me to clarify these things.

Sincerely,

Frederick M. Avolio
DEC—Ultrix Support
{seismo,decvax}!grendel!avolio

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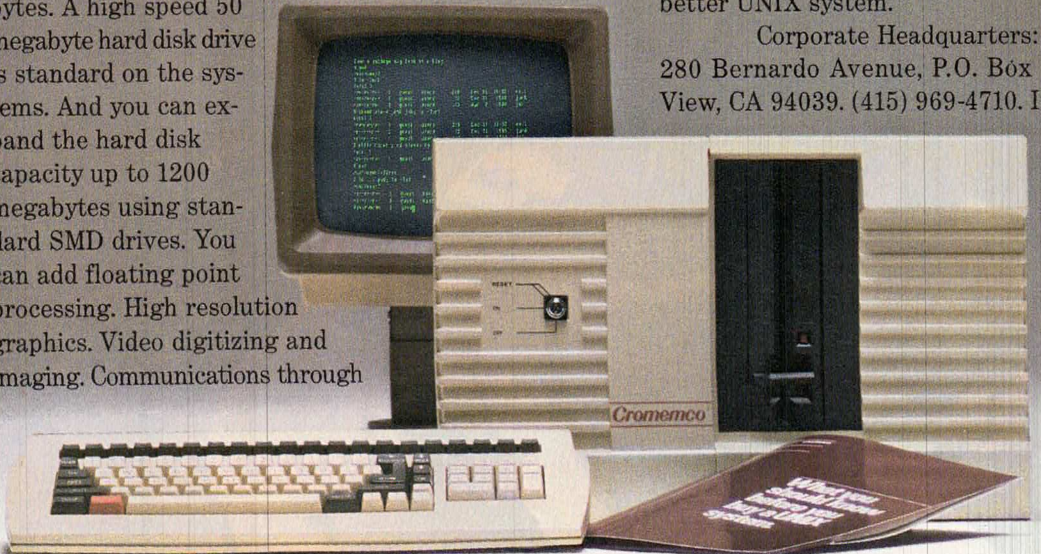

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SPERRY LAUNCHES BOLD UNIX SYSTEM THRUST WITH NCR, ARETE, CCI GEAR

BY OMRI SERLIN

In an attempt to break out of the BUNCH mold, Sperry Corp.'s Information Systems Group (née Univac) has set forth a comprehensive and bold new corporate strategy. The plan is predicated on using the Unix system on processors supplied to Sperry by NCR, Arete, and Computer Consoles. In addition to offering these new Unix system engines under the Sperry label, the Blue Bell, Pa.-based mainframer will also support Unix system variations on its Mitsubishi-supplied desktop PC and on its large-scale 1100-series machines, creating the first compatible computer line, ranging all the way from micros to mainframes.

Will Sperry be successful in its new direction? Past experience is not encouraging. In the 1950s Sperry was an early leader in both digital computers and typewriters; the term "Univac" was then often used synonymously with "computer," much as "Remington" was often a generic term for "typewriter." By the early 1960s, through a combination of short-sighted management and other factors, Sperry lost its unique leadership positions in both computers and typewriters to IBM.

In the mid-sixties Sperry introduced its 1108, a 36-bit, large-scale mainframe that has had substantial acceptance in scientific and engineering applications. The 1100 series of mainframes that followed is still Sperry's bread-and-butter line in computers. (The corporation is actually a conglomerate, including farm machinery, military gear, and other businesses, none of which has been especially successful recently.)

On a number of occasions Sperry has attempted to expand its horizon beyond its 1100 series of 36-bit mainframes. A number of mid-size machines were based on the old RCA line, whose installed base Sperry acquired in 1971, while others were attempts to bridge the 360-like RCA architecture with the 1100 line.

The BC-7, introduced in 1977, was a small-business computer Sperry designed and made. Through the acquisition of mini-maker Varian Data Machines, also in 1977, Sperry hoped to become a factor in that market in its heyday. None of these moves, however, resulted in any notable successes.

In October 1982 Sperry attempted to penetrate the office market with Sperrylink, an integrated system combining word and data processing, personal computing, and electronic mail/voice, based on 1100-series proprietary software and expensive, bulky, internally built terminals.

THE TRILOGY INVESTMENT

Less than a year later, in June 1983, Sperry made a $40 million investment in Trilogy, hoping to apply the wafer-scale-integration (WSI) technology under development at Trilogy to Sperry's next generation of mainframes. But that thrust fizzled when Trilogy ran into trouble and canceled its WSI effort.

About the only bright spot in this otherwise bleak picture is Mapper, an applications generator based on a relational DBMS running on the 1100 series. Mapper, like a number of similar products from IBM and others, allows non-expert users to construct simple business applications in a nonprocedural language.

Meanwhile, Sperry's mainframe business has come under severe pressure from both directions in the last few years: from above, by IBM's new aggressiveness; and from below, by the new breed of superminis from DEC and Data General. Sperry's market share has been eroding; the company's computer business revenues peaked in fiscal year 1982 at $2.8 billion and have stayed essentially flat over the next two fiscal years (ending March 31), constituting about 57 percent of total fiscal year 1984 revenues.

Pretax income from computer operations, which declined sharply in fiscal years 1982 and 1983, rebounded slightly in fiscal year 1984 to $161 million; but it remains a puny 5.7 percent of revenues, well under the $286 million level of fiscal year 1981. Results for the fiscal half ended September 30 show a 17 percent increase in revenues for the Information Systems Group (ISG); however, without a Domestic International Sales Corp. (DISC) tax reversal contribution, income from operations was weak, due partly to write-downs related to the Trilogy investment.

Having concluded that it needs outside help, Sperry seems to have pulled out all the stops. It has invested in Sequoia, a maker of fault-tolerant transaction systems, and in Encore, whose Hydra subsidiary planned to unveil an MMP design in January. It has also concluded an agreement with TI to market TI's AI-oriented, LISP-running Explorer (née "Nu Machine"); and with Intellicorp for marketing KEE (Knowledge Engineering Environment), a LISP-based, $30,000 software tool for constructing "expert systems."

Sperry also said it has established a six-member Technology Advisory Board. The group is chaired by AI expert Ed Feigenbaum (Stanford) and includes noted computer architect Gordon Bell (ex-DEC, and now with Encore) and graphics expert Robert Sproull (Carnegie-Mellon).

BRAVE NEW DIRECTIONS

Sperry is now extending this kind of thinking into the sub-mainframe general-purpose multiuser machines. In describing the move to a press conference at Comdex, Jim Aldrich, vice president of product strategy and market development, suggested that Sperry was undergoing a major change. The "old" Sperry was engineering driven, mainframe oriented, and intent on building all its products in-house.

The "new" Sperry has new management (among them, the formation of the Micro Products Division under Frank Holst earlier this year); a new strategy (the Unix system); and a new product line (the 5000 series from NCR and Arete, the 7000 from CCI). The new Sperry is going to act principally as a system integrator and marketer for products made by others. It brings to the party a worldwide ISG sales force of 1700, supported by a large field-support organization.

MODEL	PERFORMANCE	ESTIMATED PRICE RANGE
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5000/40	0.96	$18,000–$50,000
5000/60 1 CPU	0.96	$62,000–
5000/60 2 CPU	1.7	$100,000
5000/80 1 CPU	0.96	$70,000–
5000/80 4 CPU	3.2	$150,000
7000/40	7.7	$160,000–$300,000

FIGURE 1: SHOWS HOW SPERRY CHARACTERIZES ITS NEW LINE, USING THE AIM BENCHMARKS AND THE DEC VAX 11/780 AS 1.0.

By offering Unix system variants on a line of products ranging from $15,000 to $250,000 and beyond (see Figure 1), Sperry will be the first company to realize the Unix system's potential in portability and scope, according to Dewaine L. Osman, vice president and general manager of the Americas sales division.

Neal M. Waddington, director of microsystems and commodities marketing, fleshed out the details as follows:

One: Xenix 3.0 on the Sperry (Mitsubishi) PC, to be augmented in midyear with Xenix 5.0, a System V-based version;

Two: A Unix System V-compatible operating system (OS) on the Sperry 5000 Models 20 and 40 (they equal the NCR miniTower and Tower XP, respectively);

Three: A Unix System V-compatible OS on the Sperry 5000 Models 60 and 80 (they equal the Arete models 1100 and 1200, respectively);

Four: Berkeley's 4.2 Unix system on the Sperry 7000 Model 40 (this equals CCI's Power 6/32), to be replaced with a System V-based OS by midyear;

Five: SX1100, a System V, Release 1-compatible environment, running as an application under the 1100 mainframe OS. Multiple such "Unix"es can run concurrently and have the ability to access Mapper and other 1100 software as well.

WILL IT WORK?

Sperry is facing some formidable obstacles in implementing this new "buy outside, standardize on Unix" strategy. Not the least of these is a conservative tradition, exemplified by the dull, conventional, and repetitive presentations Sperry officials gave when the firm announced its new thrust at the Fall 1984 Comdex show. Not surprisingly, the resulting press coverage has been scant. Sperry's PR people should attend an Apple product introduction to learn how to generate excitement at such events.

In the past, Sperry has been notably unsuccessful in trying to implement new product strategies. There is reason to question whether its engineering-driven, mainframe-oriented culture can be changed quickly. How quickly its field force will become effective in executing the new strategy is also an important question at this point.

Sperry is banking on the Unix system to become a standard that end-users will demand. While some evidence of such demand is begin-

Continued on page 24

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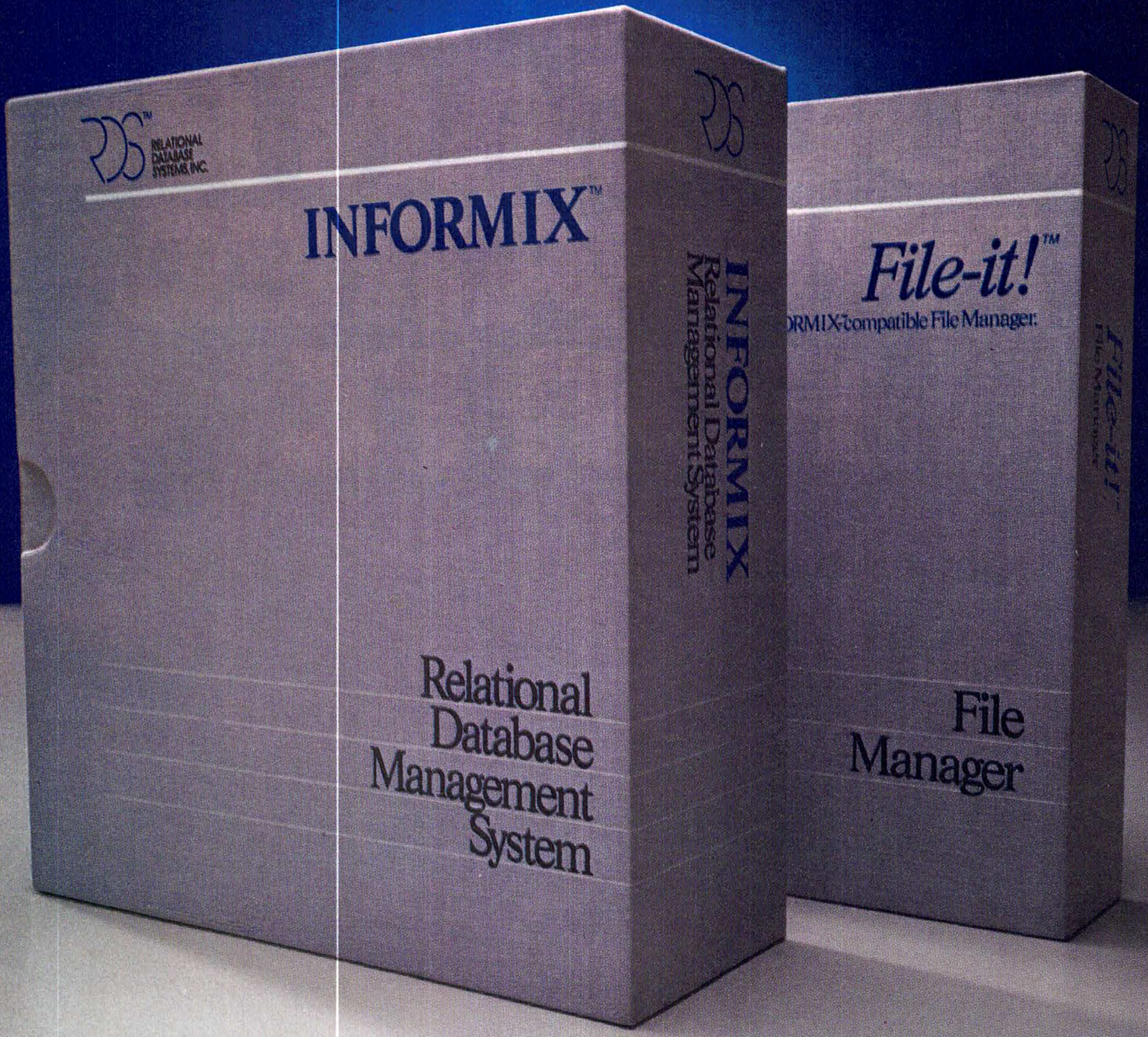

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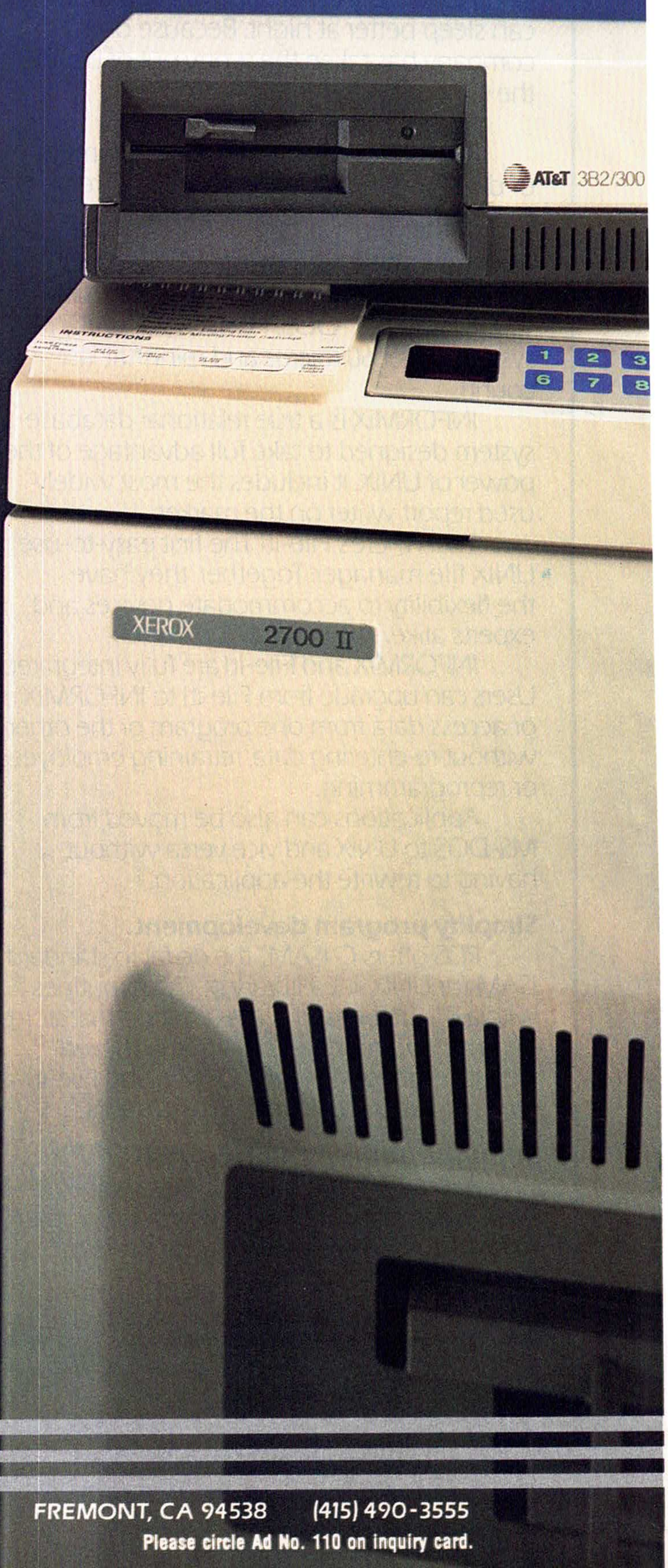

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ning to surface, there is no assurance that the Unix system will fulfill this promise. Some of the leading Unix system independent software vendors (ISVs) and virtually all the Unix system engine suppliers have so far been deeply disappointed with the Unix system's market penetration. One school of thought even suggests that the Unix system wave has already peaked and is on its way down.

While Sperry is promoting the compatibility advantages of the Unix system, it faces the hard reality that the Unix system itself isn't standardized. As a result, Sperry's new "compatible" line offers no less than *four* not fully compatible Unix system versions (Xenix, System V, 4.2BSD, and SX1100). Even if all goes well, not until midyear at the earliest will there be a common, System V base across the line.

How will Sperry cope with supporting five distinctly different new hardware boxes, not counting the PC? The 5000 Models 20, 40, 60, and 80 are all M68000 based, but each is differently packaged; and the 4000/40 uses an ad hoc TTL architecture and still another packaging. The required sparing, training, and support functions appear overwhelming, even for a corporation the size of Sperry. So far, Sperry has merely given its salespeople a two-day course, while about 100 field analysts underwent a more extensive, two-week course, which they are supposed to repeat at their individual branches. Clearly, much more remains to be done before Sperry becomes a credible force in the Unix system arena.

A more difficult question is inherent in the Unix system strategy. Eventually, if the Unix system is established as a standard, the compatibility feature of the Unix system, as well as the Quadratron office software (already offered by some 17 vendors), will extend not just across the Sperry line, but outside it as well. This will make it easy for Sperry customers to "jump ship" at the sight of the next, "hotter" box from a competitor. Loyalty is a rare commodity in a commodity market. Sperry evidently hopes to "keep 'em down on the farm" with such proprietary offerings as Mapper. Integrating this with the Unix system will take time. Meanwhile, Sperry could respond by OEMing the "hotter" box.

On the other hand, what has Sperry got to lose? The original equipment manufacturer (OEM) contracts it signed with NCR, Arete, and CCI can always be renegotiated as the realities of the marketplace dictate. If the Unix system thrust fails, Sperry can retreat to its mainframe niche, being only slightly poorer than if it hadn't tried the Unix system ploy at all.

Really at risk are Sperry's new partners, especially Arete and Computer Consoles. They will have to strive mightily to build up their respective production capacities to satisfy Sperry's demand, which virtually excludes their ability to court and win any other business. Should Sperry's projections prove overconfident, these small companies may end up with enormous overhead and lots of product, but no other takers.

AT&T-IS TO UNVEIL UNIX SYSTEM RUNNING DESKTOP

As we were going to press, word reached us that AT&T Information Systems is already receiving the Safari 4 computers from Convergent Technologies. Delivery ramp-up was set to begin in December, with about 400 units, to be followed by 1000 in January, 2000 in February, and doubling every month later. AT&T will call the product the PC 7300.

Set initially for introduction at Comdex (where prototypes were said to have been secretly shown to press and analysts under nondisclosure terms), the introduction was delayed because of the recent reorganization, AT&T suggested. The more likely reason: applications software delays and shortage of production quantities. To avoid charges of "vaporware," AT&T wants to be able to demonstrate the software and have the machine on dealers' shelves at announcement time.

The 7300 is based on the M68010 microprocessor unit (MPU). It features a minimum of 512K bytes RAM (expandable to 2 Mbytes) and will run Unix System V, Release 2, with Berkeley demand paging and a record-locking scheme. The bit-mapped screen will support up to about 720-by-500 resolution. Along with a Wang-like word processor, it will also feature a Mac-like software ergonomic interface that is touch-screen based. With one 500K-byte floppy, one 10-Mbyte hard disk, a built-in modem, and an integrated voice line (for a conventional phone), its price is expected to be between $4000 and $5000.

Some ISVs are already developing software for the machine, but AT&T is evidently waiting for some packages to reach the demonstration stage before unveiling the machine. Apparently, the 7300 will not support any IBM or MS-DOS compatibility features.

SHORT NOTES

Apple chairman Steve Jobs confirmed at an analysts' meeting that Apple will drop the Lisa 7/7 soft-

Continued on page 26

ware and that it will not develop any more Lisa software. Instead, Lisa will use Mac software and will be positioned as "Mac compatible" (as predicted in this column last year). However, Jobs categorically denied that Apple plans to kill the Lisa hardware, which had its best month ever last September.

Hydra (Natick, Mass.), the Encore Computer Corp. subsidiary, should have unveiled its MMP system by the time you read this, perhaps at the UniForum show in Dallas. The system is constructed from four basic modules: a processor board carrying two National 32016 MPUs, each rated at 0.75 million instructions per second (MIPS); a memory board using 256K-bit chips; a system controller board; and a peripheral controller.

The basic enclosure has 20 slots and can accommodate up to 32 Mbytes and 10 I/O ports. It also uses a proprietary, high-speed bus. The company thinks it will have a threefold price/performance edge over the DEC VAX 8600 (née Venus). The system is capable of networking up to 12 basic systems locally. Its operating system will be Berkeley 4.2 with some System V features.

NCR's Microelectronics Division (Colorado Springs, Colo.) is attempting to increase the lukewarm acceptance of its 32-bit MPU chip set (MPU, address translator, and extended arithmetic chips). To that end, NCR is now offering the chip set on a standard Multibus I board. The board, including 16K-byte fast RAM for external microcode control, is priced at $4995.

Convergent Technologies named Paul C. Ely Jr. president and CEO. Ely previously led Hewlett-Packard's computer group but was shuffled to a minor job in a mid-1984 reorganization. CT's founder, Allen Michels, remains chairman; president Ben Wegbreight will become executive vice president and will continue to run the Data Systems Division, which makes the MegaFrame and MiniFrame systems.

Hewlett-Packard unveiled a Unix system-running transportable computer priced at $4995. Developed by the Corvallis, Ore.-based Portable Computer Division, the computer features an M68000 microprocessor, 800K bytes of memory, a nine-inch electroluminescent flat-panel display, and a built-in ink-jet printer. The ROM-based HP-UX operating system is based on Unix System III. Application software released so far is heavily oriented to engineering and scientific areas.

HP also introduced another HP-UX operating system, the HP 9000 Model 550. Part of a desktop, engineering-oriented series, the 550 is based on a proprietary, HP-developed 32-bit microprocessor chip set. The multiuser system can support up to three tightly coupled processors. Prices begin at $19,425.

Despite its recent Unix system thrust, **Sperry** isn't giving up on IBM compatibility: It has an RFQ out for a 286-based machine to match the IBM PC/AT. As soon as we can, we'll let you know who won the bid. In September, if you recall, Sperry announced a deal with Corona to private-label Corona's 8088-based "luggable" units, which run MS-DOS.

IBM will market Xenix under a System V license it has in place directly with AT&T. IBM-ESD has no serious qualms about System V, after all, and it has apparently taken that license in anticipation of Microsoft's Xenix 5.0, which, our sources confirm, will be based on System V. (Present Xenix 3.x versions are based on System III). Xenix 5.0 is expected by midyear.

RISC Watch: The rumor mill has it that IBM has two reduced instruction set computer (RISC)-related chip developments, both dubbed ROMP. One, at the Yorktown research center, is apparently an experiment with no immediate product application, although the 32-bit microprocessor and a matching memory chip have been produced and are mounted on IBM PC expansion cards. Performance is reportedly up to a 4 MIPS peak, with 2.5 MIPS typical. Naturally, it isn't compatible with any IBM architecture (or anyone else's, for that matter).

A second, less-well-known ROMP project is reportedly underway in Austin, Texas, where most facilities are now under ESD. Both ROMPs are probably part of IBM's effort to develop an Advanced Workstation (AWS), which has been promised to a number of universities (Stanford and UCLA, among others). An "Interim" AWS, with the Sritek National 16032 board instead of the ROMP, will be delivered as a temporary solution.

Philips Data Systems (Eindhoven, Holland) is believed to be readying a Unix system-based supermicro. □

Omri Serlin heads ITOM International Co., a research and consulting firm in Los Altos, Calif. He is the editor/publisher of Supermicro, *a newsletter from which the material in this column was derived, and of the* FT Systems Newsletter, *a monthly covering developments in fault-tolerant systems.*

THE UNIX SYSTEM IN LARGE ORGANIZATIONS

The boom in mainframe Unix system shipments might not hit tomorrow, but the Unix system's chances for becoming a fixture at major commercial companies look extremely good.

BY VANESSA SCHNATMEIER

It crept out of the lab in Murray Hill, was spotted on the Verrazano Narrows Bridge headed for Armonk, and is now pounding on the walls at White Plains. No one's home turf, not even IBM's, is safe, because the age-old question of whether the Unix system will ever become truly popular on mainframe computers and, by default, acceptable to mainstream commercial users, is finally being answered—in the affirmative.

Not that we'll see a boom in mainframe Unix system shipments immediately; plenty of jockeying for position is yet to come, and standardization, which will greatly aid the Unix system's cause in large companies, in the strictest sense is a way off. Nevertheless, the Unix system's chances for becoming a fixture at major commercial companies, as well as at the smaller, more technical firms, look extremely good.

One factor in its favor is that penetrating the *Fortune* 1000, mainframe-reliant community is crucial to AT&T's overall success in the computer business. AT&T hasn't waited for *Fortune* 1000 companies to come knocking on its door but instead has moved to position its products so that they are attractive to major firms.

The three most important branches of AT&T's strategy surfaced at the recent UniForum trade show: First, an agreement with Amdahl Corp, the IBM-compatible mainframe maker, to support a System V-compatible version of Amdahl's UTS mainframe product; second, an agreement with Microsoft to work toward a version of Xenix that is compatible with System V; and third, the availability of AT&T's System V Interface Definition, along with an agreement with UniSoft to have that firm help validate derivatives of System V.

The result: AT&T has gone a long way toward delivering on the Unix system's vaunted portability promises, literally everywhere "from the PC to the Cray," as the


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saying goes. This is extremely important to large companies seeking to standardize their distributed processing and departmental computing systems. And AT&T is hoping that software developers will look to the Interface Definition for their future offerings. The communications giant is working to develop that much-beloved "system solution" for which larger companies typically hunger.

The trumpeting of the Unix system as the be-all and end-all of operating systems has so far left many major companies cool and skeptical. Not the hardware or software vendors, that is, but the banks, oil companies, food conglomerates, and drug wholesalers— you get it, the *Fortune* 1000. Most of them have heard of the Unix system but haven't evaluated it yet as a basis for companywide information systems, although many firms use some brand of the Unix system in selected departments.

"But it's not commercial, it's for the scientific or technical market," they cry. "It's not a commercial mainframe solution." However, analysis from Yates Ventures, the Palo Alto, Calif.-based market research company, doesn't bear those cries out. According to the firm, the Unix system is eminently commercial: More than 90 percent of Unix system boxes ended up in commercial applications in 1984.

A MAINFRAME SOLUTION?

The next question, then, is this: Is the Unix system a mainframe solution? Let's look at this further. Several major vendors—IBM, Amdahl, Sperry, and, via Amdahl, AT&T—now offer the Unix system on mainframes. Other vendors such as Control Data threaten to announce a mainframe Unix system port momentarily.

Sperry's strategy gives the lie to the adage "You can't teach an old company new tricks." Once an engineering-oriented mainframe company, Sperry has changed tracks and transformed itself into a systems integrator, marketing other companies' products.

While IBM mulls over just how it wishes to push its mainframe Unix system offering, Sperry has a definite Unix system offering everywhere in its lineup, from top to bottom, PC to mainframe, to be standardized this year along System V. (See this month's "Inside Edge" for an analysis of Sperry and its Unix system strategy.)

Sperry plans to work with its existing customers first on its 1100 Series of Unix system mainframes. Eventually, said Sperry's Ron Ackerman, group manager of Unix system development, users of Sperry machines based on NCR and Arete hardware "can grow into larger mainframes for expansion."

However, Sperry announced Unix system availability for its 1100 Series mainframes in January, just before the start of UniForum. Thus, it's difficult to tell at this point how much the Sperry offering will affect the market.

Amdahl, of course, has offered a mainframe version of the Unix system for years. [See "UTS: Amdahl's (and AT&T's) Mainframe Unix System" in this month's "Review" section.] UTS on Amdahl's 580 mainframes can be found in many communications and governmental organizations, from Boeing to ITT to the armed forces. Amdahl and AT&T have long worked arm-in-arm. Donal O'Shea, manager of UTS products at Amdahl, says AT&T is one of Amdahl's biggest customers, noting that Amdahl has installed 40 "very large" native systems at AT&T.

O'Shea claims that, far from orienting itself toward the scientific and technical markets, Amdahl has just discovered those markets. "If you look at our product line—it may not be a strategic event but to some extent an accident—we have all the ingredients now for the scientific, technical, and engineering marketplace. . . . We've traditionally focused on the commercial customers."

Penetrating the Fortune 1000, mainframe-reliant community is crucial to AT&T's overall success in the computer business.

LITTLE ENTHUSIASM, NO COMMITMENT

IBM's commitment to its own mainframe version of the Unix system, VM/IX, seems unclear at best. At UniForum in January, Dr. Robert Carberry, IBM's vice president of product development and technology, reviewed IBM's Unix system offerings in a strangely lackluster manner. He explained Big Blue's need to bring disparate product lines together but offered little enthusiasm and no commitment.

IBM's offerings now include VM/IX for mainframes, Xenix for the PÇ/AT and the S9000 machines, and PC/IX for the PC/XT; here too, note the Unix system up and down the line. This means compatibility for program interfaces, easy interchange of media, and simple migration of applications from the host to the micro, certainly ideal circumstances for the IBM aficionado.

Although IBM's intentions for the Unix system are as yet unclear, its VM/IX and PC/IX products make good on one of the Unix system's long-heralded promises—PC-to-mainframe compatibility. In fact, VM/IX and PC/IX are remarkably compatible. In fact, they are largely identical, with such minor exceptions as

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commands to translate the physical format of non-Unix system files or to change options for control of a terminal.

An anonymous staffer at Interactive Systems Corp., the firm that wrought both of these products for IBM, said that when VM/IX went into field testing, the company sent it out with PC/IX documentation; users apparently voiced no problems other than bitter complaints about how the documentation had the wrong system name.

IBM's overall Unix system strategy remains confusing—confusing enough, in fact, to hold back the market, according to many observers. And no wonder.

One Unix system analyst said that as of last year, three IBM operations were clamoring for an IBM version of the Unix system—the Dallas group, working with Interactive Systems; the Palo Alto group, pushing for a version of Berkeley's offering; and Kingston, New York, which wanted a product that ran under IBM's Time-Sharing System (TSS).

Many expected IBM to unveil more for the Unix system at UniForum. At this writing, we continue to wait with bated breath.

The most important reason the Unix system hasn't extended its tentacles into the data-processing departments at the largest companies is almost too obvious: IBM got there first. That is, the Unix system entered the commercial market to face entrenched, hard-core IBM mainframe MVS and VM users, an uphill battle for anyone.

The bad news is that until more Unix system applications magically appear, the Big Guys won't buy. But this situation won't last. A raft of vendors announced Unix system-based applications at UniForum, although the main effects of the coming wave of applications will hit most strongly in 1986. According to Yates Ventures figures, one clear signal of the success in the mainframe market will have occurred when Unix system application sales for existing hardware equal or top the sales to new machines. But Yates Ventures projects that this won't happen until 1987.

THE TECHNICAL DOWNSIDE

If you examine the list of *Fortune* 500 or 1000 companies, you'll note that they often depend heavily on processing financial transactions—banks turning over money by millions per minute, oil companies handling credit card transactions. And here the Unix system falls down: It wasn't originally designed for high-volume, transaction-oriented data processing.

Philip Bernstein, vice president of Sequoia Systems, said: "Almost all such data-processing applications are involved in essential business systems that *must not fail.* Not just that the computer mustn't go down, not just the fault-tolerance issue, but the fact that if you're building an automatic teller machine for a bank or an on-line inventory control system for a warehouse operation, that application simply has to succeed. Period. And if you're working with a new Unix system vendor in doing that, you've added significant risk to your project."

Bernstein added that when his company decided to write a fault-tolerant version of the Unix system designed for financial transactions, it had to rewrite the kernel from scratch. However, he said, while one has to do significant work inside a Unix system kernel to give it appropriate performance and functionality, "one can do it without doing too much violence to the Unix system interface."

Bob Cramer, Unix system business manager for the Ingres DBMS at Relational Technology Inc., concurred that there are technical difficulties not only in the transaction processing area, but also in the ticklish (but necessary) area of developing software that can communicate with IBM files.

"They'll need software that does data extraction from VSAM files and IMS. They'd need communications capabilities. It sounds simple, but it's tough to do, especially when you start getting down to levels of how does one communicate efficiently over long distances, where AT&T is supposed to be strong," Cramer said.

Numerous vendors with good products badly wanted and needed by *Fortune* 1000 companies have stumbled here. All is not lost, however. (For a look at Unix system communications requirements in large companies, see "No Way Around IBM's SNA?" elsewhere in this issue.)

HOW TO AVOID THE IBM STANDARD

No question that the IBM presence in the mainframe market must be dealt with rather than avoided. But how? Sequoia's Bernstein suggested that vendors write new, specialized applications to deal with problems the IBM machines don't or can't touch. Consider Tandem's NonStop computer family: It's not compatible with IBM in

They laughed when they saw AT&T sit down at the System V piano, but when they heard it play. . . .

any significant way except that it can communicate with IBM machines, but it is fault tolerant.

"There's hardly a major bank in the country that doesn't use a

Tandem computer for some major application," Bernstein said. "The important thing is that your computer be able to communicate with IBM using IBM protocols, and to extract the data and move it back and forth."

Donal O'Shea thinks the best strategy for Unix system vendors is to pick up the new mainframe users, those growing into mainframes, rather than trying to pick off users already entrenched into another product. Indeed, he suggested, the Unix system may spring up where IBM hasn't reached because it's politically good within a company.

How's that, you say? The management information systems (MIS) managers at large corporations have watched their power steadily wane as mini's crept in on little VAX feet into engineering and clerical departments. The micro wreaked even more damage. But with mainframe Unix systems, said O'Shea, "here is an opportunity for the MIS manager to step in and operate an economically priced service to the engineering departments and the manufacturing departments and all the rest. I think we'll see Unix as a pivotal point in that."

IBM's commitment to its own mainframe version of the Unix system, VM/IX, seems unclear, at best.

O'Shea added that if Unix system applications can run on a mainframe, it's no longer cheaper for the engineering departments to do their own data processing. "If you look at the requirements for CPU cycles in those shops using VAXen, the requirements are going up much faster than the ability of the machines like DEC's and Data General's."

Bernie Toth, Unix product manager for DEC, disagreed pointedly. The number of applications available for mini's and micro's is what's responsible for the MIS managers losing power, he said. Toth thinks the biggest difficulty in getting the Unix system into *Fortune* 1000 companies hasn't been IBM's presence, but the turtle-like nature of the mainframe market itself.

AT&T, AMDAHL JOIN FORCES FOR FORTUNE 1000 PUSH

AT&T and Amdahl Corp. opened the lid on the first in an expected series of major joint marketing efforts recently, disclosing what could be the mainframe Unix system match made in heaven—as long as pressure from IBM doesn't make their wedding a sham.

At UniForum this year, AT&T and Amdahl announced an agreement to bring Amdahl's UTS product, a mainframe version of the Unix system that runs as a guest under IBM's Virtual Machine (VM) operating system, into line with AT&T's Unix System V. This move will put the two firms in direct challenge to IBM in its home turf, the mainframe data-processing shop.

As Michael J. DeFazio, director of software systems product management for AT&T, told UNIX/WORLD, "Our intent is to point out the mutual benefit of ensuring compatibility of UTS and System V."

Benefit there certainly is—Amdahl, always closely linked with AT&T (the telecommunications giant is one of Amdahl's largest customers) now has the backing of AT&T in getting its product out on the market. AT&T now has System V up and down its product line; it further firmed up this complete line with a simultaneous announcement of an agreement with Microsoft to produce compatible future releases of Microsoft Xenix and Unix System V.

In other words, they laughed when they saw AT&T sit down at the System V piano, but when they heard it play. . . . AT&T is very close to making System V the standard on everything from PCs to mainframes and beyond.

Other expected announcements were held back; for instance, AT&T's plan to actually market UTS has been put off until at least this month, and the native version of UTS that sits directly on top of Amdahl's mainframe without requiring VM won't be announced until the service staff gets further training. An announcement also indicates that an OEM agreement between the two firms, under which AT&T would resell Amdahl mainframes, is in the offing.

Amdahl has never been shy about its place in the mainframe world. Director of UTS products Donal O'Shea has said for a while now that his company holds the lead in mainframe Unix systems.

Amdahl strengthened its position even further with its announcement at UniForum of an agreement with Fujitsu Ltd. of Japan (Amdahl's major stockholder), a plan similar to that with AT&T, that calls for Fujitsu and Amdahl to jointly support the UTS System V-compatible product on mainframe computers worldwide. John C. Lewis, president of Amdahl, modestly said he expects the agreements to provide "accelerated product development and greater momentum for UTS in the marketplace."

The only thing that could hinder the harmony of these love matches is the entrance of IBM further into the mainframe Unix system market. However, if, as some analysts say, IBM's VM/IX is a smoke screen for the real mainframe Unix system product down the road, the triumph of AT&T and Amdahl could eventually ring hollow.

—V.S.

"The high-end commercial market is the last holdout," he said. "Those users are more oriented toward the total system—the smaller technical users have more of a piece-type mentality." System solutions,

The Unix system is eminently commercial: More than 90 percent of Unix system boxes ended up in commercial applications in 1984.

so recent to the Unix system marketplace, will turn the key in the door to the major company commercial marketplace.

RTI's Cramer said the *Fortune* 1000 companies are currently trying to find an answer to their information management requirements. The system approach now being offered by IBM, Sperry, and AT&T and Amdahl will probably break the ice, he thinks.

Michael J. DeFazio, director of software systems product management for AT&T, emphasized that AT&T is working with other companies besides Amdahl to provide mainframe solutions, although he wouldn't specify any particular firms.

So if it seems to you at times as if the mainframe Unix system market has been a living example of the chicken or the egg argument, you're probably right. Which comes first, you ask, the Unix market or the Unix applications? With the entrance of major hardware and software vendors into the mainframe market, it's clear that the chicken will get out of the egg.

Vanessa Schnatmeier, a frequent contributor to UNIX/WORLD, lives in Oakland, Calif. Her latest work for the magazine appeared in the March 1985 issue.

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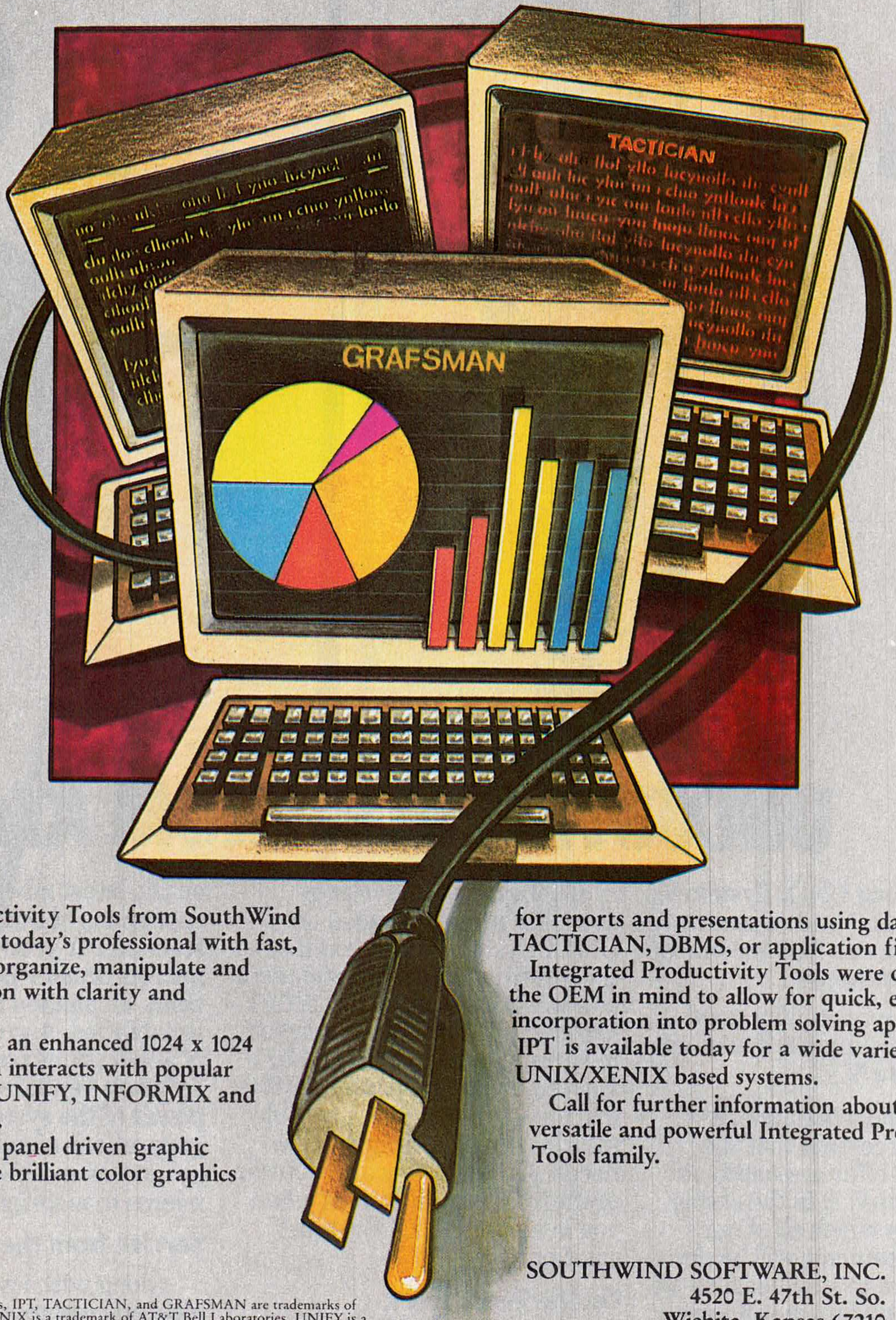

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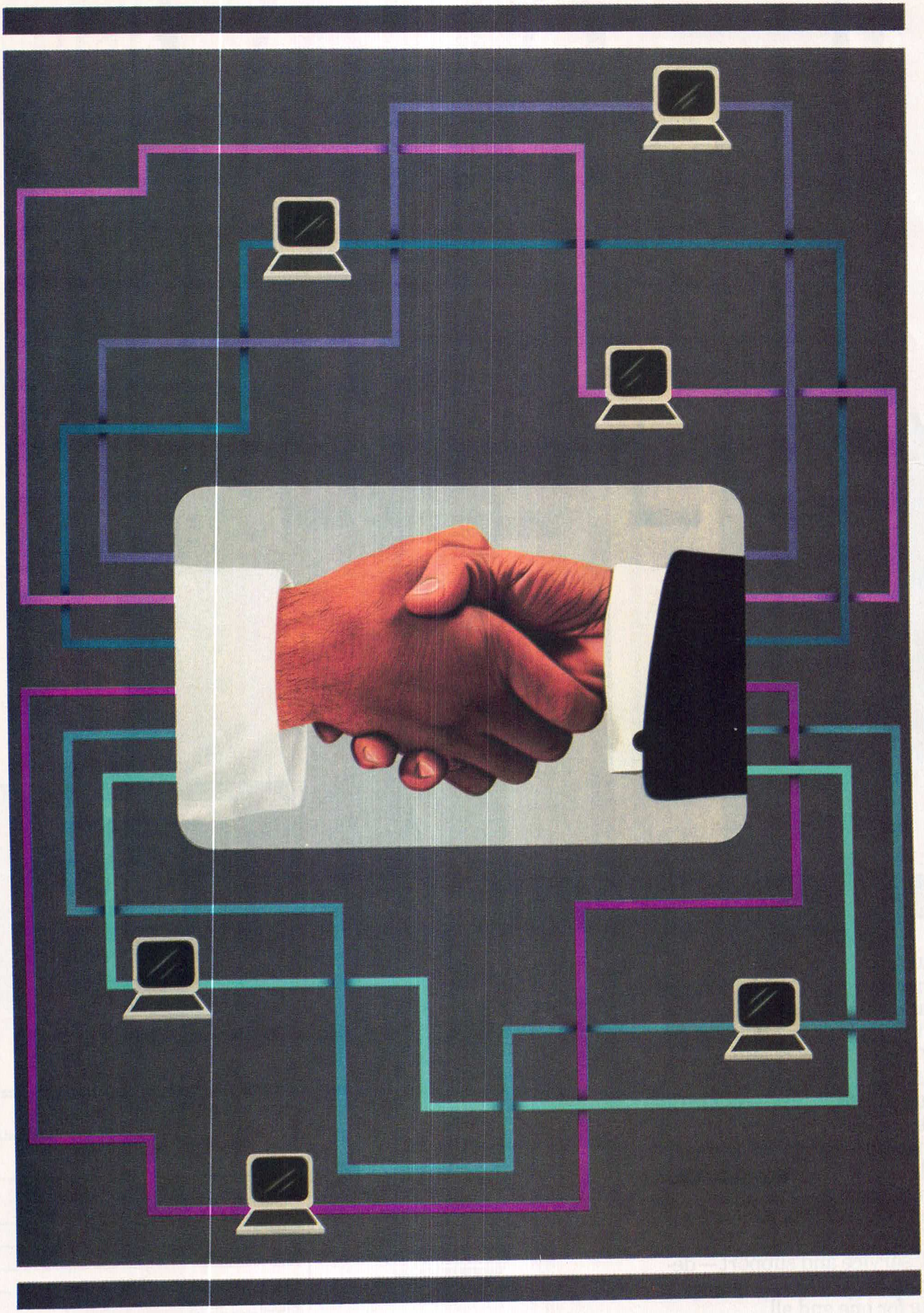

NO WAY AROUND BIG BLUE'S SNA

The success of any multiuser system depends on its ability to communicate with the IBM environment, say our authors, who examine one of the leading network architectures—IBM's SNA.

BY TOM CLARK AND VIC FORGETTA

The trend toward decentralized processing using multiuser microsystems is greatly increasing in the *Fortune* 2000 marketplace. At the same time, industry leaders such as IBM, AT&T, and DEC have endorsed the Unix system as a viable multiuser environment. However, because distributed sites typically communicate with IBM hosts at a central location, the success of any multiuser system depends on its ability to communicate with the IBM environment.

Some users and vendors say that the way to communicate with the centralized IBM host is with multiple PCs connected via a local-area network (LAN). Others say that using Unix system-based machines that support multiple users is the best approach to distributed processing.

The debate over which technology is consistently preferred is truly a moot point because both are multiuser environments and both have applications to which they are best suited. A company with installed personal computers, for example, may simply be looking for a communications scheme, such as that offered by popular LAN vendors, that provides enhanced functionality for the company's existing PC investment. Another firm may choose a Unix system as a cost-effective introduction to a multiuser environment.

In addition, current Unix-based systems can be viewed as part of the evolution of the personal computer from a stand-alone unit to a true distributed processing tool, where it will be involved in data management in multiuser, multitasking applications. The new Unix system-based machines, as with the personal computers before them, will also become nodes on local- and wide-area networks, further increasing their interconnect and communications capabilities.

If Unix-based systems are to become effective networking tools, they must be incorporated into IBM's Systems Network Architecture (SNA). SNA is developing in directions that position it as one of the major networking architectures for both IBM and non-IBM equipment. Clearly, a Unix system/SNA connection is becoming increasingly important to corporate communications strategies. However, when selecting a Unix system/SNA communications connection (or gateway), you should consider several important factors.

In this article we will discuss several different gateway designs, how each has approached structuring the SNA layers within the Unix system, the advantages and disadvantages of each, and what features you should look for when you select a gateway product.

SNA'S LAYERING APPROACH

The way SNA's layers are structured within the Unix system's architecture can vary. This, in turn, affects the performance of both the communication connection and, when the gateway is in operation, of the Unix system. In order to understand the effect of this different structuring, we should first examine SNA's layering approach.

SNA is built according to a sophisticated seven-layer process that manages the relationship between IBM's data communications access methods and remote devices.

SNA's first two layers, Comms and SDLC, represent the lowest level of data flow, managing the physical hardware interface and mediating between the other SNA layers and the communications line. The next three layers—Path Control (PC), Transmission Control (TC), and Data Flow Control (DFC)—organize data into information units and make sure that data arrives or is sent in the proper sequence to and from the other SNA layers.

SNA's top layers, the Network Addressable Unit (NAU) layer and the 3270 Presentation Services, are SNA's most intelligent layers. These layers process data further, manage the 3270 user keyboard, and translate information units into screen images for presentation to user devices.

In the development of a Unix system gateway, the SNA layers are grouped further into three functional areas: the device driver, the daemon, and the user layer. The device driver, which is the utility software that interfaces directly with the communications hardware, is implemented in the Unix system kernel. The daemon is a Unix system background process, managing data between the device driver and the uppermost user layer; it is implemented in the Unix system's application layer. The user layer manages the data flow between the daemon and devices, such as printers or terminals, and also is implemented in the Unix system's application layer.

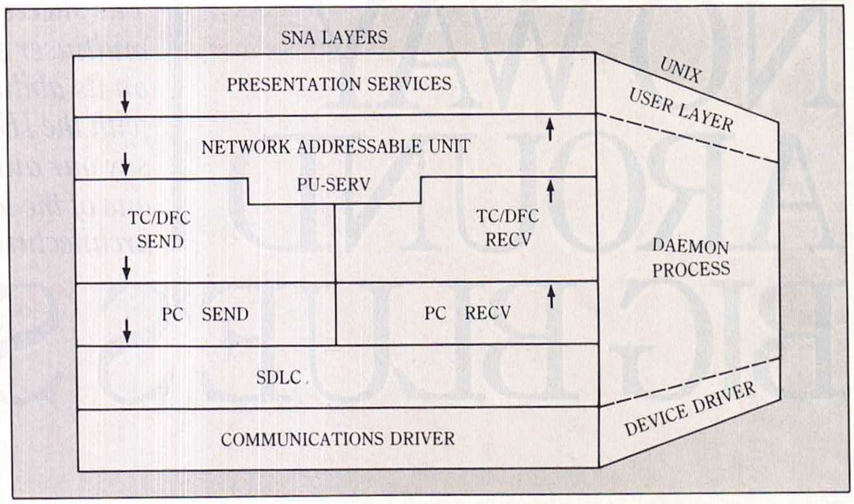

FIGURE 1: The application implementation defines the least amount of communications code in the kernel, leaving the maximum amount of available addressable space.

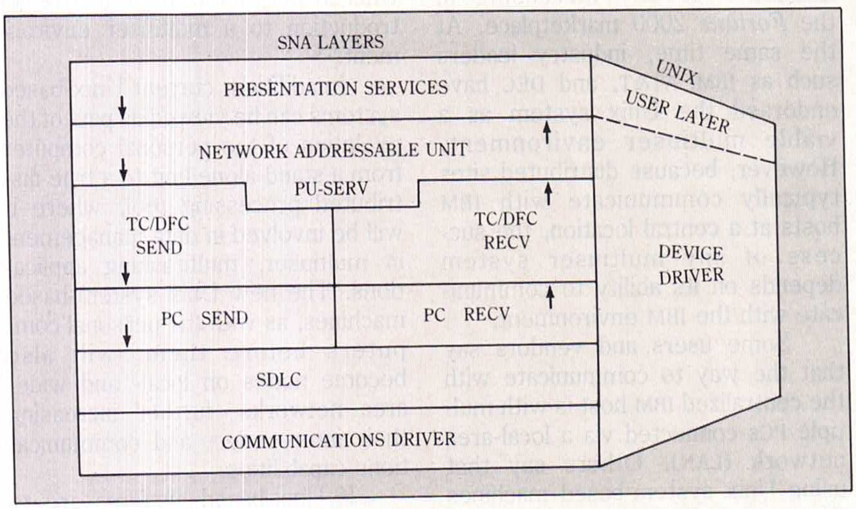

FIGURE 2: The kernel implementation improves the performance of the gateway; however, it leaves a minimal amount of available addressable space.

TWO IMPLEMENTATIONS

One approach to structuring the SNA layers within the Unix system is the application implementation, which defines the device driver as the very first SNA layer. Although the device driver is implemented in the Unix system's kernel, all other SNA layers are organized in the daemon and user layers and are implemented in the Unix system's application layer.

There are both advantages and disadvantages to this approach. Because only one layer is structured within the kernel, the kernel contains a small amount of communications code. Because many Unix system implementations use most of the available addressable space to execute multiuser and multitasking activities, this implementation allows the use of the Unix system to its fullest capacity while the gateway is in operation.

This approach, however, does take its toll on the gateway's performance. As stated, the first two

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layers of SNA, Comms and SDLC, are responsible for the lowest level of data flow and for preparing data for the other layers. When Comms and SDLC are separated and when SDLC is structured with other SNA layers in the daemon, the entire daemon must be activated each time a data character arrives on the communications line.

If the daemon does not quickly respond, then the request is missed and must be reissued. Although the application implementation allows the Unix system maximum addressable space to conduct normal Unix

If you purchase the Unix system solely to support several users communicating with a remote host, then the gateway's performance would be paramount.

system processing, it does so at the expense of the gateway's performance.

The kernel implementation, on the other hand, places all seven SNA layers within the kernel. When an SNA application makes a request, it manipulates completed information units. In this approach, the daemon is entirely eliminated, and the performance of the gateway is greatly improved. Once again, though, there are disadvantages. Just as the application implementation's tradeoff offered full Unix system functionality at the expense of gateway performance, the kernel implementation's trade-off is just the opposite.

Performance is improved with the kernel implementation, but longer interrupts are now required to execute that code, and there is the risk that interrupts from other devices may be missed. In addition, available addressable space is minimized with the large amount of communication code structured within the kernel.

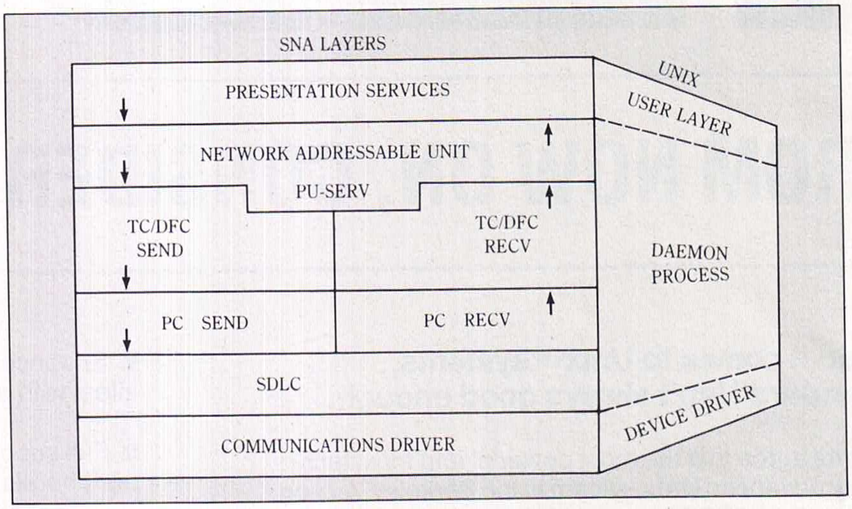

FIGURE 3: This last approach offers a combination of both worlds, performance and addressable space, by defining the device driver as SDLC and communications.

A COMPROMISE

Both gateway designs discussed above offer clear advantages and disadvantages. Note that the tradeoffs of both approaches are due more to limitations of current Unix system and communications hardware technology than to deficiencies in the SNA architecture or in the gateway design itself.

As faster, more powerful coprocessors are developed, and as the Unix system expands in capability, the kernel implementation in particular may be a viable and preferable solution. Currently, though, neither approach is the optimal implementation for today's software and hardware environment. A more moderate approach than these should maximize the advantages of both approaches.

As an example, a compromise approach might define the device driver as both Comms and SDLC—a contracted version of the application implementation. By doing this, the first level of communications processing can be completed in the kernel. Unlike the application implementation, the daemon does not have to be activated each time a character arrives from the communications line.

Queuing frames of characters rather than single characters to be processed by the daemon directly will improve the gateway's performance. Of course, placing more communications code within the Unix system kernel consumes available addressable space. However, this trade-off is more worthwhile than those of the other two implementations when we compare improved performance to the loss of addressable space.

This moderate approach ad-

Continued on page 47


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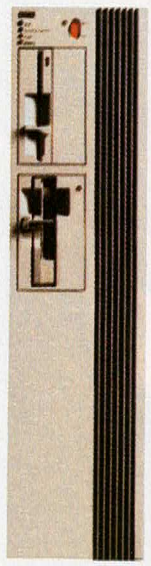

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vocates a design for the most typical communications scenario, in which both Unix system functionality and gateway performance are equally important. Some gateway applications may differ, however, and in such cases, one of the more extreme implementations may be appropriate.

If, for example, you purchase the Unix system solely to support several users communicating with a remote host, then the gateway's performance would be of utmost importance and the kernel implementation might be preferable. On the other hand, if you purchase the Unix system for on-site multiuser, multitasking use with minimal remote host communications, then the application implementation might be more appropriate.

Clearly, not all Unix-to-SNA communications requirements will be status quo. Regardless of the application, however, all Unix-to-SNA communications software should feature certain capabilities.

IMPLEMENTATION QUALITY

Although our discussion of the performance of both the gateway and the Unix system has been based on the implementations of SNA layers within the Unix system's architecture, the features the gateway supports are dependent on the quality of the SNA implementation itself.

A complete SNA implementation should emulate Physical Unit Type 2 (see sidebar), with support for numerous, different Logical Units (LUs). A complete SNA implementation should also offer such features as multiple concurrent session support, user transparency, file transfer, printer configurability, and a flexible architecture for expansion to suit future technological advancements.

The Unix-to-SNA software should support concurrent communications sessions for up to 32 devices per controller emulated, with the Unix system able to support different types of controller

> **The features the gateway supports are dependent on the quality of the SNA implementation itself.**

emulation. As part of this micro-to-host communication, the software should permit uploading and downloading of data to and from IBM applications such as CICS, CMS, and

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FINDING YOUR WAY THROUGH SNA

IBM's Systems Network Architecture (SNA) is considered the de facto networking standard today. However, SNA appears to carry with it such a myriad of complex acronyms as to confuse the non-communications specialist. Let the confusion cease.

Quite simply, SNA manages the data communications relationship between IBM's remote devices and access methods to central host computers. The SNA architecture is built according to a multilayered approach. *Synchronous Data Link Control* (SDLC), the lowest SNA layer, is the protocol used in SNA networks for remote communications; it is a bit-oriented, half- or full-duplex data communications protocol.

***Path Control* (PC) is the next SNA layer. It manages the shared data-link resources of a network and handles end-to-end routing of data. The *Transmission Control* (TC) layer, sitting on top of the Path Control layer, manages the data flow, or pacing, between devices and assures correct sequencing of data. The *Data Flow Control* (DFC) layer, following the TC layer, controls the direction and logical grouping of data.**

The *Network Addressable Unit* (NAU), positioned on top of all the previously mentioned layers, provides the port for end-user access to the communication system. Each NAU is assigned a network address and is the origin and destination of information.

In addition to these definitions, there are several other frequently used terms you should know in order to speak the SNA language. For example, *Physical Unit Type 2* is a cluster controller node that supports a number of devices, such as displays or printers, for end-user support. Another commonly used term, *Logical Unit 6.2,* provides the set of resources necessary to permit program-to-program communication over the SNA network.

***Document Interchange Architecture/Document Content Architecture* (DIA/DCA), located in SNA's application layer, is another valuable term to know. It defines the application-to-application protocol as well as the format and protocols within a document for electronic document exchange.**

As you can see, the SNA language is not that complex. Equipped with these definitions, you can examine the different approaches for implementing the Unix system in IBM's SNA environment and the trade-offs and benefits of each design.

TSO/SPF, in both interactive and batch modes.

In addition, users should be able to toggle back and forth between communication sessions and local applications, as well as continue to download and upload files while running a local application.

A Unix system user wanting to communicate with the IBM host should be able to access and use the communications software with little difficulty. The keyboard should be configured as the user wishes, including support for foreign keyboards. The SNA implementation should also allow users to define a variety of parameters, including establishing logical unit, device, and physical unit configurations.

IBM's SNA is developing in directions that position it as one of the major networking architectures for both IBM and non-IBM equipment.

FUTURE ENHANCEMENTS

In terms of future enhancements, the SNA implementation also should be able to support LU 6.2 and IBM's Document Interchange/Document Content Architectures (DIA/DCA)—important IBM network capabilities. IBM's LU 6.2 is a transport mechanism that provides standardized formats for data transmission. DIA/DCA replaces the 3270 Presentation Services as SNA's top layer and, in combination with LU 6.2, compensates for differences in hardware environments and provides program-to-program communications.

This is especially important for Unix system users requiring communications in the IBM environment. Because DIA/DCA and LU 6.2 allow the Unix system to appear as an intelligent device to the host, throughput is greatly increased by reducing the instructional information transmitted with the data and by allowing a variety of different instructional code to be interpreted. With the new architecture, information from the IBM host can be entered directly into Unix system applications, regardless of the difference in environments.

With SNA developing into a networking standard and with the Unix system moving rapidly from the scientific to the commercial arena, the Unix-to-SNA connection is quickly growing in importance.

In a Unix-to-SNA software solution, the gateway should support capabilities such as multiple, concurrent communications sessions, file transfer, and printer configurability in an implementation that has taken into account the performance of both the gateway and the Unix system. Finally, the design of the Unix-to-SNA gateway architecture must be flexible enough to be able to work with networks of Unix systems and to accommodate advances made to the Unix system and to Unix system-based hardware. □

Tom Clark and Vic Forgetta are employees of Pathway Design Inc., a Wellesley, Mass.-based firm whose products link computers and communications networks.

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BY JEAN S. BOZMAN

In a huge room high above New York City, the eyes of 100 money-market and options traders remain glued to tiny screens for hours on end. These Citibank, N.A., employees would rather stare at green-and-gray CRTs than at a breathtaking view of the historic Brooklyn Bridge and South Street Seaport, as work has become a kind of intoxication for them. They eat in a back-room cafeteria to stay close to the action and often talk while holding two phones. Their aim is to make split-second evaluations of the future worth of federal bonds, over-the-counter securities, and options—and then decide to buy or sell profitably.

"Buy or sell?" is, therefore, a frequently heard question, often directed at a row of senior analysts who gauge the money-market ebbs and flows over the course of a day. This process is called "arbitrage," which one dictionary defines as "simultaneous purchase and sale of the same or equivalent security in order to profit from price discrepancies."

To speed some of these time-dependent decisions, Citibank hired a Boston College economics professor, Jack Ciccolo, in early 1983. Originally retained as a consultant to Citibank, Ciccolo is now vice president of arbitrage at Citibank.

Citibank's money-market managers asked Ciccolo to come up with a CRT-screenful of nearly 200 menu-driven instant calculation aids, partly to avoid asking the company's data-processing group to do the same thing. Citibank, like many other large corporate users, has found a significant backlog in the generation of new applications by a centralized data-processing group.

A substantial productivity gain was achieved over the next 18 months, as Ciccolo converted many of his economics formulas to an eight-user, Unix system-based supermicro. By writing macro commands under the auspices of Fortune's enhanced Unix Version 7 operating system, Ciccolo was able to quickly amass the needed instant-calculators.

In practice, Citibank analysts can log on to the system, insert the date of a bond's maturity and one or two other numbers the menu-driven guide requests, and receive their answers—all in a matter of seconds.

Ciccolo, a 6-foot-6-inch amiable academic who is as comfortable with computer systems as he is with his economic formulas, wrote many of the calculation aids directly from a dictionary of Unix system commands. He strung several commands together into a "macro command" in order to create a one-step calculation that formerly would have taken two or three steps to complete.

But about 40 percent of the Citibank arbitrage library of 175 calculation aids was created by conversion from a DEC VAX 11/780 computer system. The FORTRAN code on the VAX 11/780 at Boston College was easily recompiled—with several small changes—to write new lines of Unix system code that would run on the 32-bit supermicro.

"We have a `sleep` command through which we can ask the machine to run 20 jobs overnight," Ciccolo said. "We can preprogram it to run the jobs at any time we designate." The `sleep` command aided in the initial FORTRAN conversion process, which took several weeks to complete, he said.

A Unix system-based supermicro was chosen for the application because it provided virtually the same performance as a more standard minicomputer at a fraction of

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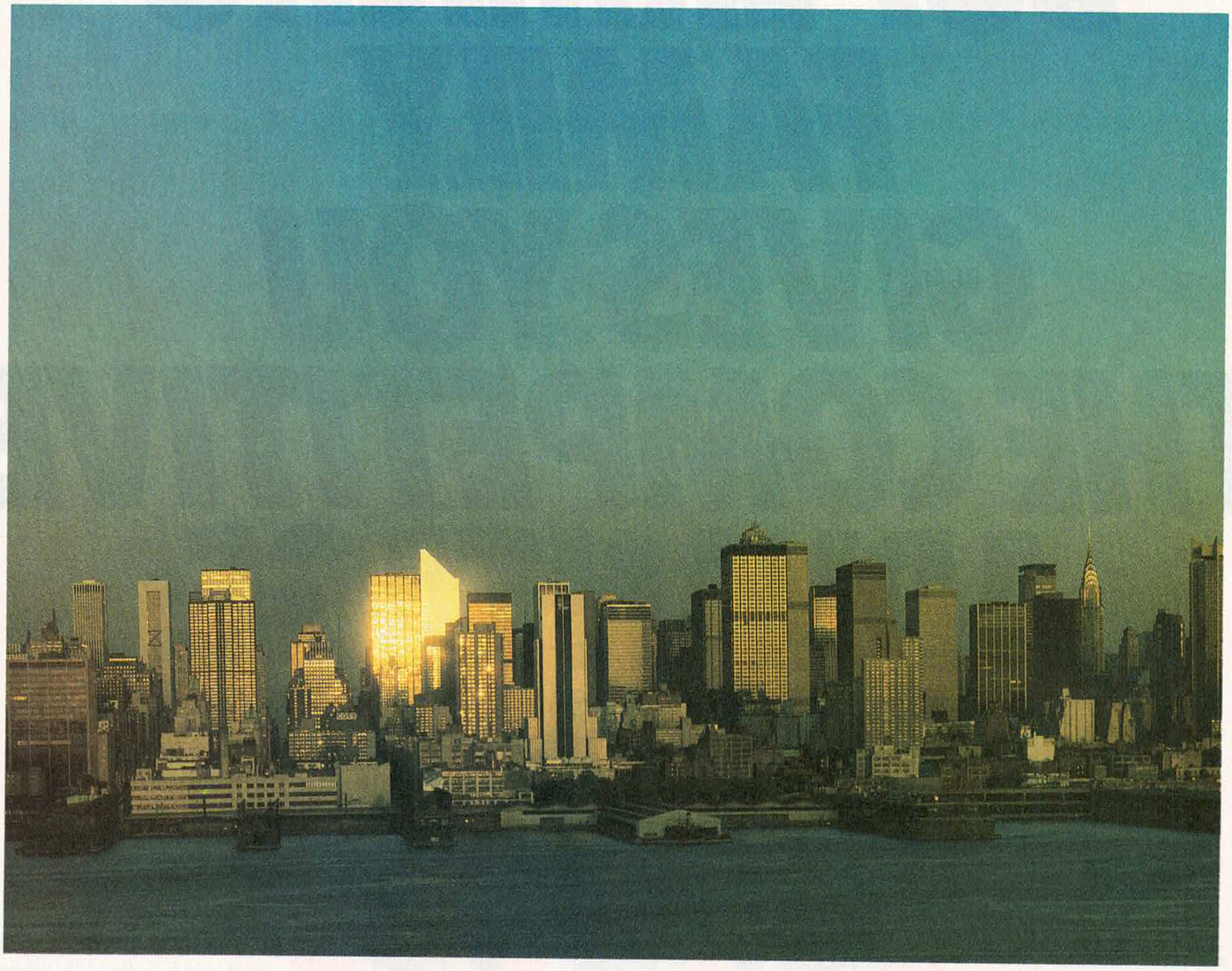

In this view of the New York City skyline, Citibank's headquarters is illuminated to the left.

the $250,000-plus cost typical of a VAX 11/780. Ciccolo chose the Fortune 32:16, which is based on a Motorola 68000 chip. Citibank paid about $25,000 for the 32:16 unit alone, with 1 Mbyte of main memory. A second system, which has 2 Mbytes of main memory and the capacity of 90 Mbytes of hard-disk storage memory at a slightly greater cost, was installed recently as well.

By choosing a desktop super-micro, Ciccolo avoided having to provide an air-conditioned, protected environment that a standard minicomputer would require. An added benefit was that the money-market arbitrage applications were developed in a small room off the trading floor—and not by the bank's management information systems developers. By remaining outside the "loop" for software applications development, Ciccolo said, arbitrage traders avoided waiting weeks or months for new programs to be developed for them.

But the price for this software independence was a lack of hardware support from Citibank's own computer systems group, Ciccolo admitted. That was overcome through a maintenance contract with a national service organization and systems support from a Long Island, N.Y., computer dealer.

All this puts Ciccolo in the category of a sophisticated end-user—a person who can operate a computer system without any hand-holding from the computer manufacturer.

Continued on page 56

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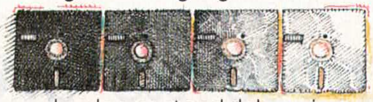

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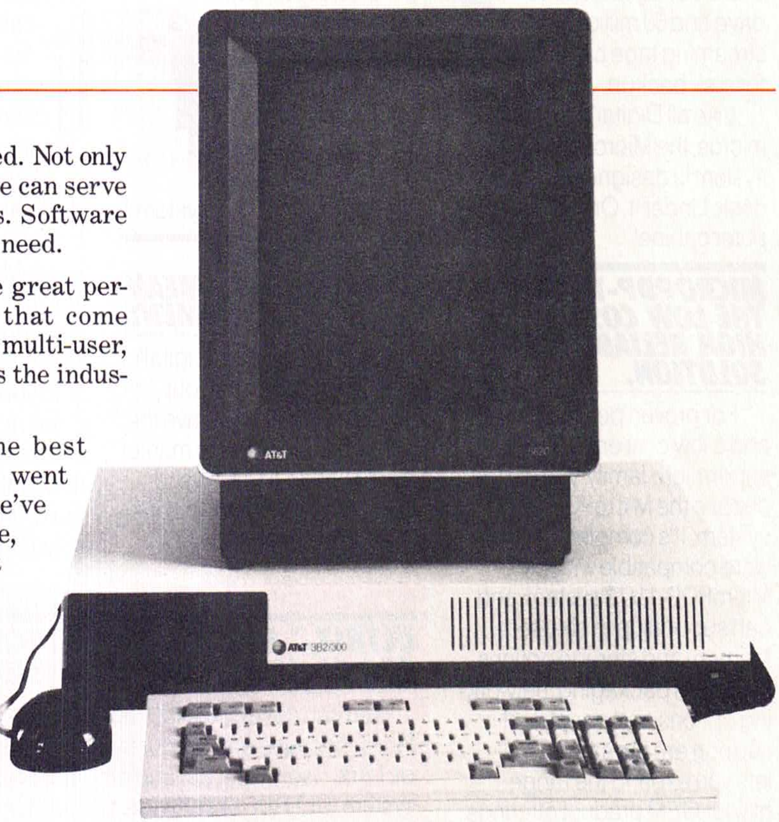

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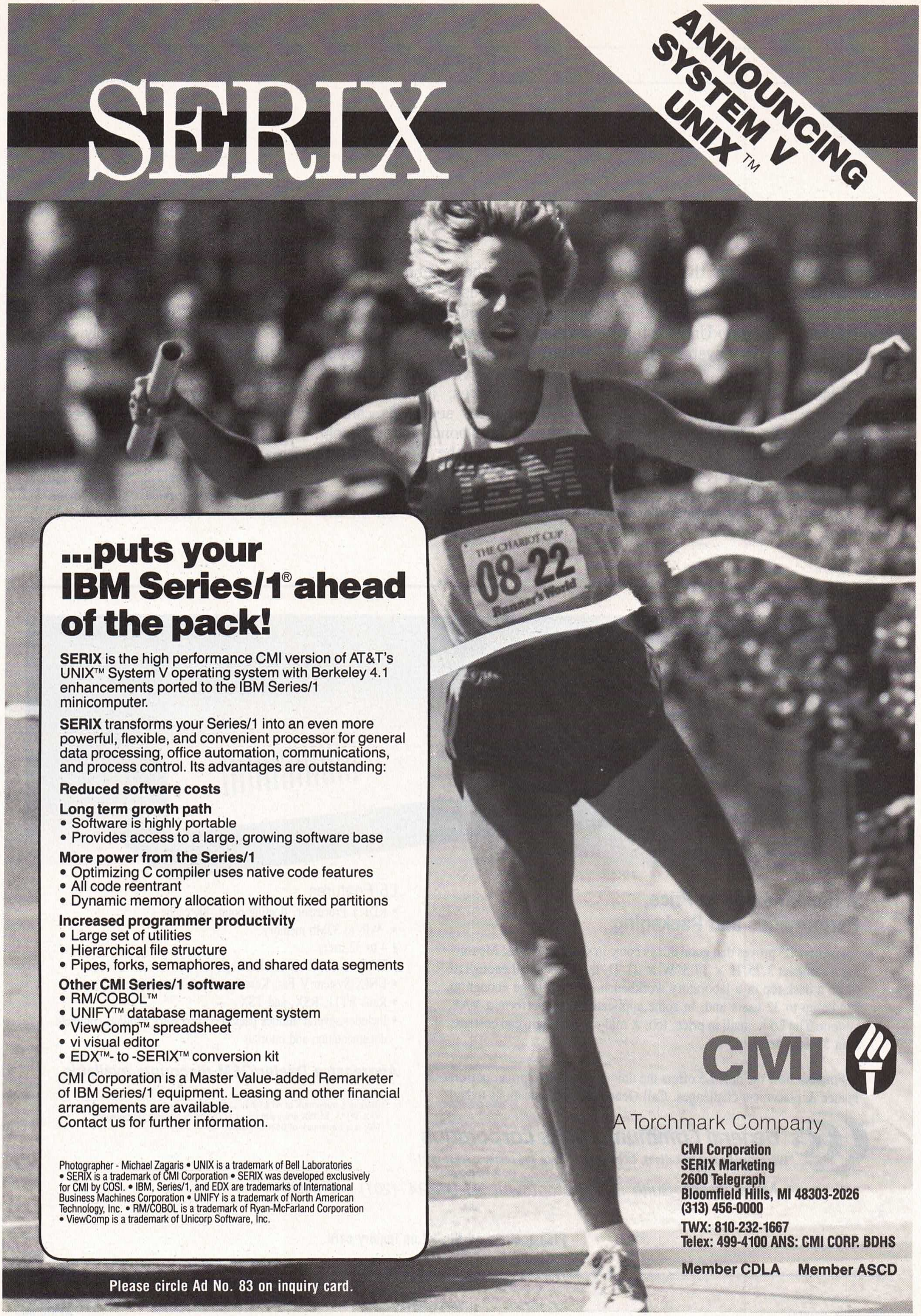

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Continued from page 51

And while Ciccolo says that he can field most software problems by himself, that means he often spends a lot of time looking up Unix system commands in a Unix system reference work.

Because the Unix system is, by design, a multiuser system, safeguards had to be placed on the system scheduler to prevent eight isolated users from requesting more than their share of memory.

Citibank's users appear to be happy with these enhancements since all eight users have been on-line simultaneously without even crashing the system, Ciccolo said. While one money-market trader does options valuation, another works on futures, a third figures over-the-counter securities, and a fourth simulates bond yields. Ciccolo plans to expand the Unix systems' availability to others on the trading floor.

So the work goes on nearly nonstop for the Unix system "that never sleeps," as traders react to the Federal Reserve's handling of the federal money supply, which changes daily just after noontime EST. □

Jean S. Bozman writes frequently on 32-bit data systems. A former data processing editor for Information Systems News, *she is president of Bozcom Inc., a market research firm based in Amityville, N.Y.*

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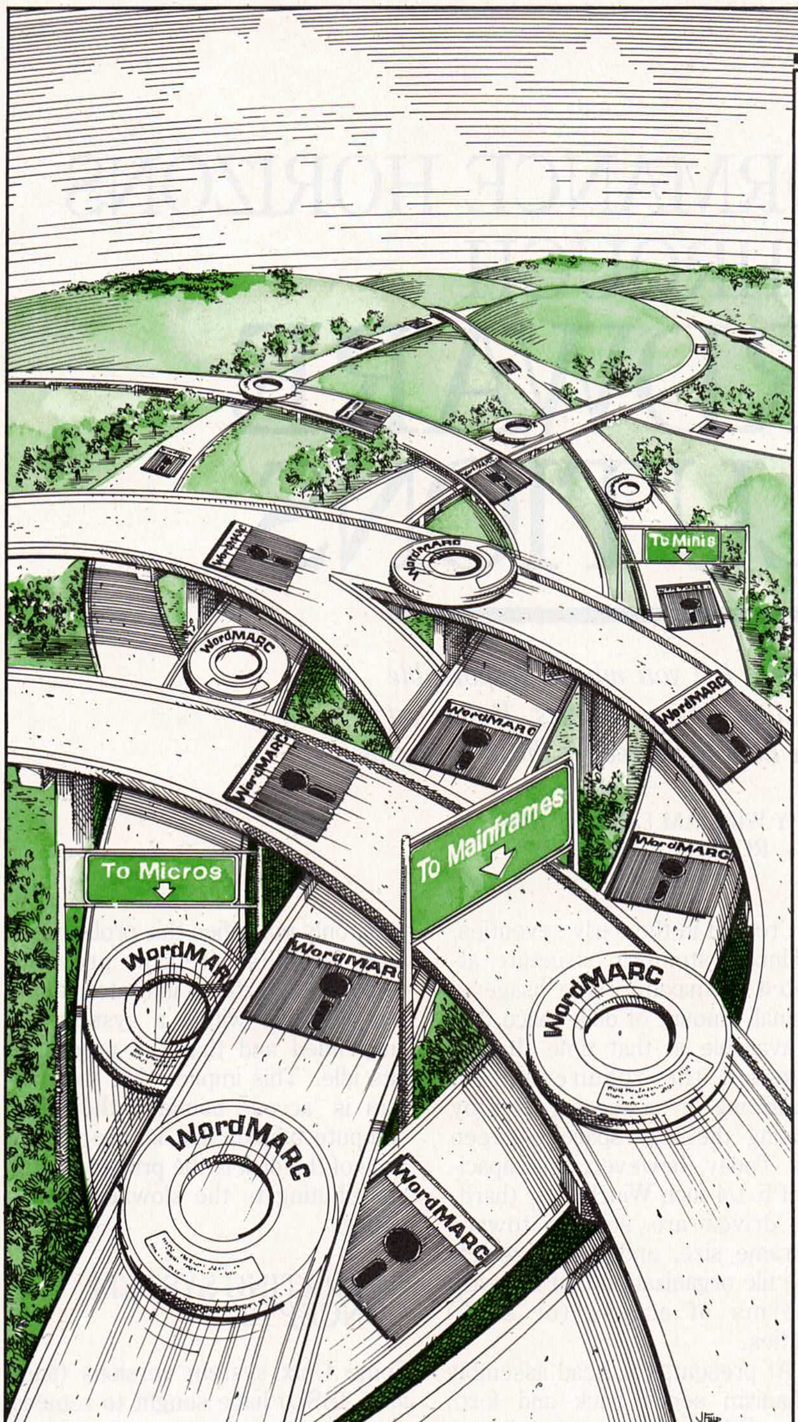

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NEW PERFORMANCE HORIZONS THROUGH HARDWARE SOLUTIONS

Our authors tell you what's responsible for those slow response times. Better yet, they tell you how to overcome those obstacles.

BY WILLIAM J. CASEY AND ROBERT A. ADOLPH

'The response time is too slow.' This must be the most frequently heard complaint from users of Unix system workstations. In some instances this is caused by slow terminal input/output (I/O), but the primary cause (especially for a multiuser environment) is the access delay of the disk subsystem.

There are two major causes of this delay. The first is the mechanical delay within the disk subsystem (caused by the time the head assembly takes to move across the disk) and by rotational latency (the time taken for data to rotate under the head). The other cause is the Unix system file structure. To some degree, improvements are being made in these areas. However, even though optical disks are on the horizon, the mechanics of rotating magnetic storage technology will not change radically in the near future.

Created in the early seventies, the Unix system file structure attempted to maximize the usage of the small amount of disk space that was available at that time. It also eliminated the requirement of reorganizing or 'squeezing' files by removing the free space between them. Today, however, the capacities of 5-1/4-inch Winchester (hard-disk) drives are soaring toward mainframe size, and users are left with a file organization that is costly in terms of access (or seek) penalties.

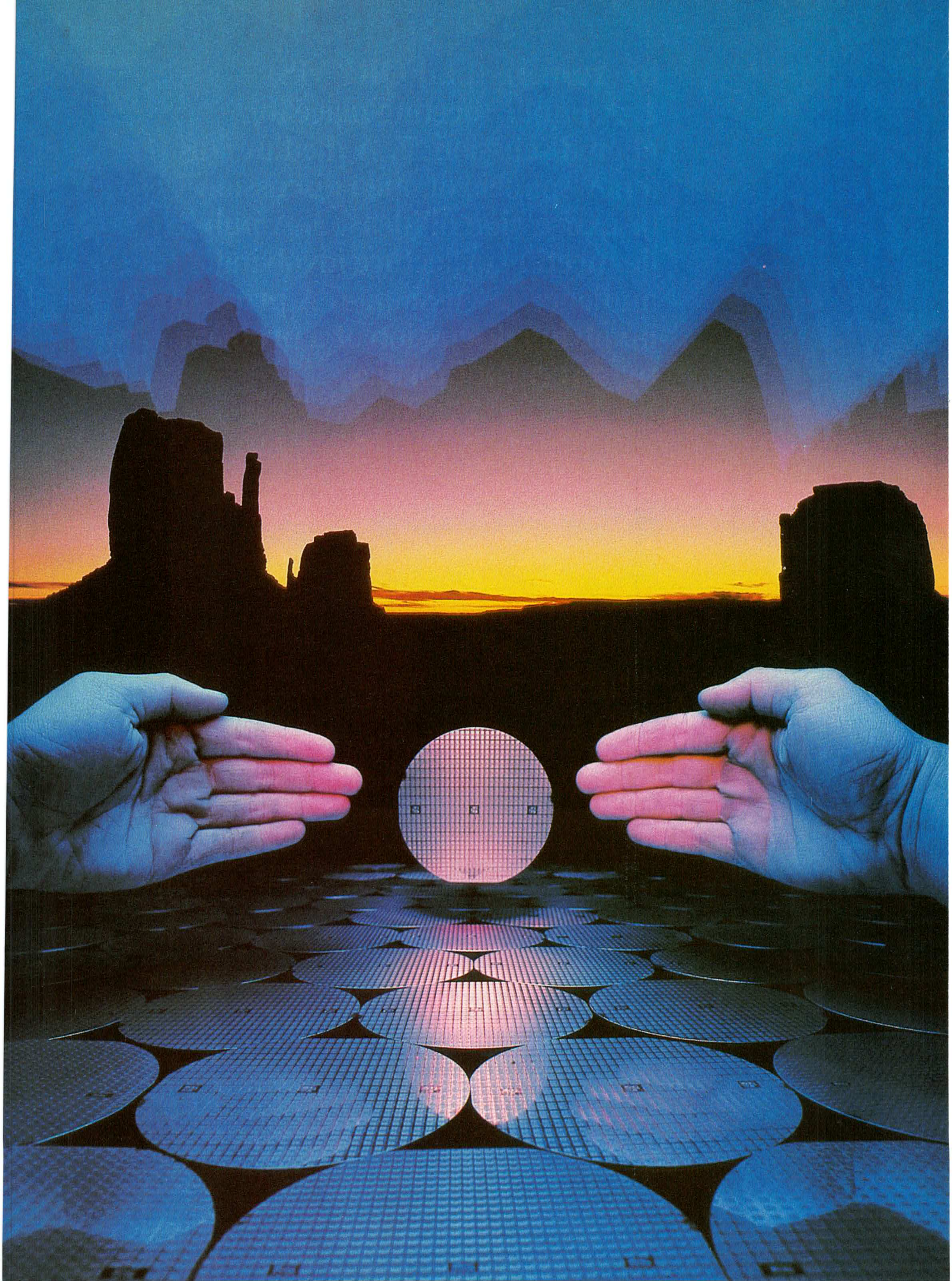
At present, the head assembly mechanism seeks back and forth across disk surfaces and pulls together the pieces (blocks) into which the Unix file system has scattered data. Thus, both the mechanics of the disk and the operating system itself slow down file retrieval.

The addition of multiple users, all seeking their own fragmented files, only magnifies this problem. In fact, studies cited in previous UNIX/WORLD articles indicate that often all tasks within a system are suspended and that the processor sits idle. This implies that the system is 'access bound' rather than compute bound; that is, the access time of the disk is the primary factor contributing to the slowness users notice.

OPERATING SYSTEM CONCEPTS

Some Unix system versions (such as 4.2BSD) have sought to remedy this situation by increasing block size (so that the operating system has fewer blocks to access per file) and by localizing directories and their associated files into cylinder groups. There are, however, serious problems associated with each of these methods.

DON LANDWEHRLE/IMAGE BANK



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Larger blocks mean wasted disk space, which spells trouble for microcomputer users. In addition, larger blocks mean that small files take longer to transfer because large portions of the block are unused or unrelated. Attempts to pack several small files into these large blocks require the operating system (in particular) to do extra work because of the reorganization caused when file spillover occurs.

Clustering into cylinder groups essentially creates a secondary file structure. In this case, more operating system overhead is again involved, with the attendant costs to processing time and system performance. Many published reports overlook the following fact: The time required to seek over one cylinder is not proportional to the distance traveled.

This is so because of inertia upon startup, with its attendant ramp-up delay. Typically, this time is between 28 percent (stepper) and 35 percent (voice coil) of the average seek time of the disk (including rotational latency). Therefore, any seeks at all are costly, even if the operating system is spanning only a few cylinders.

Obviously, if frequently used blocks or files are kept in a fast-access memory bin (or cache), then disk performance and overall system throughput will increase. Although host memory may be a cheaper resource to use, it requires that tables be upgraded and that searches be performed, using both memory and processor bandwidth. Having the main central processing unit (CPU) perform this function negates the desired ends, which are faster processing speeds and faster system response.

On the other hand, a dedicated intelligent caching scheme run within the disk controller itself offers a number of benefits. First, it obviates the need for disk access in the case of a resident file. Second, it groups together the scattered file blocks for immediate transfer to the host on subsequent requests. Third, it eliminates rotational latency, which, in fast voice-coil drives, amounts to 30 percent of the average seek time. Fourth, all manipulation of cached blocks, block searching, and algorithm execution is performed transparently and in parallel with host CPU processing. Parallelism is a time-honored technique for boosting overall computing speeds.

SCSI CONCEPTS

The combination of caching and a high bandwidth peripheral bus for pipelined operation yields dramatic performance increases. Furthermore, if this bus has a logical-block addressing format, then host drivers can become device independent and are reduced both in number and complexity. Driver software also becomes highly stable in the face of continuing changes in storage technology, which greatly reduces the cost of system software development and maintenance for original equipment manufacturers (OEMs) and end-users.

The Small Computer Systems Interface (SCSI), a widely used parallel bus for peripherals, was patterned after the IBM 360 I/O channel model. It includes the previously mentioned features in such concepts as disconnect/reconnect, logical-block addressing, and device-independent command structure.

GLOSSARY

Access time: **The time required to retrieve or deposit information on a disk. This includes the time to move the head assembly mechanism to the requested cylinder, head-settling time, rotational latency, and data transfer. Data transfer time is only a small percentage of total access time.**

Cache: **A staging area for information (instructions in a CPU or data blocks on a disk) that has faster access time than the information's source.**

Locality: **In time, the tendency for the same information to be requested at short intervals; in space, the tendency of successive storage element requests to be located close together physically or by address.**

Look-ahead: **The concept of buffering data by reading blocks in advance to anticipate subsequent access.**

LRU: **A commonly used replacement algorithm (see below) that schedules the least recently used element for replacement by new data during a read.**

Overlapped disk operations: **The concurrent movement of multiple drive head mechanisms to increase data throughput.**

Replacement algorithm: **The method used to decide (during a read) what old cache block should be removed to make room for the incoming data.**

Restructuring: **Rearrangement of cylinders on a disk so as to group the most frequently accessed ones.**

Rotational latency: **After head movement to the desired cylinder, the time for the requested sector to revolve under the head (on average, half a rotation, or 8.33 ms).**

SCSI: **Small Computer Systems Interface, a widely used parallel bus for peripherals.**

When you add a second drive to a single-drive system, the disconnect/reconnect feature alone can double throughput. SCSI also benefits from being a standard that many manufacturers support. These manufacturers include disk and tape-controller houses as well as a number of microcomputer and workstation suppliers.

Companies are increasingly realizing that peripheral device controllers must contain more embedded intelligence to offload the burden of I/O from the processor. Multiuser systems, in particular, need to simplify I/O operations.

In order to gain high performance in applications where disk I/O is the major performance bottleneck, these controllers must have processors on board to optimize data transfers. In addition, they should employ sufficient cache memory in order to reduce the apparent average access time of the supported drives. The controller must optimize, through statistical processes, the flow of data to and from the host.

RAW READING SPEED

Several benefits result from a processor/cache combination within a controller. Caching the most frequently used blocks from the disk yields high apparent access speeds for many operations. This is a result of both temporal and spatial locality of disk access.

Temporal locality means there is a high probability that the same block(s) will be accessed again within a short time. This is true in compiling, linking, and locating, where temporary files are constantly active, and in many number-crunching operations, where a group of programs massage data in repetitive cycles (seismic data processing, for example).

Obvious candidates for caching disk controllers include all Unix system installations, multiuser systems, CAD/CAM installations, business systems, etc.

Spatial locality means that if block A is accessed, the next most likely block to be accessed will be an adjacent block (A + 1). Thus, reading a certain number of 'anticipatory' blocks in advance can boost performance. To be truly effective, this number should be user controlled because only the user knows the system's current 'access profile.'

A valuable feature that helps prevent a 'double-transfer' penalty (that is, disk-to-cache, cache-to-host) is simultaneous transfer of disk data to both cache and host. Also, the ability to 'lock' certain important blocks or groups (such as directories) in a cache can further speed file access.

FAST WRITES AND OTHER CONCEPTS

A large random-access memory (RAM) space in the controller facilitates the following scenario for writing: Upon receiving the `write` command, the controller can start the seek operation on the drive. Data can then be read into buffers up to some limit in size, and the command can then terminate while the controller finishes writing the data to the disk.

There are two overlapped operations here: (1) disk movement with data transfer from the host, and (2) host processing of the next command (or other jobs) with the write operation to the disk. Of course, users can still use the standard write-thru operation, where command completion implies that data has been transferred to the disk.

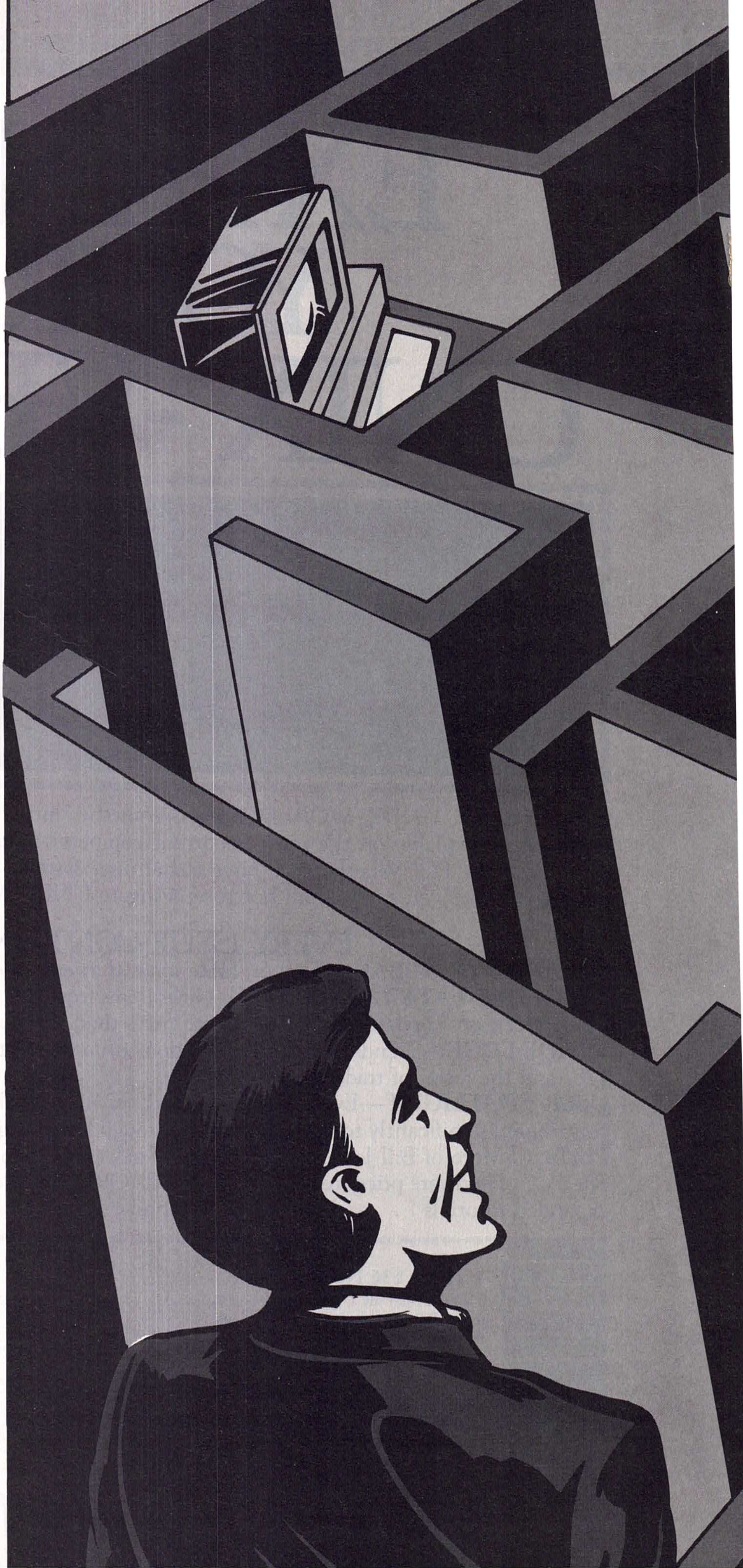
A controller that has a local processor and cache memory also offers other system features. Dynamic user 'tuning' of certain operational and cache parameters enables users to optimize controller performance to match their particular environment and the current access profile of an application.

Split formatting allows restructuring of physical cylinder arrangements in order to reduce average seek time; that is, certain cylinders have a preferred usage in some systems. Variable-size look-ahead buffers can also tailor cache operation to a specific process. Reporting of cache statistics, along with 'settable' cache parameters, forms a feedback loop you can use to optimize controller/system performance.

Applications that are obvious candidates for caching disk controllers include all Unix system installations, multiuser systems, computer-aided design and manufacturing (CAD/CAM) installations, business systems, real-time systems, and so on.

The use of standard I/O buses and software protocols combined with host CPU offloading by a controller with on-board processor and cache can extract the most out of today's disk-based microcomputer systems. □

Bill Casey, president of Advanced Storage Concepts (Houston, Texas), has a B.S.E.E. from Notre Dame and is on the ANSI SCSI committee. Bob Adolph, vice president of engineering at the same firm, is a Rice honors' graduate in electrical engineering.



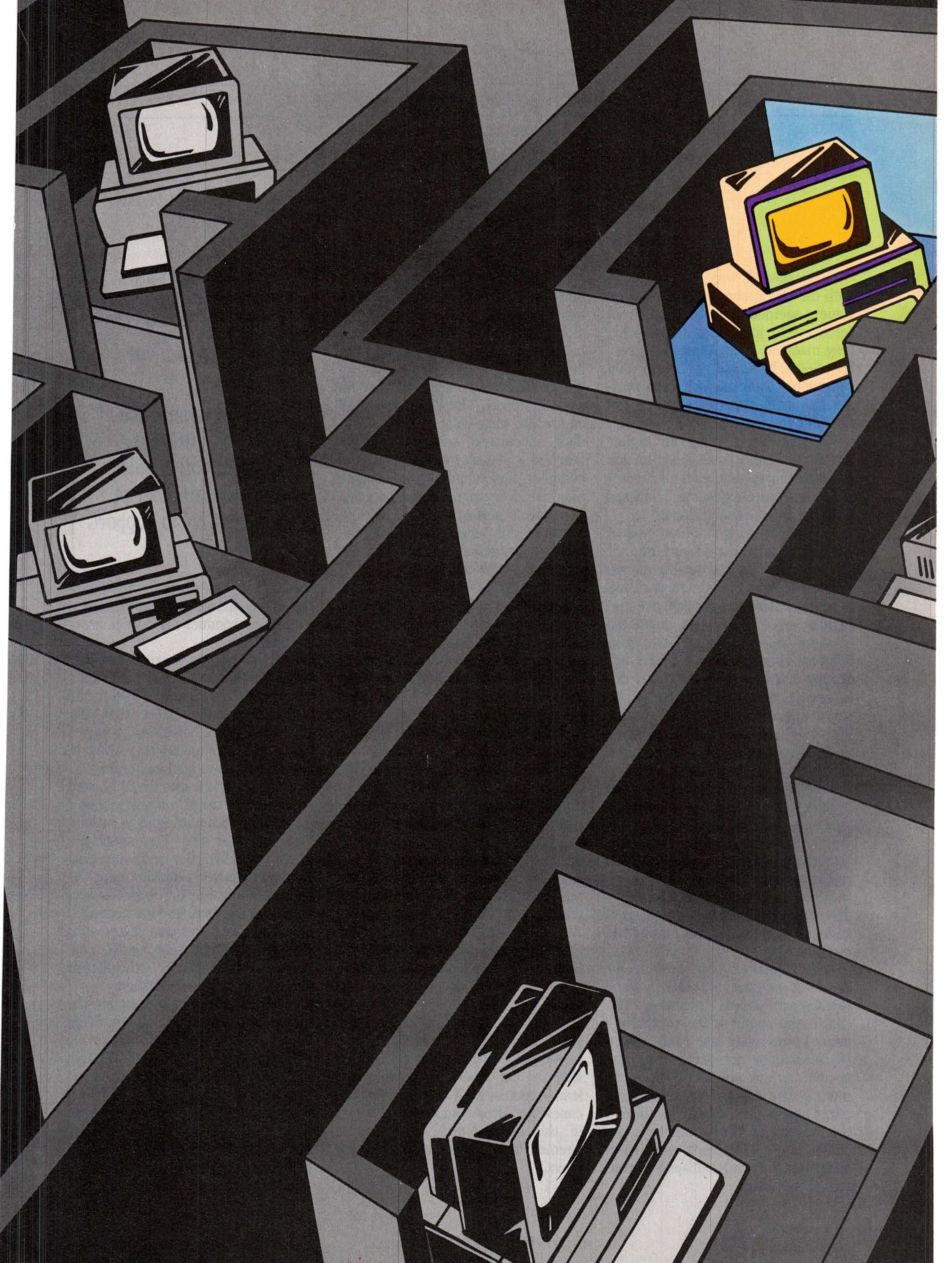
Benchmarking used to be a difficult effort that led to imprecise results. This software vendor's story shows how far benchmarking has come.

BENCHMARKS TO DO BUSINESS BY: UNIX, XENIX SYSTEMS AT WORK

BY NEAL NELSON

'How much does it cost? And how many users can it support?' This was the response from one of my customers after he had listened to a lengthy discussion about benchmark results for various Unix system-based computers. I had to admit that he had just cut to the heart of the matter.

My first experiences with serious benchmarks started in 1983. I have had a Chicago-based systems house since 1973 and had been installing small-business accounting systems on Onyx model C8002M multiuser microcomputers. After selling several Onyx machines, someone urged me to consider the Altos 586 as an alternative.



Because I was very pleased with the Onyx, and because my customers seemed to be satisfied, I was reluctant to just jump ship to this new machine. The Altos, however, cost $6000 less, and, if it performed reasonably well, might be appropriate for smaller customers who did not need the Onyx's power (and who were unwilling to pay its higher price). I wanted to investigate this machine thoroughly before I recommended it to anyone, so I started thinking about benchmarking.

Benchmarking is the process of running exactly the same program on two different computers to see which one runs it faster. At one time benchmarking was difficult and the results were somewhat unreliable because different computers used different languages and different operating systems. With this many differences, you had to modify or rewrite the benchmark programs for each machine, and the first premise of benchmarking (using exactly the same program) became a myth.

However, with the recent proliferation of standard operating systems (Oasis, CP/M, MS-DOS, Unix) that use standard languages (FORTRAN, BASIC, COBOL, C), you can now write benchmark programs that you can move from machine to machine without changing one line of code, thereby producing some valid comparisons.

A computer has three major areas of functionality that a good benchmark should measure. The first is the speed of the computer's central processing unit (CPU), where all calculations are performed. The second is the speed of the computer's disk drive, where the computer stores data files. The third is the speed of the computer's input/output (I/O) drivers, which run such items as video display terminals and printers.

Back to my problem, though. I knew that I didn't know much about benchmarking, so I sought the advice of Don Peterson, a friend who had benchmarked several different machines. Don provided me with a set of benchmark routines that he had developed. These routines read and wrote huge volumes of data to disk, calculated scores of prime numbers, tested the speed of the compiler, and seemed to thoroughly exercise every significant aspect of a computer's performance.

Not only did Don provide me with the routines, but he gave me test results for the Onyx C8002M. This meant that if I ran these same programs on the Altos, I could tell immediately which machine was faster and by how much. Thus armed with my personal copy of a benchmark library, I set out to learn the truth about the Altos 586.

GOING FOR A TEST DRIVE

You don't have to buy a particular computer in order to run a benchmark program on it; computer dealers are gracious about letting you use a machine in a showroom or data center long enough to let you run the program and record the results. It's a little like asking to test drive a car. Another friend had an Altos 586, and he invited me to run the benchmark programs any time. (He was also anxious to see how the Altos would stack up against the Onyx.)

When I ran the tests a few days later, the results were astonishing. I had expected the Altos to be slower than the Onyx because it was much less expensive. Although in some cases the Altos completed the tests in the same time, in others it seemed to run twice as fast as the Onyx.

I was shocked. The Onyx C8002M had proved itself to be an outstanding workhorse for many years, and I couldn't believe that the 586 was so much faster yet cost so much less. Thinking that I must have run the tests incorrectly, I contacted my friend Don and arranged for him to conduct his own tests of the 586.

> **If your programs use BASIC or a database manager, you should reduce the number of users you try to support.**

Don's results were essentially the same as mine. Every indication seemed to say that the Altos 586 was dramatically faster than the Onyx C8002M. Needless to say, I began to recommend the Altos to some of my potential customers.

Within a few months, I booked an order for the Altos and installed our general accounting system on it at a customer site. The installation went smoothly, but soon the customer began to complain about the computer's speed (or rather lack of speed). This surprised me because I felt that the Altos was faster than the Onyx and because similar customers with Onyx computers seemed to be quite satisfied.

When I went to investigate the customer's report, I had to admit that the Altos did seem to be running slowly. At first I thought that this particular machine had something wrong with it, so I benchmarked the customer's unit. The results were consistent with my earlier tests. The Altos ran the benchmark programs faster than did the Onyx, but my accounting programs seemed to run slower. I had two serious problems: First, a customer was unhappy with a machine I had recommended; second, if the benchmark programs did not give me an indication of what to expect, how could I ever measure a machine before installing it at a customer site?

THE MYSTERIOUS 'SOMETHING'

Now I had a real mystery on my hands. There was something different between the Onyx and the Altos, and it was something that the "normal" benchmark programs didn't measure. This "something" was making my accounting programs run slower on the Altos than they did on the Onyx. I needed to find out what this something was. After realizing that the benchmark program I had wouldn't do, I wrote my own.

The previous benchmarks I had used were fairly broad measurements of overall machine performance. They measured the speed of math functions, of the compiler, etc. I wrote a benchmark that measured 13 specific areas: 16-bit math, 32-bit math, floating-point math, speed of function calls, speed of stack allocation, sequential reads, sequential writes, block reads, block writes, random reads, repetitive reads of the same area, repetitive reads of alternating areas, and disk syncs.

I knew which machine functions I wanted to measure because I knew which ones my programs used. By measuring them individually, I hoped that I could identify the "something" that was causing my problem.

I ran my benchmark program on both the Onyx and the Altos machines, and, sure enough, the Altos was faster than the Onyx in 11 of the 13 categories. But the Altos was slower in the random disk I/O test and in the disk `sync` test. The indexed-access method that my accounting programs used performed extensive random disk I/O, and it also issued the `sync` command at various times. The first benchmark routines had not specifically tested these functions.

Once I knew which were the problem areas, I was able to modify my accounting programs to minimize the use of the random disk I/O and `sync` functions. When I did this, the Altos' performance improved significantly. However, while helping solve the customer's problem, I had been bitten by the benchmark bug.

I improved the multiuser aspect of my benchmark program to synchronize each test from a master location and to record the time for each copy individually. I also modified the program so that I could select how many users I wanted to simulate for which tests, and I expanded the number of tests to 18. Armed with my new benchmark program, I set out to learn the truth about Unix system-based computers.

HUNDREDS OF COMBINATIONS

Over 90 manufacturers now offer Unix system-based computers, and most of these manufacturers offer more than one model. Because they all offer options for memory size, disk speed, and so forth, there are hundreds of different combinations that you can benchmark. Right now, I am testing three or four new machines each month.

I chose my initial tests carefully because I wanted answers to some specific questions, including the following: How many users can a machine support before response time becomes unacceptable? Are new versions of the Unix system faster or slower than the old ones and, if so, by how much? What effect does memory size have on response time? Is a big machine with 30 users faster (or slower) than a small machine with 3 users? What are the relative speeds of a personal computer, a supermicro, and a supermini? Are the new processing chips (68000, 80286) actually faster than the older chips (Z8000, 8086) ?

Before getting back to our original two questions of users and cost, I must explain the types of programs I run and the performance level I desire. My programs are written entirely in C and have a classical, linked-list, indexed-file structure. Remember that COBOL programs tend to be larger than C programs. Thus, if your programs are written in COBOL rather than C, you should buy a computer with a larger main memory to prevent the machine from "swapping."

In addition, programs in BASIC tend to be slower than programs in C, and database management systems tend to be slower than linked-list, indexed-access methods. If your programs use BASIC or a database manager, you should reduce the number of users you try to support on any machine.

My customers usually want quick response times (almost instantaneous for field validation, and three or four seconds for full-screen inquiries). If you need faster response, or if you can tolerate slower response, you could also adjust the number of users (see Figure 1). Based on my tests, I prefer the machines listed in Figure 2.

For those of you interested in the nitty-gritty details, here are some of the more interesting technical points I uncovered with my benchmark program.

TWO MAJOR TYPES

There are two major types of multiuser operating systems, which I refer to as "partitioned" and "swapped." A partitioned multiuser operating system divides main memory into several partitions, and each user program is placed in a partition. The computer's "brain" constantly switches from one partition to another, executing each program for a short time.

This is a relatively fast form of a multiuser operating system, but it requires a computer with a large main memory. There is a drawback, however. If the main memory is large enough for six user programs, a seventh person who trys to use the computer will not be able to do any work until someone else's job ends.

A swapped multiuser operating system will normally have a save area on a disk storage unit where it can place user programs temporarily. The operating system will execute a user's program for some length of time, copy it out to the disk, and then copy a different user's program in from disk. The operating system then executes the new program for a time and repeats the process.

Brand	Model	Memory	Disk	Unix/Version	Heavy Users	Light Users	Approx. Price($)
Altos	586-40	512K	32Mbyte	Xenix 2.5	3	6	$ 10,000
AT&T	3B2/300	1024K	32Mbyte	Unix 5.1	6	20+	$ 15,500
CCI	5/20	1024K	72Mbyte	Perpos 3	4	13	$ 42,000
DEC	VAX/750	2048K	121Mbyte	4.2BSD	6	19	$ 60,000
IBM	Series/1	512K	29Mbyte	Serix 5	2	6	$ 42,000
Intel	286/310	980K	32Mbyte	Xenix 2.3	5	10	$ 17,500
Momentum	32E	1024K	33Mbyte	UniPlus 2.2	1	7	$ 22,000
Onyx	C8002M	512K	36Mbyte	Unix 3.0.3	5	8	$ 15,000
Plexus	P-35	2048K	145Mbyte	Unix 3.1	9	20+	$ 28,000
Pyramid	90x	4096K	214Mbyte	OSx 2.3	14	30+	$100,000
Zilog	32	1024K	168Mbyte	Zeus 3.21	12	18	$ 33,000

FIGURE 1: A comparison, based on the author's benchmarks, that shows the number of "heavy" users, "light" users, and price tags of some of the more popular Unix system-based multiuser computers.

Users	Brand/Model	Price	Comments
1	none		I haven't yet tested the PC/AT or the new AT&T personal computer.
2–4	Altos 586-40 512K 32MB	$9995	Good price/performance; inexpensive on-site equipment maintenance.
5–8	AT&T 3B2 1024K 32MB	$15,500	Response curve is very flat. The system does not "degrade" much as more users become active.
9–16	Plexus P-35 2048K 145MB	$28,000	Good (although expensive) repair and software support.

FIGURE 2: The author's recommended systems for different numbers of users.

Benchmarking is the process of running exactly the same program on two different computers to see which one runs it faster.

One advantage of a swapped system is that the computer's main memory need only be large enough for the single largest user program, thereby reducing cost. Another advantage is that it will continue to run (albeit slowly) when it is overloaded. The most notable disadvantage of a swapped system is that it is usually much slower than a partitioned system; all the copying back and forth from disk takes a considerable amount of time.

The Unix system uses both partition and swap techniques. As more user jobs are started on a Unix system computer, they are loaded into available memory. When all of the memory has been used, the Unix system begins to swap some tasks out to a disk area. This allows the system to provide the best features of both techniques—it uses the faster partitioning technique until all available memory has been used, but it absorbs "overload" conditions by using the swapping technique.

But this raises some important questions: At what point does a particular computer shift from partitioned to swapped? And how much

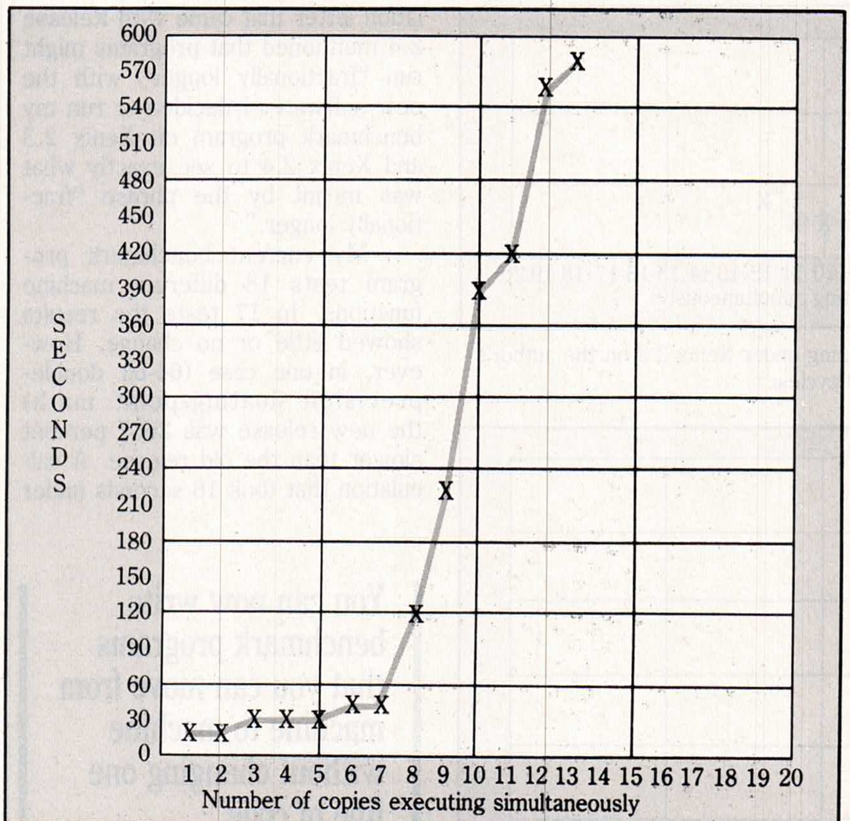


FIGURE 3: Results of the Onyx C8002M (512K) on the author's Test 1, Disk I/O and Calculations, 100 cycles.

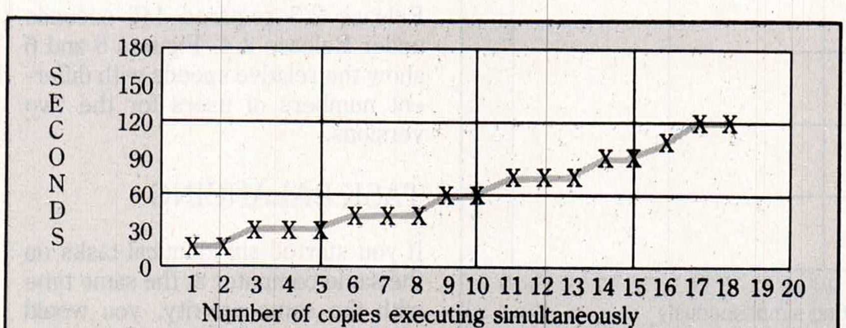


FIGURE 4: Results of the Onyx C8002M (1024K) on the author's Test 1, Disk I/O and Calculations, 100 cycles.

slower will it run once it starts the swapping process? My benchmark program answers these questions by executing multiple copies of identical programs that perform exactly the same function at the same time. The benchmark measures the time required to complete these identical tasks; when you plot the results, you can easily see at what point the system starts swapping and exactly how much slower it will run once the swapping starts.

Figures 3 and 4 show some sample results. The first of these figures shows the results for an Onyx C8002M with 512K bytes of main memory. You can see that the swapping process starts with the eighth program and that response time changes dramatically after that point. The other figure shows the same computer with 1024K bytes of main memory. It is easy to see that with 13 active tasks the 1024K-byte machine is completing work 900 percent faster than is the 512K-byte machine.

There was something different between the Onyx and the Altos, something the 'normal' benchmark programs didn't measure.

NEW OPERATING SYSTEM RELEASES

From time to time, equipment manufacturers offer a new release of a computer's operating system. Included with these new releases are corrections of problems that users of the previous release have reported and, sometimes, additional features that the manufacturer feels will make the product more attractive. Experienced programmers frequently grow quite cynical about new releases, which always seem to create two new problems for each

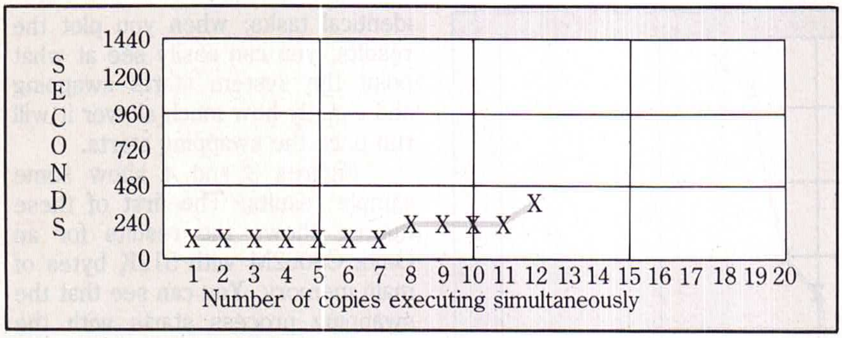


FIGURE 5: Results of the Altos 586-40 running under Xenix 2.3 on the author's Test 7, Double Floating-Point Math, 25,000 cycles.

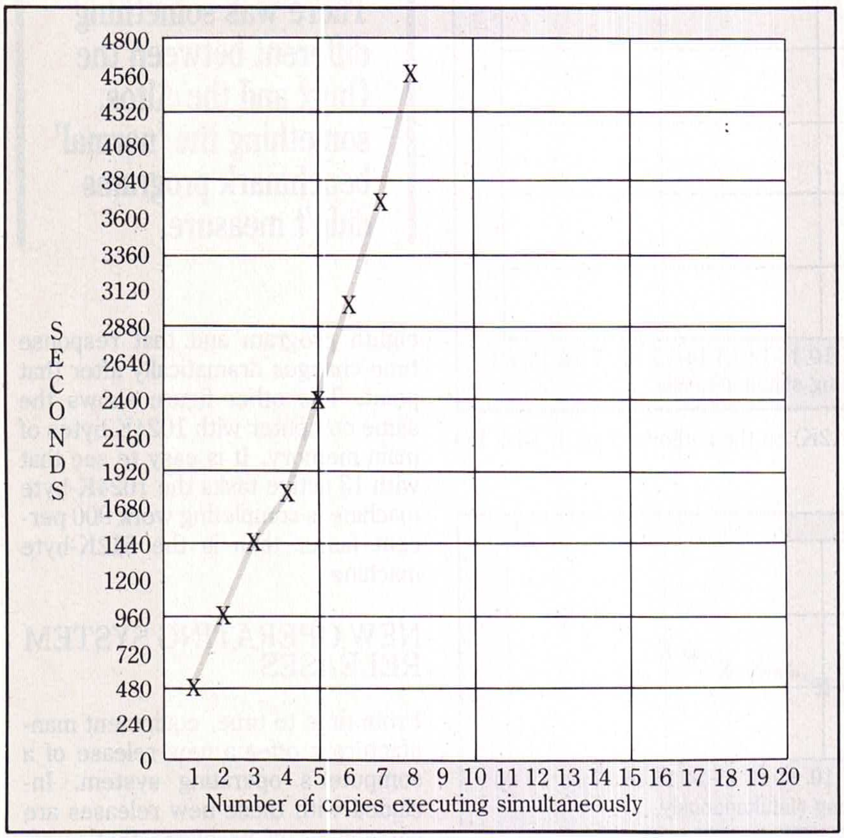


FIGURE 6: Results of the Altos 586-40 running under Xenix 2.4 on the author's Test 7, Double Floating-Point Math, 25,000 cycles.

one they have solved, and programs always seem to get bigger and slower under the new release.

In 1983 Altos began distributing Release 2.4 of Microsoft's Xenix system. This release included some changes that allow program sizes greater than 64K bytes. The installation letter that came with Release 2.4 mentioned that programs might run "fractionally longer" with the new software. I decided to run my benchmark program on Xenix 2.3 and Xenix 2.4 to see exactly what was meant by the phrase "fractionally longer."

My current benchmark program tests 18 different machine functions. In 17 tests the results showed little or no change. However, in one case (64-bit double-precision floating-point math) the new release was 2687 percent slower than the old release. A calculation that took 16 seconds under

You can now write benchmark programs that you can move from machine to machine without changing one line of code.

Release 2.3 required 446 seconds under Release 2.4. Figures 5 and 6 show the relative speeds with different numbers of users for the two versions.

TASK BALANCING

If you started six identical tasks on the same computer at the same time with the same priority, you would expect that they would take about the same time to complete—right? Wrong! My benchmark program has uncovered numerous cases in which the times taken to complete identical tasks executing simultaneously differ dramatically. I refer to this as a "task balancing" problem. Figures 7 and 8 list some sample results that

	Altos 586	AT&T 3B2	Momentum 32E	Onyx C8002M
Copy 1	253	143	403	86
Copy 2	249	174	322	86
Copy 3	249	158	322	168
Copy 4	273	208	165	171
Copy 5	265	116	163	211
Variance	10%	79%	147%	145%

FIGURE 7: The results of the author's Test 15 (Write 500 Records to Disk, "sync" Disk After Each Write), five copies executing simultaneously. Numbers represent seconds required to complete each test for each copy.

	Altos 586	AT&T 3B2	Momentum 32E	Onyx C8002M
Copy 1	106	54	91	43
Copy 2	105	76	72	44
Copy 3	105	82	71	82
Copy 4	105	59	36	86
Copy 5	106	38	35	106
Variance	1%	116%	160%	147%

FIGURE 8: The results of the author's Test 18 (Read 500 Records Randomly From Disk), five copies executing simultaneously at the same priority. Numbers represent seconds required to complete test for each of the five copies.

illustrate both good and bad task balancing.

Although the time variance from fastest to slowest is interesting, what I found to be more interesting was that, on the Onyx, the first copy created ran fastest and that the last copy ran slowest. On the Momentum, the first copy ran slowest and the last copy ran fastest. On the AT&T, there was significant variance, but no visible pattern; and on the Altos, there was relatively little variance. And these are only a few examples. The results in my files contain dozens of similar cases where the same patterns are evident.

These results, and others like them, show how far benchmarking has come in the last several years. Yes, benchmarking used to be hard and the results imprecise. But thanks to the spread of standard operating systems and their standard languages, you can move benchmark programs from machine to machine without changing any code. This means that you can now produce valid comparisons of machines, finally giving us a reliable way to answer those two nettlesome questions we began with. □

Neal Nelson graduated from Purdue University in 1970. His firm, Neal Nelson and Assoc., has been providing application software in the Chicago area since 1973.

UTS: AMDAHL's and AT&T's MAINFRAME UNIX SYSTEM

Amdahl's Maxi-Unix System, UTS, represents an uncommonly fast and powerful marriage of two usually opposing worlds: the Unix system and IBM's mainframe environment.

BY BRUCE HUNTER

Few people know that Amdahl Corp. has managed a stunning marriage between two formerly diverse worlds: the Unix system and the IBM mainframe environment. This melding is likely to become even more important in the not-so-distant future, as AT&T Information Systems (AT&T-IS) and Amdahl Corp. team up to push System V to major accounts and to *Fortune* 100 users (see this issue's cover story).

Consider the potential of merging the Unix system with IBM architecture. The Unix system has many strengths, including its programming environment, its writers' environment, and its unique capabilities as a communications machine.

Critics, however, often deride the Unix system for its lack of speed and for its weakness as a production environment in batch-processing-oriented applications. Amdahl's version of the Unix system, the Universal Timesharing System (UTS), clearly shows that these failings are intrinsic to the mini and supermicro classes of computers, rather than to the Unix system itself.

This review discusses two versions of UTS: UTS 2.3 and the soon-to-be-released UTS 5, a System V-based version. Both were reviewed on an Amdahl 470 v7a.

Most installations with UTS use it on top of VM, IBM's proprietary "virtual machine" operating system. VM is not an operating system in the conventional sense—it's more accurate to call VM a "software platform" because it can support a multitude of other operating systems.

For instance, VM can support several IBM operating systems simultaneously (including CMS, IBM's single-user operating system), and all can co-exist with one or several UTS Unix systems on the same piece of hardware.

Naturally, subtle differences exist between UTS 2.3 and the "vanilla" AT&T Unix system. For the most part, these differences occur when UTS interfaces with other UTS machines (both real and virtual), with IBM's VMsystem, with CMS, and with commands that talk to IBM hardware.

With virtual Unix systems sitting on IBM's architecture, traditional Unix system commands have a Big Blue accent. IBM tapes are labeled with a volume number and a serial number called volser' (from *vol*ume and *ser*ial), Winchester disk drives are dubbed DASD (for direct access storage devices), and so on.

If the device doesn't start with a *3* and if it doesn't have three more digits following, most likely it doesn't belong to the system. (Almost all IBM devices start with the numeral *3,* followed by three digits.) You never "boot" the system; instead, you do an IPL (Initial Program Load).

A TYPICAL VM/UTS INSTALLATION

Typically, a mainframe running UTS has a large number of CMS virtual machines sharing the system with several UTS machines. The number of UTS machines present on the system depends both on the judgment of the system manager and on the needs of the users.

There is nothing unusual, for example, about having 12 virtual UTS machines, each with up to 100 user log-ins and 4 to 16 active users at any given time on each virtual Unix system machine. The number of available lines to each machine is also a matter of system management discretion.

Because IBM operating systems and the Unix system have so few similarities, system administration should be handled by two individuals—one managing the

COMPANY OVERVIEW

Corporate:

Company name:	**Amdahl Corp.**	
Public/private:	**Public**	
Year founded:	**1970**	
Headquarters:	**1250 E. Arques, Sunnyvale, CA 94086**	
CEO	**John C. Lewis**	
Senior VP corporate Strategy and software:	**William F. O'Connell Jr.**	
General sales contact:	**Donal O'Shea, Director, UTS products (408/746-6289)**	

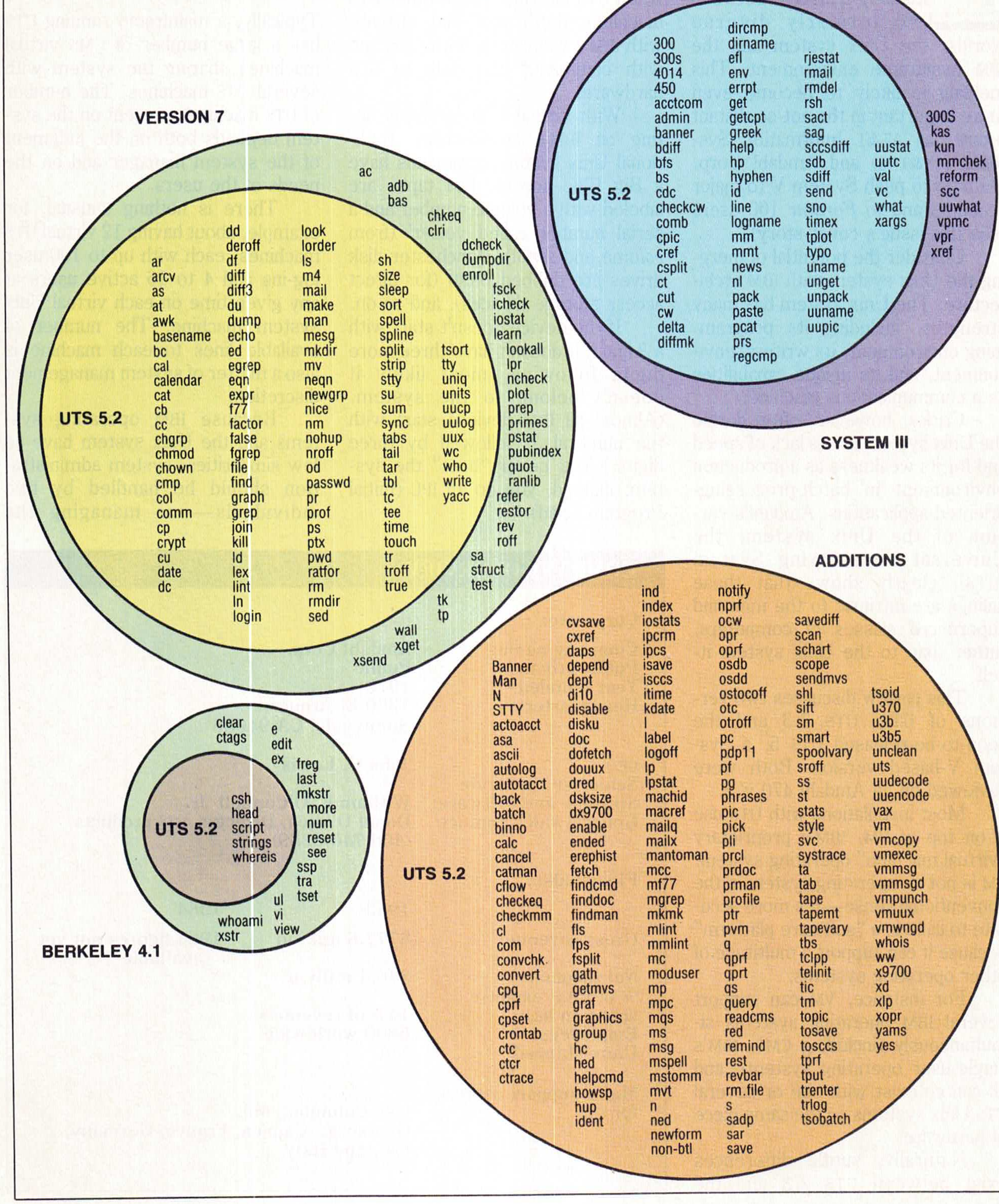
Financials:

	1983	**1984**
Gross revenue:	**$777.6 million**	**1984 figures not yet available**
Net income:	**$46.4 million**	
% of total expense spent on R&D:	**14% of revenues**	
Employees:	**6800 worldwide**	
Units shipped:	**N/A**	

Major support centers for UTS

U.S.: Columbia, Md.
Overseas: Canada, France, Germany, U.K., and Italy

UTS 5.2 UTILITY COMMAND COMPLETENESS



VM/UTS side and the other managing the VM/CMS and VM/CP side. A working team of administrators is the best possible approach to this kind of machine.

If you have administered the Unix system on a lesser machine, UTS' virtual machines will take your breath away. In a matter of hours you can take an entire machine off the system or put it back on; total user backups take only a few minutes. Because the system tape drives have capabilities of 6250 bytes per inch and 200 inches per minute, taking files to and from tape is not at all time consuming.

With virtual Unix systems sitting on IBM's architecture, traditional Unix system commands have a Big Blue accent.

Formatting disks, making file systems, and mounting them are pretty much the same under UTS as they are on other, standard Unix systems, except for speed. Formatting a mini disk for an entire file system takes less time than a trivial compilation on a mini. You can copy a file tree from one disk to another in a few minutes, and an experienced VM system programmer using DDR (a byte-for-byte copy command) can transfer an entire virtual machine.

UTS administration tasks are, however, more time intensive than those of traditional Unix systems. You have to deal with incredible amounts of disk storage (storage is in deca gigabytes), and caring for all that storage takes time. In addition, you are administering a multitude of virtual Unix machines, and each one has its own unique topology. Because the IBM architecture is so fast, every moment counts.

The challenge is to incorporate UTS in the most efficient way possible, while still giving each user an even share of the resources. A co-worker and I have devised a system for putting each UTS machine on its own disk pack, location file trees by user about the central cylinder. This scheme keeps head and channel contention from seldom rising above 1 percent.

UTS 2.3 AND UTS 5

To individual users, UTS Version 2.3 seems similar to Unix Version , with some Berkeley enhancements thrown in for good measure. At the ordinary user level, the only noticeable difference from the standard Unix system is UTS' visual editor, `ned`, which differs from the Unix system's `vi` because of the IBM terminals' half-duplex operation.

Speed of operation is fast, and compilations take a few seconds. The only noticeable delay occurs with `nroff` using the `ms` macro. Because of its searching algorithms, `ms` on UTS 2.3 is central processing unit (CPU) intensive, and a 15-page document takes as long as five seconds to format (this is improved in UTS Version 5.01).

Even University Ingres, the most notorious CPU hog of all, doesn't affect the performance of the Amdahl computer. The combination of speed and computational power on this computer allows the UTS 2.3 system to breeze along at well under 100 percent loading nearly all the time, even with 100 users. As a result, users do not have to put up with system degradation, typical of so many Unix system-based multiuser supermicros and minicomputers. Other system deficiencies—such as lack of `uucp` —are corrected in UTS 5.

It was only a matter of time before Amdahl created an embedded, or native, Unix system. That product, UTS 5.01, is in beta test at the time of this writing. Versions of UTS (up to and including 2.3) have had to be run as guests under IBM's proprietary virtual operating system, VM. UTSVersion 5, however, can run in two ways—either with VM or as a free-standing (embedded) UTS Unix system. UTS Version 5 is essentially AT&T's System V, Release 2 with Berkeley Unix system additions.

UTS 5 heralds a new era for Amdahl's UTS Unix system. Because it makes UTS available in two ways (as a free-standing system and as a guest under VM), both have had to rejoin the mainstream of Unix systems. In Version 2.3, a special command called `opr` (off-line printer), which took over the function of standard Unix's `lpr`, handles the problem of multiple printers, typical of a mainframe.

UTS 5.01 comes to grips with the problem of multiple printers and classes of printers by using the standard Unix System V command `lp`. However, an additional command, `lpcntl`, is needed to mount print bands to IBM-type printers. Other than that, UTS Version 5.01 is similar to the straight AT&T Unix operating system. The new UTS version includes support for non-IBM terminals, so `vi`, `ex`, and `ed` are all at home.

WHAT'S WRONG WITH UTS

The marriage of the Unix system and the IBM mainframe architecture is not always an easy one. The Unix system is an ASCII, full-duplex operating system, and problems arise when it is placed in an EBCDIC (Extended MBinary Coded Decimal Interchange Code), half-duplex environment.

The user's biggest problem is the transition from full-duplex to half-dupex operations, particularly with regard to terminals. The Unix sysem was born on a Teletype, but it lives on an ASCII, full-duplex, scrolling terminal that has character-by-character transmission. IBM's 370 architecture, however, requires block-mode transmission. Half-duplex, block-mode transmission was created for speed, whereas full-duplex was created for convenience. Combine the two, and you end up with problems.

On conventional Unix systems, users rely on the Berkeley database `termcap` to set their terminals. `termcap`, however, was never intended to live with IBM 3270 terminals! As a result, `vi` is not available to UTS in the 2.3 VM version. UTS 5 implementations on Amdahl 580 computers have `vi`, but that's little consolation for those people using an Amdahl 470.

To make up for the loss, Amdahl has created its own native editor, called `ned`, for UTS. `ned` is a cross between IBM's `XEDIT` and the Unix system's `ed`. It is a full-screen, visual editor that has most of the "bells and whistles" of a Unix system editor: global search and replace; search; add, delete, and insert; move rapidly through text; and read to and from files.

Additionally, it allows strike-overs, something that `vi` does not. The only things missing are scrolling and word wraparound because 3270 terminals don't scroll. These problems disappear, however, if you use UTS 5 on an Amdahl 580 computer.

Crossing the ASCII/EBCDIC interfac also presents some problems. The terminals are EBCDIC, and because many IBM terminals cannot produce square brackets, the system expands all brackets into parenthesis/pipe pairs. In other words, "[ ]" becomes "(¦ ¦)."

Coordinating the printer bands using device-driver translation tables tends to be more of a lifetime occupation than a one-time setup. Some characters refuse to translate exactly; for example, back slashes come out as cent signs, and the only way to change them is to alter a set of translation tables long enough to wallpaper Salt Lake City's Salt Palace.

THE ADVANTAGES OF VM/UTS

The advantages of UTS far outweigh the disadvantages, however. The biggest single advantage is that you are able to run multiple (virtual) UTS Unix system machines on the same powerful piece of physical hardware. The ability to create a number of virtual machines gives you an additional advantage because you can customize each machine to further suit the needs of the users by adding additional software. Because all UTS machines have full communications capabilities with each other and are, in effect, loosely coupled, there is no handicap.

In non-data-processing environments, such as software development and scientific applications, it is not only possible but also efficient to put each smaller virtual machine on a single ⅛-gigabyte Winchester

BENCHMARK MEASUREMENTS

Memory Loop Access Times (nanoseconds per byte)

	read	*write*	*copy*
Char type	350ns	445ns	608ns
Short type	193ns	209ns	287ns
Long type	123ns	106ns	149ns

Input/Output Rates (bytes/sec)

	read	*write*	*copy*
Disk	322K	258K	122K
Pipe			582K
TTY 1		0	
TTY 1+2		0	
RAM 1-byte			1645K
RAM 4-byte			6716K

Array Subscript References (nanoseconds)

short[ ]	long[ ]
601ns	574ns

Function References (nanoseconds/ref)

0-parameters	1-parameter	2-parameters
funct()	funct(i)	funct(i,i)
643	834	887

Process Forks

(65K bytes)
29 per second

System Kernel Calls
(calls-per-second and microseconds-per-call)

`getpid()` calls:	2 Kcalls/sec or	424 microseconds/call
`sbrk(0)` calls:	1 Kcall/sec or	950 microseconds/call
`create/close` calls:	713 pairs/sec or	1403 microseconds/pair
`umask(0)` calls:	2 Kcalls/sec or	424 microseconds/call

disk. This one-machine/one-spindle system allows substantial optimization when it comes to the physical placement of Unix system file trees on disk.

Under VM, the number of seeks for any given mounted file system can be monitored (by `vmap`), so you can determine which trees get the most use. Arranging the location of these trees to keep the Winchester drive heads as close to center at all times reduces head (and channel) contention substantially (from nearly 100 percent down to 4 percent or less).

You can thus combine VM's system diagnostic capabilities, the smaller machine size allowable with virtual machines, and the intrinsic speed of IBM 370 architecture to create fast and supremely efficient UTS virtual machines.

Another advantage of multiple virtual machines is redundancy. All system managers and administrators are aware of the necessity of hardware redundancy. If one malfunctioning printer needs to be dropped, you simply reroute the printer spooler to another printer.

Why not apply the concept of redundancy to software as well? The ability to create virtual UTS Unix system machines frees you from being tied to a single system. Systems degrade with time, but new machines can be created or cloned as needed.

VM allows you to place each mounted file tree at an exact physical (real) address. The child system is then not only faster and more robust, but also new file systems will be re-created (by recursive copy commands) into a dense and contiguous system. Space lost by removals and poorly fitted additions is regained by the recsive copy techniques.

VM/UTS als allows you to create what I call a UTS Unix system "engine"—that is, a system consisting of essential UTS Unix system trees (`/dev`, `/usr`, `/bin`, `/usr/spool`, `/tmp`, and so on). The only user tree added—usually `/usr/system`—is a small landing place for the system administrator, operators, and system programmers. Once you have created and tested this engine for integrity, it can be a lifesaver.

The worst disaster imaginable is the loss of a disk pack by a head crash. If you have one virtual machine on one physical machine, you're out of business. However, if you have a running UTS Unix system engine, all you have to do is format the remainder of the disk for the user areas, make the file systems, and load in the previous night's backup tapes, preferably in some form of archived format (I use `tar`).

PERFORMANCE IN PERSPECTIVE

When it comes to measuring mainframe system performance, the usual benchmark programs are inadequate. There is no practical way to measure the enormous speed and power of a large mainframe such as an Amdahl computer running UTS. Gilbreath's Sieve of Eratosthenes (see *Byte,* September 1981) takes about 30 milliseconds to generate all the primes from 1 to 8190. In contrast, CompuPro's supermicro runs the sieve in 600 milliseconds.

> **The marriage of the Unix system and the IBM maiframe architecture is not always an easy one.**

Obviously, you can't make direct comparisons between these two systems. Aside from obvious hardware differences, more subtle differences exist. An Amdahl computer, for example, takes up to 100 log-ins, or six times as many users, as a VAX 11/780 or Data General MV 800, without appreciable degradation. In fact, if the sieve is run on 100 Amdahl teminals simultaneousy, the time difference is barely discernible.

A more meaningful measure of performance for a mainframe-class Unix system is the use of CPU- and disk-intensive commands such as `man`, especially when the system is being used during peak user hours. The `man` command uses `nroff`

VIRTUAL IS REAL

To fully understand a virtual operating system environment such as UTS/VM and CMS/VM, we must put the concept of "virtual" into perspective. Everything in the system relies on the concept that real hardware (the system resources) can be utilized as virtual resources, resulting in a whole that is much larger than the sum of its parts.

If the system's real memory is a "scant" 16 Mbytes (64 Mbytes is not uncommon on a mainframe), and even if there are 300 virtual systems on the one physical system, nevertheless, the users on each virtual system will feel as if the entire 16 Mbytes are at their disposal.

How the system swaps and pages to give each user a virtual 16 Mbytes is beyond the scope of this review, but it works, and it goes far beyond memory size. For each physical device, there is a corresponding virtual device, and most of the devices appear to be exclusively available to each virtual machine. Virtual addresses also appear to be addressing the same disk address, such as disk 191, as if it were a unique location.

The most magnificent aspect of the virtual system is that separate virtual systems co-exist within the same real machine—each being unique, each independent, and each with the majority of the system's resources at its disposal.

with the `man` macro package to format the manual pages from `/usr/man`. `nroff` is so memory intensive that it accounts for more CPU time than any other Unix system utility. On a small Unix system, such as a Codata, the `man` command takes about 20 to 30 seconds to format a set of manual pages. On an Amdahl 470, it takes only two to three seconds.

With Amdahl's UTS, everything seems bigger than life. The Amdahl 470's 16-megabyte memory is dwarfed by the Amdahl 580's 64-megabyte memory. The system tape drives are normally a dense 6250 bytes per inch and a fast 200 inches per second. User systems can be put to tape in about five minutes.

"All day" tasks (Winchester disk formatting, for example) are accomplished in jst a minute or two. The longest tasks usually encountered in day-to-day use are massive tree copies, and it takes less than five minutes to copy an entire file tree from one mini disk to another. Floating-point operations are in a class by themselves—the IBM architecture lives to process floating point, and its only competitor is the fabled Cray supercomputer.

So when you read the benchmark data, bear in mind that the Amdahl 470 v7a computer I used to benchmark UTS is one of Amdahl's slower machines. It was chosen at my installation for dependability, not speed; an Amdahl 580 computer runs three times as fast.

In stand-alone or virtual machine configuration, Amdahl's UTS Unix system is the fastest and most powerful Unix system available today. UTS is a friendly mix of Unix Version 7, System III, System V, and Berkeley Unix with a touch of VM/VP and VM/CMS. Because Amdahl has been offering UTS for several years, the product is mature and fully developed, and it is backed by some of the best support in the computer industry. It will be a long time before you see anything that can compete with this Unix system. □

Bruce Hunter is Unix system administrator for Interstate Electronics, Anaheim, Calif. He has written several books and numerous magazine articles about computer-related subjects.

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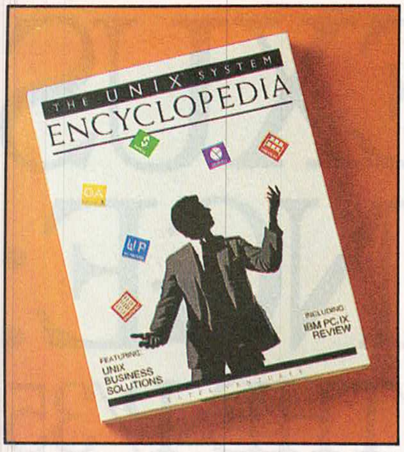

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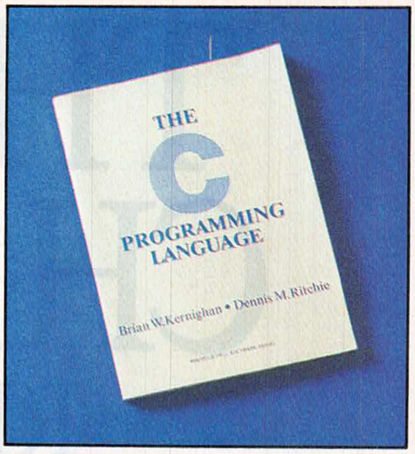

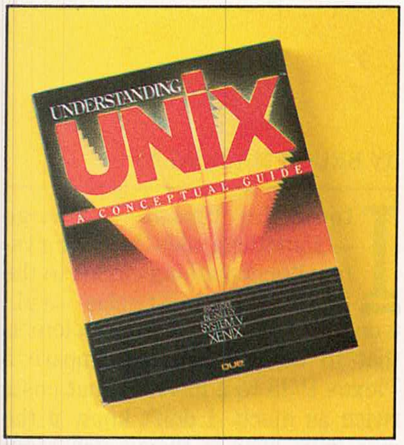

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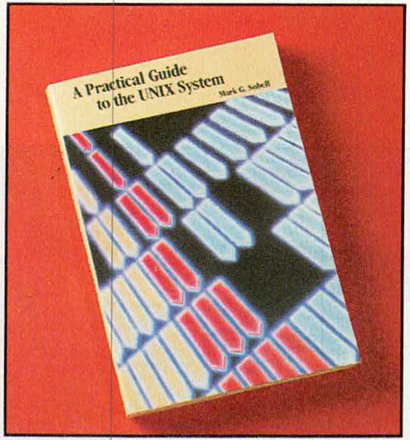

A Practical Guide to the Unix System
Mark Sobell
BENJAMIN CUMMINGS GROUP

A Practical Guide to the Unix System is an excellent reference as well as a detailed learning tool. As an added bonus, the author had included a comprehensive overview of Xenix.
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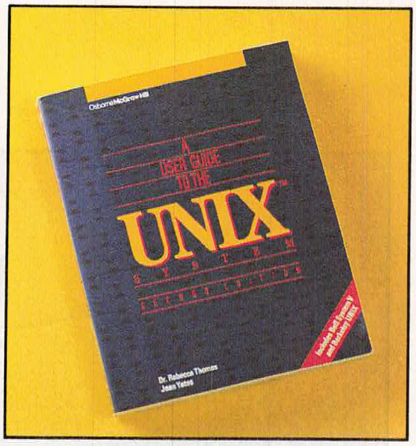

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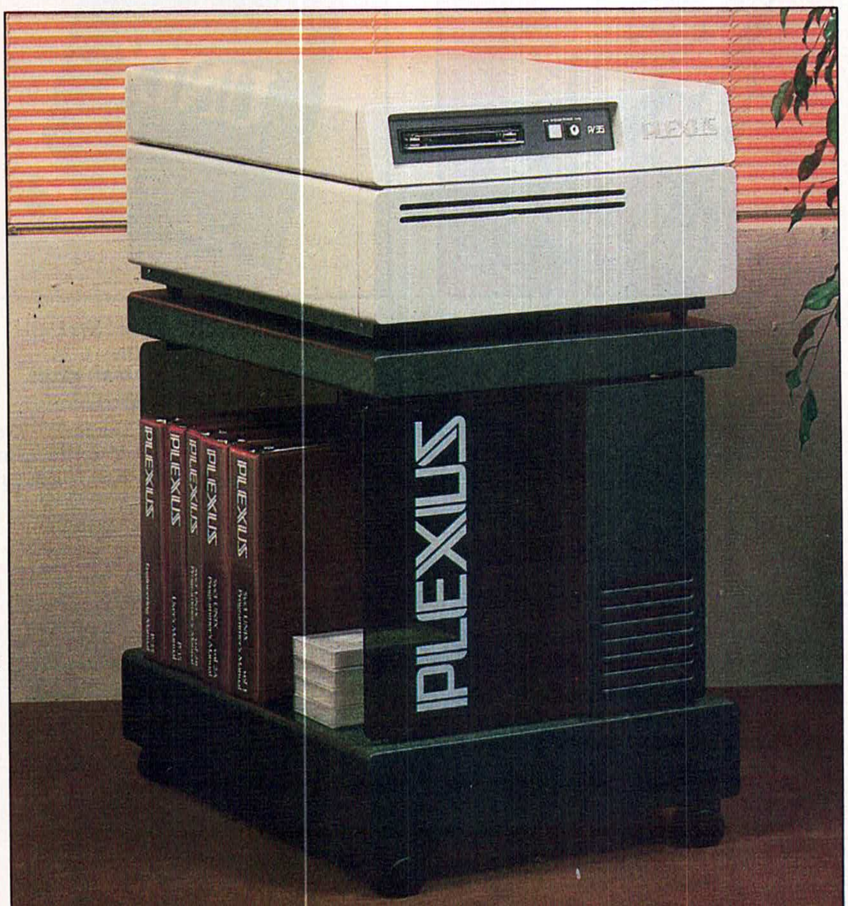
THE PLEXUS CHALLENGE: REVIEWING THE P/35



This month our crazed reviewer sets out to win himself a watch.

BY BRUCE MACKINLAY

I took the Plexus Challenge—something akin in Unix system benchmarking circles to the Pepsi challenge for colas—and I won, kind of. The only problem is that to do it I had to compare a Plexus P/35 to a machine that costs twice as much. I don't know if the nice guys over at Plexus will count this one, but I thought I'd give it a shot anyway.

If you're a little lost right now, let me take a second to explain. The challenge of Plexus' recent advertisement was simply too much for me. Plexus promised a fancy new $485 Heuer Chronograph to anyone who could find an equivalent Unix system-based supermicro that beat one of its own. I just can't resist a dare. I said to myself that there must be another supermicro in the market that is faster than the Plexus. And if I can find one, I can win a free watch. For its part, Plexus was so confident that it couldn't be beat that it loaned me a P/35 to make the tests.

For those remaining few of you out there who don't know Plexus, it was one of the first companies to enter the supermicro market, back in 1980. In the last few years, the firm has earned quite a reputation for producing machines with a good price/performance ratio, good support, and excellent networking. On top of all that, because it was one of the first and because its machines have been so good, a large selection of software is available on the Plexus.

The P/35 is an M68000-based supermicro built around the Multibus communications bus. The machine I benchmarked had 1 Mbyte of memory and a 36-Mbyte hard disk. What makes the machine so fast is the use of memory caching and a separate input/output (I/O) processor. The processor runs at 12.5 MHz and uses a 4K-byte cache. Standard on the P/35 is a 45-Mbyte streaming tape cartridge for system backup. The base system starts at $17,000, and the machine I benchmarked is currently priced around $22,500.

THE HARDWARE

There are a number of different types of I/O processors on the P/35: one to handle all serial (terminal) I/O, another that handles block (disk and tape) I/O, and another to handle local-area network (LAN) I/O. The Unix system is known to be very I/O intensive, and on many Unix systems the main central processing unit (CPU) spends most of its time handling I/O and very little time doing "useful" work (that is, processing data).

The heavy use of I/O coprocessors on the P/35 keeps it from degrading in Unix system environments when many others' response times bog down. Both the serial and block I/O processors use the Z8000 with local and shared memory. The serial I/O processor handles up to eight terminals and parallel printers. The maximum data rate for terminals is 19.2K baud, or 1920 characters per second.

The P-35 also supports both synchronous and asynchronous I/O, allowing the Plexus to support remote job entry (RJE) and HASP protocols, which are important in large IBM-dominated companies. The block I/O processor handles both the SMD disk drive and the tape. The basic P/35 comes with a 22-Mbyte NEC hard disk and a streamer cassette tape for backup. You can add a second drive or upgrade to a number of larger disks, including a 145-Mbyte Fujitsu (pronounced very fast) hard disk.

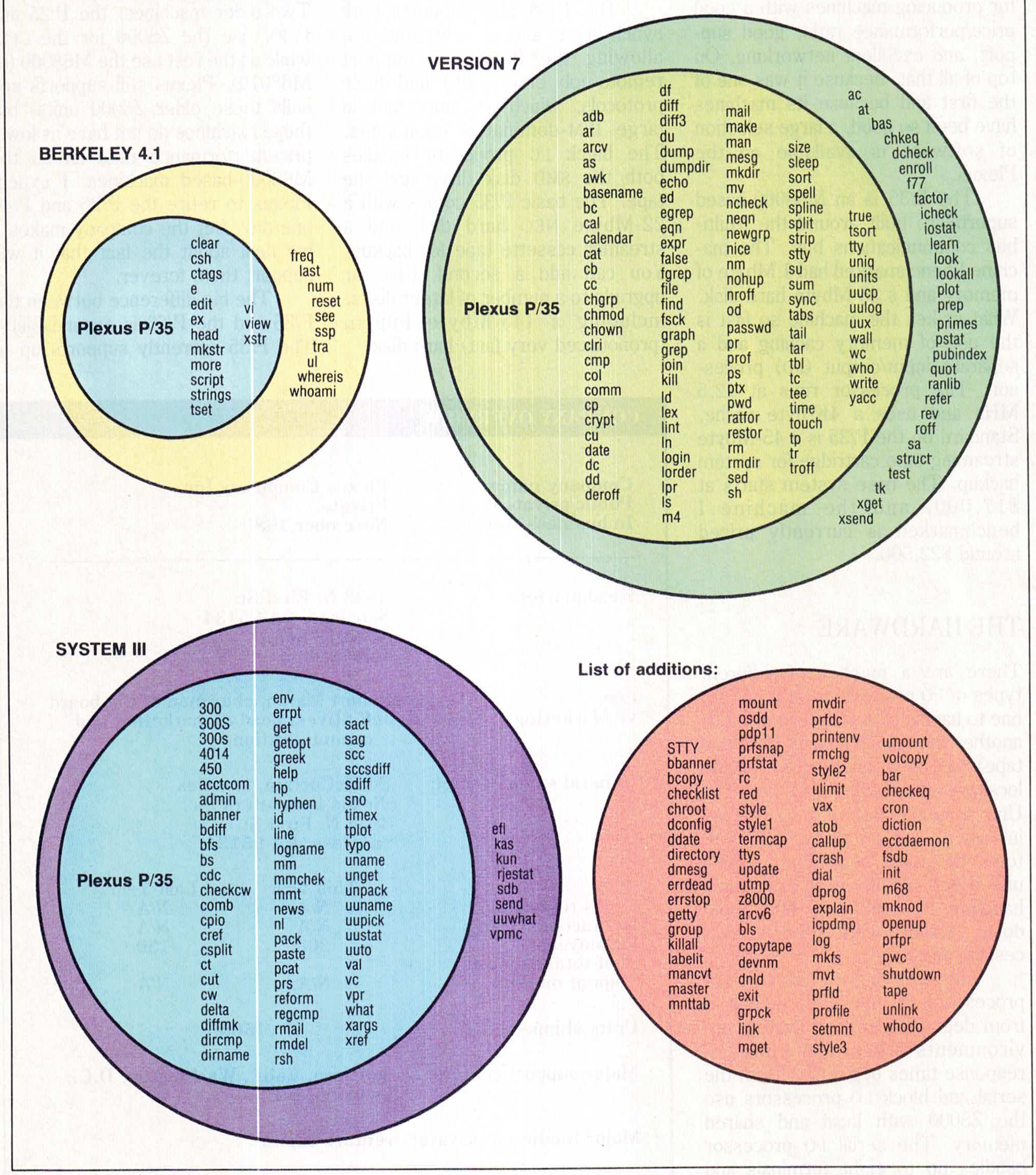
Other machines in the Plexus hardware family include the P/15 and other models up through the P/60. Two older machines, the P/25 and P/40, use the Z8000 for the CPU, while all the rest use the M68000 (or M68010). Plexus still supports and sells these older Z8000 units, but these machines do not have as low a price/performance ratio as do the M68000-based machines. I expect Plexus to retire the P/25 and P/40 one day, but the company makes a big deal about the fact that it will support them forever.

The big difference between the P/35 and the P/60 is expandability. The P/35 currently supports up to

COMPANY OVERVIEW

Company name:	Plexus Computers Inc.	
Public/private:	Private	
In business since:	November 1980	
Headquarters:	3833 N. First St. San Jose, CA 95134 408/943-9433 TWX/TELEX 910 338 2223	
CEO:	Robert Marsh, chairman of the board	
VP Marketing:	Jeff Stives, head of marketing and communications	
General sales contact:	Ed McCurtain, VP sales Plexus Computers Inc. 3833 N. First St. San Jose, CA 95134	
	This Year	Last Year
Gross revenue	N/A	N/A
Net income:	N/A	N/A
Employees:	200	150
% of total expense spent on R&D:	N/A	N/A
Units shipped:	1500+	
Major support centers:	San Jose, Calif., Washington, D.C., Swindon, U.K.	
Major funding if private:	venture capital	

COMMAND COMPLETENESS



BENCHMARK MEASUREMENTS

Aim Technology Suite II: Plexus P/35 Benchmark Results

Plexus P/35

Arithmetic Instruction Times (microseconds per op.)

	short	*long*	*float*	*double*
+ Add	2	905ns	343	229
+ Multiply	28	38	560	424
/ Divide	49	52	400	297

Memory Loop Access Times (nanoseconds per byte)

	read	*write*	*copy*
Char type	866ns	2	1
Short type	438ns	827ns	613ns
Long type	312ns	440ns	487ns

Input/Output Rates (bytes/sec)

	read	*write*	*copy*
Disk	34K	28K	19K (NEC 22-Mbyte Disk)
	184K	52K	33K (Fujitsu 72-Mbyte Disk)
	145K	64K	39K (Fujitsu 145-Mbyte Disk)
Pipe			123K
TTY 1		615	
TTY 1+2		1K	
RAM 1-byte			823K
RAM 4-byte			2059K

Array Subscript References (microseconds)

short[ ]	long[ ]
4	4

Function References (microseconds/ref)

0-parameters	1-parameter	2-parameters
funct()	funct(i)	funct(i,i)
7	13	18

Process Forks

(49K bytes)
19 per second

System Kernel Calls
(calls-per-second and microseconds per call)

`getpid()` calls:	4 kcalls/sec or	236 microseconds/call
`sbrk(0)` calls:	210 calls/sec or	4762 microseconds/call
`create`/close calls:	129 pairs/sec or	7752 microseconds/pair
`umask(0)` calls:	3 kcalls/sec or	303 microseconds/call

16 terminals and 2 Mbytes of random-access memory (RAM), while the P/60 supports up to 40 terminals and 8 Mbytes of RAM. A nine-track cypher tape drive is standard on the P/60, and there are more slots on the backplane.

The most recent addition to Plexus' product line, the P/15, is a low-priced machine intended to compete with the AT&T 3B2 and IBM PC/AT. Of course, AT&T and IBM have a great name advantage, but the Plexus P/15 should perform circles around these brand-name computers. Moreover, the P/15 starts at $11,000 and will easily support eight users.

NETWORKING AND SUPPORT

One of the most exciting things about the Plexus line of computers is its use of local-area networking and extensive communications. Of course, Plexus supports the Unix-to-Unix Copy (`uucp`) facility, but it also supports its own remote job entry (RJE) system. RJE is used heavily on IBM mainframes to share resources (and to hide the fact that IBM operating systems are slow). The Plexus RJE facility uses the standard HASP (read IBM) protocol, which allows the Plexus supermicro to be a front-end RJE station on your IBM mainframe.

The real jewel of Plexus' communications options, however, is its local-area network (LAN), which is Ethernet based and which uses the Excelan Ethernet Multibus card. This card supports full 10-Mbit machine-to-machine data rates. On top of this hardware, Plexus has developed what it calls the Network Operating System (NOS). NOS is really just an extension of Unix System III to support networking.

First, here are the good things about NOS. It is a very complete LAN; it even supports a distributed file system. Of the big players, none currently has a Unix system-compatible distributed file system. Distributed file systems are important because you can build a LAN without worrying too much about where the hardware is. This means that a user on machine A could use files and devices on machine B transparently and efficiently.

The problem with NOS is that it is not a standard LAN. The base hardware is standard (ISO level 1 and 2), but the rest is nonstandard. This means that you will have a hard time using Plexus equipment in other, more conventional ISO standard networks. While no real standard in local-area networks exists, there are some strong contenders. One is the ICP/TP protocol developed for the Unix system at UC Berkeley. A number of manufacturers (including Digital) have picked up ICP/TP, and it is the protocol of choice in the Unix system research community.

The other contending protocol is X.25. This seems to be the protocol that AT&T will embrace, and it has a very wide following, especially in Europe. I should not discount IBM and its SNA protocol. IBM could still make its terrible protocol the standard (but I hope not). Unfortunately, Plexus' NOS doesn't work with either the X.25 or SNA protocols, and it seems unlikely that IBM or AT&T will adopt NOS as a standard.

One of the nicest things about the Plexus computer is the support. While many other small supermicro companies provide poor support, Plexus saw that supermicros are a lot like minicomputers and thus require the same type of support. Plexus offers a number of good support plans, including a field maintenance support program under which Plexus will send a field engineer within four hours of your call.

If you are willing to wing it, Plexus will repair your machine on a time-and-parts basis, or you can ship your machine back to factory for repairs. Plexus will also train your personnel to identify, isolate, and repair Plexus problems, and the firm will provide exchange parts upon demand. There is also a software support contract under which subscribing customers are provided with automatic updates, bug reports, enhancements, and a toll-free "software consulting" service.

A COMPARISON OF THE SUN-120 AND THE PLEXUS P/35

(The fields that are full are the amount that the Sun-120 is faster than the Plexus P/35, based on the Aim benchmarks.)

Arithmetic Instruction Times

	short	*long*	*float*	*double*
+ Add	+	+	1.5043	1.8031
+ Multiply	1.2173	1.3571	1.7210	2.3186
/ Divide	3.4285	1.6250	+	+

Memory Loop Access Times

	read	*write*	*copy*
Char type	+	+	+
Short type	+	+	+
Long type	+	+	+

Input/Output Rates

	read	*write*	*copy*
Disk	6.8529	10.2857	3.6315 (Using NEC disk)
	1.2663	3.6154	2.0910 (Using Fujitsu 72-Mbyte disk)
	1.6069	2.9375	1.6410 (Using Fujitsu 145-Mbyte disk)
Pipe			1.3902
TTY 1		++	
TTY 1+2		++	
RAM 1-byte			+
RAM 4-byte			+

Array Subscript References

short[ ]	long[ ]
+	+

Function References

0-parameters	1-parameters	2-parameters
funct()	funct(i)	funct(i,i)
1.8571	1.4615	1.3333

Process Forks

+++

+	Plexus P/35 is faster or identical
++	Not comparable
+++	Numbers not available

Aim Technology Suite II: Plexus P/60 Benchmark Results

Arithmetic Instruction Times (microseconds per op)

	short	*long*	*float*	*double*
+ Add	2	1	367	231
+ Multiply	29	30	514	377
/ Divide	49	52	448	334

Memory Loop Access Times (nanoseconds per byte)

	read	*write*	*copy*
Char type	978ns	2	1
Short type	439ns	827ns	613ns
Long type	317ns	456ns	500ns

Input/Output Rates (bytes/sec)

	read	*write*	*copy*
Disk	145K	64K	39K
Pipe			115K
TTY 1		0	
TTY 1+2		0	
RAM 1-byte			784K
RAM 4-byte			2000K

Array Subscript References (microseconds)

short[ ]	long[ ]
4	5

Function References (microseconds/ref)

0-parameters funct()	1-parameter funct(i)	2-parameters funct(i,i)
7	14	20

Process Forks

(50K bytes)
17 per second

System Kernel Calls (calls-per-second and microseconds per call)

getpid() calls:	119 Kcalls/sec or	8 microseconds/call
sbrk(0) calls:	206 calls/sec or	4854 microseconds/call
create/close calls:	119 pairs/sec or	8403 microseconds/pair
umask(0) calls:	3 Kcalls/sec or	394 microseconds/call

BENCHMARKS AND COMPARISONS

Finding a machine that is faster than the Plexus is easy: Try the Amdahl V7 IBM-compatible mainframe. Finding a machine that is both faster *and* that fulfills the requirements of the ad is another problem.

The ad clearly states that the machine must be a "supermicro." Well, that's easy. How about the Apollo; its arithmetic instruction times are from 2 to 40 times faster than the P/35. The problem with the Apollo is that it is not a "Unix system-based" supermicro. If you apply this requirement, you eliminate a number of machines that would otherwise contend with the Plexus, including the Charles River Data Systems machine. This machine runs UNOS, which is a "Unix-like" operating system, but it is not strictly a Unix system supermicro.

So after you throw out the mainframes, minicomputers, and non-Unix (not pure Unix) system supermicros, you are left with a lot of slower machines (including the NCR Tower, the IBM PC/AT, and the AT&T 3B2/300). Of the machines I have benchmarked, only one, the Sun-120, is faster, and even then only on some of its benchmarks. This is a little unfair because the Sun-120 is about twice as expensive and is marketed as a single-user professional workstation.

More specifically, the Sun is faster in some respects (for the benchmarks, see Vol. 1, No. 5), but not in all respects. It is faster in most of the arithmetic operations, the disk is faster, and the operating system is faster; but the Plexus P/35 is faster in the rest of the arithmetic instructions and in all memory I/O.

The remaining question is whether the Sun-120 is a supermicro. I believe that it is: It is based upon the M68000, a very large scale integration (VLSI) CPU. This is the traditional mark of a micro, and it supports multiple users, also the mark of a supermicro.

In analyzing the benchmarks, I have concluded that the P/35 has faster overall hardware (with the exception of the disk controller) and that the Sun has faster software. This makes sense when you consider history. The Plexus software is derived from AT&T System III code, which is known to be a little slow, while the Sun software is derived from Berkeley 4.2 code. UC Berkeley put a lot of research and energy into making 4.2 Unix fast, and it paid off.

The disk was the one area where the P/35 showed poor performance. The P/35 I reviewed used the NEC 36-Mbyte hard disk. This disk is not as fast as the Fujitsu disk in the Sun, but it is not slow. The NEC is rated (by the manufacturer) at 38.8 msec. average access time, while the Fujitsu disk is rated at 28.1 msec. average access time.

After benchmarking the slower 36-Mbyte machine, I went over to Plexus' headquarters in San Jose and tested a number of other machines. Although the disks on these machines were faster than that of the P/35, they were still slower than the Sun-120's. The difference is more than the disk speeds. The explanation must be in the choice of controller hardware and operating system overhead. Choosing the correct controller can make or break disk performance. This is the area where Plexus must make improvements because a lot of applications are disk intensive. In fact, I understand that Plexus has recently announced a faster controller for the P/60, a move apparently intended to address this very problem.

PRICE/PERFORMANCE AND POPULARITY

Plexus' early entry into the Unix supermicro market has resulted in one of largest lists of third-party application packages. In fact, many of the most popular Unix system-based applications on the market today were developed on the Plexus, a fact that may also account for the long list of software ported to this family of machines.

This point was clearly driven home at the Fall 1983 Comdex show. At that show I made an informal survey of Unix system application software on the floor. Almost all of the software vendors on the floor were demonstrating their software on the Plexus, and many had developed their software on the Plexus. I think I found so many Plexus machines at Comdex because it is a small, fast, and reliable machine.

Plexus prints a software catalog that contains over 200 products, including a large number of vertical applications. Other machines might come close to the Plexus in performance, but very few have software libraries that can rival that from Plexus.

THE UNIX SYSTEM AND PLEXUS

The Unix system on the P/35 is very complete. The code started out as System III, but there have been so many Berkeley and Version 7 programs added that I find it very satisfactory. Included are the important (at least for me) `csh` and `vi`.

One problem I have had on other Unix systems is the very primitive tape drive controller. The Plexus commands `tape`, `copytape`, and `volcopy`, added to the Unix system commands `cpio`, `tar`, `dump`, `dumpdir`, and `restor`, gave me a great deal more control over the tape.

Most Unix systems have a hard time reading and writing multifile tapes, but this has been solved on the Plexus. The `bls` command is really the Berkeley version of `ls`. Plexus wrote an `openup` daemon that keeps key files and directories open. Not only does this result in faster access, but it also solves a System III problem with the line printer. On many System III Unix machines, the line printer speed reverts to the default speed every time the printing stops. Plexus' `openup` command keeps the device open and preserves the `stty` settings.

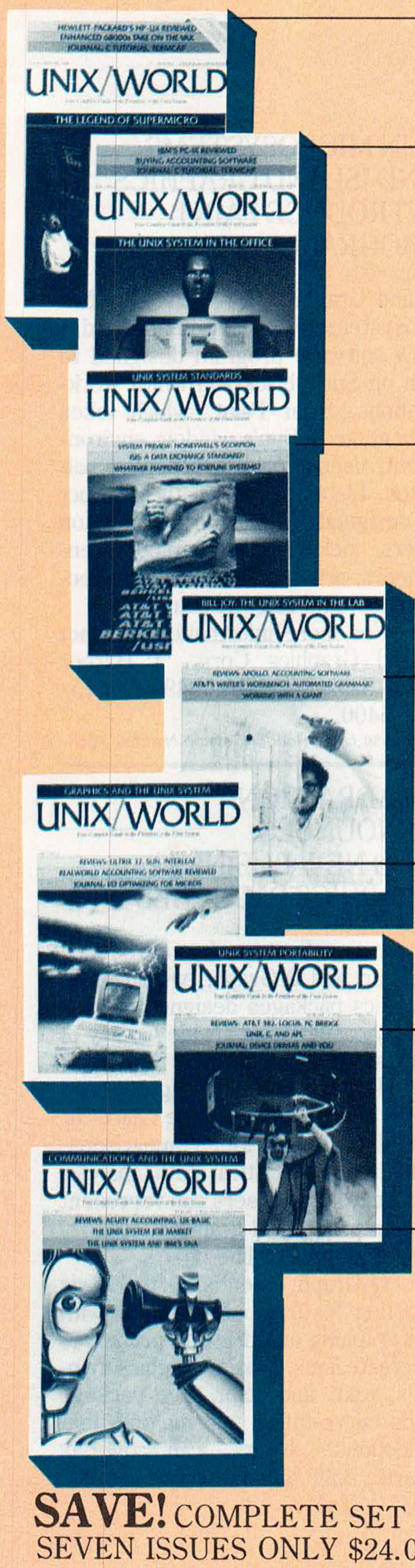
Surprising additions are the programs `style` and `diction`, commands usually part of Writer's Workbench. You can find them on Berkeley Unix system releases, but not on Bell-derived Unix system code unless you purchase them separately (as part of Writer's Workbench).

The Plexus P/35 has been around for a number of years; it is an oldie-but-goody that has captured a significant market share because it is a real performer. It is not the fastest supermicro in the world (and I will get my watch to prove it), but to find a faster machine, I had to compare the Plexus P/35 to a machine costing twice as much.

Another plus is that Plexus is marketing and supporting this machine like a minicomputer. I predict that Plexus' outstanding support and its large software library will keep the company going strong, even after AT&T and IBM have killed off much of the rest of the supermicro bunch. □

Bruce Mackinlay, a frequent UNIX/WORLD contributor, is currently working for WMZ/Novatech, a computer consulting firm located in Concord, Calif.

THE UNIX/WORLD COLLECTION



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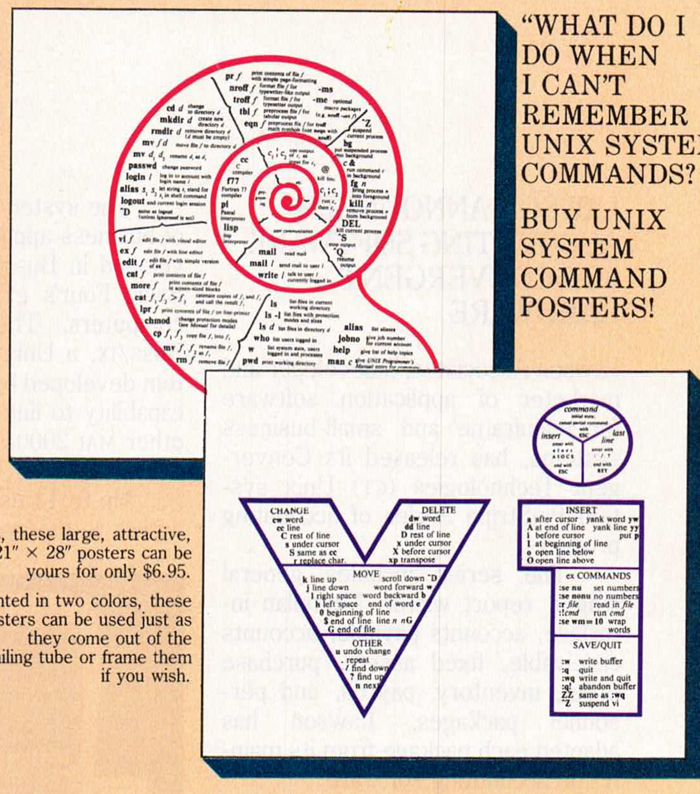

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BIP45

NEW PRODUCTS

LAWSON ANNOUNCES ACCOUNTING SOFTWARE FOR CONVERGENT HARDWARE

Lawson Associates, a developer and marketer of application software for mainframe and small-business systems, has released its Convergent Technologies (CT) Unix system PinStripe Series of accounting products.

The series includes general ledger, report writer, Multiplan interface, accounts payable, accounts receivable, fixed assets, purchase order, inventory, payroll, and personnel packages. Lawson has adapted each package from its mainframe accounting software.

The PinStripe series is already offered through the Lawson dealer network in a Convergent Technologies Operating System (CTOS) version. These products are available for use with workstations provided by CT and its affiliated original equipment manufacturers (OEMS) such as Burroughs, Gould, Prime, Datapoint, and NCR. Pricing for the Unix system versions is expected to be $4000 to $5000 per package.

For more information, contact Lawson Associates Inc., 2021 E. Hennepin Ave., Minneapolis, MN 55413; 800/672-0200.

Please circle Reader Service Number 160.

MAI/BASIC FOUR INTRODUCES BUSINESS SYSTEM

MAI/Basic Four Information Systems has unveiled its MAI 2000 Management System, a multiuser supermicrocomputer that has a wide range of business application software available at introduction.

The system runs an entire line of business application software developed in Business BASIC for MAI/Basic Four's existing line of minicomputers. The system features Boss/IX, a Unix-like operating system developed by MAI, and it has the capability to link with more than 60 other MAI 2000s in a local-area network (LAN).

Up to 14 users can have direct access to the system at one time in a multitasking environment. Additionally, a networking capability called MAGNET (Management Assistance General Network) provides for the interconnection of up to 63 MAI 2000 systems in a local-area network with a distributed database.

The MAI 2000 is a 16-bit, expandable machine. Its central processing unit (CPU) is based on the M68010 chip. Each system can hold up to six memory boards of 256K bytes each (the system comes with a minimum of 768K bytes) and up to five controller boards.

For more information, contact MAI/Basic Four Information Systems, 14101 Myford Rd., Tustin, CA 92680; 714/731-5100.

Please circle Reader Service Number 161.

SUN MICROSYSTEMS AND ISLAND GRAPHICS INTRODUCE PAINT PROGRAM

Island Graphics Corp. and Sun Microsystems Inc. have announced a new software program designed to run on Sun's black-and-white workstations. Solar Paint, which takes advantage of Sun's window environment, uses proprietary pop-up palettes. Listed at $1895, the product is designed for all Sun workstation users, including programmers, engineers, artists and illustrators, secretaries, and sales executives.

For more information, contact Island Graphics Corp., 1 Harbor Dr., Sausalito, CA 94965; 415/332-5400.

Please circle Reader Service Number 162.

QUADRATRON ANNOUNCES TWO NEW BUSINESS GRAPHICS PACKAGES

Quadratron Systems has introduced Q-Chart and Q-Graph, two business graphics packages designed to turn numerical data into a wide variety of charts and graphs.

The Q-Chart drawing program helps users create simple charts or complex grids for comparisons, schedules, or critical path analysis layouts. Novice users can represent data in predefined graphics formats, including bar and line charts.

Q-Graph extends all the basic charting features of Q-Chart, with full graphing and drawing primitives to create lines, boxes, graphics symbols, text, and color. The package adds curve-fitting and multiple font selections. Users can overlay charts, scale data automatically, and

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UNIPLEX II uses termcap, so it can run on virtually any computer terminal. "Softkeys" allow the user to define function keys which are displayed on the 25th line of most terminals to provide versatility and ease of use.

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select fonts for labels, titles, and text additions.

The software is based on GKS (Graphics Kernel System) industry standards, so users can generate hard-copy graphics without dependence on a specific printer or plotter. Q-Chart and Q-Graph are available for source and OEM licensing, as well as quantity and dealer discounts. Q-Chart prices per unit range from $325 to $2000. Q-Graph prices range from $395 to $2500.

For more information, contact Quadratron Systems Inc., 15760 Ventura Blvd., Suite 1032, Encino, CA 91436; 818/789-8588.

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LATEST VERSION OF INFORMIX DBMS NOW AVAILABLE FROM RDS

Relational Database Systems (RDS) Inc., a supplier of information management software for the Unix system, has introduced Informix 3.3, the latest version of its relational database management system (DBMS).

Informix 3.3 offers users greater control over screen manipulation with the use of Perform, Informix's form-generation facility. In addition to the Perform screen builder, Informix includes such features as a report writer, a query language, menu-creation facilities, and an extensive C language interface.

RDS offers its family of database management tools on Unix, Unix-compatible, Xenix, PC/IX, MS-DOS, and PC-DOS operating systems. RDS products are available for more than 60 different machines.

For more information, contact RDS Inc., 2471 E. Bayshore Rd., Suite 600, Palo Alto, CA 94303; 415/424-1300.

Please circle Reader Service Number 164.

RABBIT SOFTWARE INTRODUCES A MULTITASKING PRINT MANAGER

Rabbit Software Corp. has introduced Spooler-Plus, an interactive print manager designed for the Unix system and other compatible operating systems. The print manager controls all print functions in a micro-to-mini-to-mainframe environment that is using one or more printers.

Spooler-Plus' features include multiple queue support, multiple printers per queue, printer sharing, and queuing by menu or Unix system format command.

In addition, Paradyne Corp. (Largo, Fla.) announced that it will exclusively offer the Rabbit Unix system version of Spooler-Plus on all Paradyne Model 8400 machines supplied during the next five years. Paradyne markets its line of computers to government and large commercial accounts.

For more information, contact Rabbit Software Corp., Great Valley Corporate Center, One Great Valley Parkway, Malvern, PA 19335; 215/647-0440.

Please circle Reader Service Number 165.

NCR'S NEW MULTIUSER BUSINESS SYSTEM INCORPORATES SYSTEM V

NCR Corp. has introduced the Tower XP, an addition to the company's Unix system-based family of multiuser business computers.

The Tower XP features an M68010 microprocessor, Unix System V operating software, a new serial input/output (I/O) controller with an on-board M68010 processor, an on-board 128K-byte random-access memory (RAM), and an on-board Unix system TTY subsystem. The XP also utilizes a new processor memory controller designed to incorporate the central processor as well as 4K-byte page registers and a 2K-byte on-board cache memory.

According to NCR, all software that runs on the Tower 1632 can run on the newer machine, and purchasers can upgrade Tower 1632s to

Tower XPs by buying an upgrade kit.

The Tower XP can support from 1 to 16 users, and its standard configuration comes with 1 Mbyte of memory, 46 Mbytes of disk storage, and a 45-Mbyte cartridge tape drive.

The list price for a typical Tower XP configuration, which includes the processor, 1 Mbyte of RAM, a 1-Mbyte flexible disk, a 46-Mbyte fixed disk, a 45-Mbyte cartridge tape drive, eight serial ports, one parallel port, and the Tower Operating System, is $19,495. OEM discount pricing is lower.

For more information, contact NCR Corp., Dayton, OH 45479; 513/445-2075.

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TEXT EDITING

Another in a series of productivity notes on UNIX™ software from UniPress.

NEW RELEASE

UNIPRESS EMACS™

VERSION 2

Subject: Multi-window, full screen editor.

Multi-window, full screen editor provides extraordinary text editing. Several files can be edited simultaneously, giving far greater programming productivity than vi. The built-in MLISP programming language provides great extensibility to the editor.

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- *New manual set, both tutorial and MLISP guide.*
- *Better terminal support, including the option of not using unneeded terminal drivers.*
- *EMACS automatically uses terminal's function and arrow keys from termcap and now handles terminals which use xon/xoff control.*
- *More emulation—TOPS20 for compatibility with other EMACS versions, EDT and simple WordStar™ emulation.*

Features:

- *Multi-window, full screen editor for a wide range of UNIX, VMS™ and MS-DOS™ machines.*
- *"Shell windows" are supported, allowing command execution at anytime during an edit session.*
- *MLISP™ programming language offers extensibility for making custom editor commands! Keyboard and named macros, too.*
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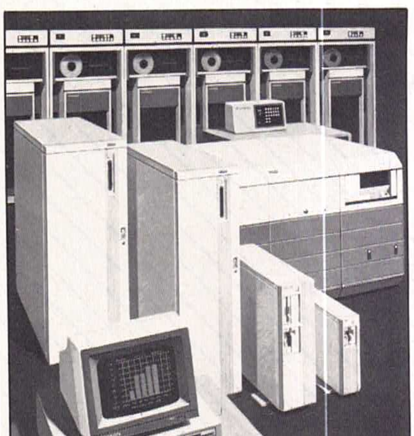
SPERRY INTRODUCES NEW MICROS AND A SUPERMINI

Sperry has introduced its 7000/40 superminicomputer and the Sperry 5000 Series of multiuser microcomputers. The 5000 Series includes four models that support System V and from 1 to 64 users. All models are based on Motorola's M68000 microprocessor technology.

The Sperry 7000/40 System, a new superminicomputer that can support up to 128 users, is designed to run the Unix operating system and the C programming language. The system has a storage capacity from 4 to 8 Mbytes of main memory.

The Sperry 5000 Series ranges in price from $15,000 to $50,000 for



the low-end models, and from $62,000 to $150,000 for the high-end models. The Sperry 7000/40 System ranges in price from $160,000 to $300,000, depending on configuration.

In addition, Sperry and DBSI Information Systems Inc. have introduced the Sperry Manufacturing Business Solution (MBS), an on-line MRP-II manufacturing control system with integrated financial applications for small- and medium-size manufacturers.

For more information, contact Sperry Corp., P.O. Box 500, Blue Bell, PA 19424; 215/542-4213.

Please circle Reader Service Number 167.

ALTOS ANNOUNCES NEW MULTIUSER XENIX SYSTEMS, OTHER PRODUCTS

Altos Computer Systems has announced the Altos 486, a 16-bit, Xenix-based microcomputer system that supports up to four users, and the Altos 986T, an enhanced version of the current Altos 986 system that supports up to nine users.

Altos said the 486 system is software-compatible with all 16-bit Altos systems. The 486 system features a CPU speed of 8 MHz, 512K bytes of RAM, a 20-Mbyte hard-disk drive, and a 1-Mbyte floppy disk drive. List price for the Altos 486 is $6490 and includes the Xenix operating system and an Altos III terminal.

The 986T utilizes a 16-bit CPU, as well as three additional microprocessors for I/O control. It also features 1-Mbyte RAM, 1 Mbyte 5¼-inch floppy disk capacity, and a choice of 40- or 80-Mbyte hard disk capacity storage. Suggested retail price for the 986T-40 is $13,490, and it includes a 40-Mbyte hard disk, the Xenix operating system, and an Altos III terminal.

Also new from Altos is Altograf, a graphics program for the Altos 186 that features a variety of graph- and chart-making capabilities. Its list price is $295.

Altos also has introduced PC Path, which allows IBM PCs and PC-compatibles running popular PC-DOS applications to share disks and printers on WorkNet, Altos' local-area network. It is priced at $395.

Several software products round out Altos' spate of product releases. The Altos Office Executive (AOE) is a multiwindow, integrated package that incorporates popular word-processing, spreadsheet, database, and electronic-mail applications.

For more information, contact Altos Computer Systems, 2641 Orchard Pkwy., San Jose, CA 95134; 408/946-6700.

Please circle Reader Service Number 168.

SUN INTRODUCES A NEW DESKTOP WORKSTATION, OTHER PRODUCTS

Sun Microsystems has introduced the Sun-2/50 Desktop SunStation, which carries a list price under $10,000. The Sun-2/50 is designed specifically for technical professionals who do not require the expansion flexibility of a card cage, but who desire the same computational and graphics performance provided by the existing Sun-2 family of workstations.

The Sun-2/50 CPU, based on the M68010 microprocessor, operates at 10 MHz with no wait states. The Sun patented memory-management design allows for 1 to 4 Mbytes of physical memory and up to 16 Mbytes of virtual address space per process. A hardware floating-point accelerator is optionally available for compute-intensive applications.

List price for a 1-Mbyte system is $9900, with volume discounts available. The Sun-2/50 is also available in 2- and 4-Mbyte configurations. Standard on the Sun-2/50 are the 4.2BSD Unix system, networking, SunCore graphics, SunWindows window manager, and C, FORTRAN, and Pascal programming languages.

Sun has also announced the Sun-2/160 Color SunStation, an integrated color workstation with advanced graphics capabilities, and the Sun Network File System (NFS), which supports transparent network-wide read and write access to directories and files.

In addition, Sun has added the following networking products to its Catalyst third-party program: the CS/1 Communications Server from Bridge Communications, Fusion network software from Network Research Corp., FlexLink from FlexComm Corp., and the EXOS 200 family of Ethernet front-end processors from Excelan Inc.

For more information, contact Sun Microsystems Inc., 2550 Garcia Ave., Mountain View, CA 94043; 415/960-1330.

Please circle Reader Service Number 169.

VIKING FORMS MANAGER NOW UNDER UNIX SYSTEM

The Viking Forms Manager (VFM), a software product developed by Viking Software Services for on-line screen formatting and data-entry, is now available for several computers that use the Unix operating system.

Viking originally developed its Forms Manager for VAX computers using the VMS operating system. The firm has since adapted VFM to the PDP-11, the IBM PC (and other MS-DOS-based micros), the DEC PRO 350, and now to computers supporting System V and Berkeley 4.2 Unix system versions.

The Unix system version of VFM consists of a Forms Development facility, the Viking Data Entry System (VDE), and a variety of utility programs. User prices range from \$800 to \$6000, with discounts for quantity purchases and OEMs.

For more information, contact Viking Software Services, 2815 E. Skelly Dr., Tulsa, OK 74105; 918/745-6550.

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SEQUENT OFFERS SCALABLE PROCESSOR POOL ARCHITECTURE FOR OEMs

Sequent Computer Systems has introduced the Balance 8000 computer system, a new expandable Unix system-based 32-bit computer family for technical OEMs.

The Balance 8000 is based on a pool of from two to a maximum of twelve 16-/32-bit NS32000-based processors. A single version of the 4.2BSD Unix system allocates these processors dynamically, automatically, and transparently as needed. PC-Interface, a PC-DOS-to-Unix system software applications bridge, provides transparent interaction over a distributed network between PC-DOS applications and the Balance 8000's Unix file system.

A complete two-processor Balance 8000 system is priced at $41,500 in OEM quantities. A complete 12-processor system is priced at $110,000 for OEM quantities.

An embedded configuration of the Balance 8000, which includes a 12-slot Balance bus backplane and chassis, 2 CPUs (each with MMU, FPU, and cache memory), 1-Mbyte RAM, an Ethernet interface, an SCSI bus interface, with Unix system, C, and diagnostics, costs $16,300.

For more information, contact Sequent Computer Systems Inc., 14360 Science Park Dr., Portland, OR 97229; 503/626-5700.

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PYRAMID ENHANCES OSX WITH SYSTEM 5.2

Pyramid Technology Corp.'s System V, Release 2 is now available on its 90x superminicomputer. Pyramid has integrated this version of the AT&T Unix operating system to form an enhanced version of OSx, Pyramid's dual port of System V from AT&T and 4.2BSD from UC Berkeley.

With the enhancements to System V, Pyramid can now offer system accounting and independent scheduling of jobs by each user. Job-control functions and Berkeley `curses` and `terminfo`, which were added to System V, were already available in Pyramid's OSx.

In addition, Pyramid and Relational Technology Inc. (RTI), of Berkeley, Calif., have signed an agreement making Ingres, the RTI Unix system relational database management system, available on Pyramid's 90x superminicomputer.

For more information, contact Pyramid Technology Corp., 1295 Charleston Rd., Mountain View, CA 94043; 415/965-7200.

Please circle Reader Service Number 172.

CIE SYSTEMS OFFERS UNIX-COMPATIBLE BUSINESS SYSTEMS

CIE Systems Inc. has introduced two Unix system-compatible multiuser business systems, the 680/100 and 680/200 business systems, which are designed for small- to medium-size businesses and for IBM PC users seeking a "gateway" into the Unix system world.

Each system includes a new central processor, a high-speed bus, dual-ported RAM memory, and an intelligent I/O controller. The 680 systems use a 10-MHz M68000 CPU developed with on-board memory management and designed for zero wait states.

The 680/100, priced from $14,995, supports between 4 and 12 users. It comes with 512K bytes of RAM (expandable to 1 Mbyte), a 500K-byte floppy-disk drive, and up to 92 Mbytes of Winchester disk storage. Optional streamer tape and ½-inch tape devices are available.

Priced from $29,995, the 680/200 supports up to 40 users. It provides between 512K bytes and 2 Mbytes of RAM and up to 336 Mbytes of hard-disk storage. Optional streamer tape and ½-inch tape devices are also available.

For more information, contact CIE Systems, P.O. Box 16579, Irvine, CA 92713; 714/660-1800.

Please circle Reader Service Number 173.

VUE PROJECT MANAGEMENT SYSTEM NOW ON PERTEC AND SPERRY

National Information Systems has announced that VUE, the menu-driven on-line project management system, can now run on the Sperry/Pertec System 3200 under Unix System V.

VUE offers a system for entering, updating, and reporting information in order to plan, schedule, and track project activities. It uses the critical path method, spotlighting those activities whose timely completion is critical to finish the project on schedule. Up to 3000 activities can be tracked per project, with up to 60,000 available through the multiproject option.

VUE offers a choice of I-J or precedence notation, and it can provide both printed and plotted output and custom reporting. VUE is already running on IBM VM/CMS, Fortune Unix, VAX VMS and Unix, HP 3000, Perkin-Elmer 3200, Honeywell DPS-6 and DPS-8, PDP-11, and DEC 10/20. VUE is also available nationally on timesharing.

For more information, contact National Information Systems, 20370 Town Center Lane, Suite 130, Cupertino, CA 95014; 408/257-7700.

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IBM TO MARKET HORIZON PACKAGE FOR PC/IX

IBM will market a version of Horizon's Unix system-based Latitude integrated word-processing and spreadsheet software for IBM PCs running the IBM PC/IX operating system.

Called IBM Interactive Executive (IX) Integrated Word/Math, the application program combines a series of business-oriented software tools that link text entry, editing, and arithmetic features.

Within IBM IX Integrated Word/Math, users can generate and edit text and tables in the same document file, with the command panel automatically offering appropriate object-oriented (text or table) menus.

IBM IX Integrated Word/Math is available from IBM's National Accounts and National Marketing divisions. Priced at $600, it runs under PC/IX on the IBM PC/XT, IBM PC/XT/370, IBM PC/AT, and IBM PC with the IBM Personal Computer Expansion Unit.

For more information, contact Horizon Software Systems Inc., 185 Berry St., Suite 4820, San Francisco, CA 94107; 415/543-1199.

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STRATUS INTRODUCES USF—A UNIX SYSTEM FACILITY

Stratus Computer Inc. has introduced Stratus USF, a System V-based facility that allows users of Unix system-based applications to be guested under Stratus' Continuous Processing computer's virtual operating system (VOS).

Stratus USF includes a range of Unix System V features, including the C language, shell, commands and applications, system calls and subroutines, as well as productivity tools and program utilities.

USF is totally integrated with VOS, the Stratus Virtual Operating

System, which has been extended to support Unix system applications. Facilities available in VOS are also accessible to USF users and include demand-paged virtual memory, indexed files, record locking, access-control lists, and transparent networking.

Stratus USF users have a wide variety of fault-tolerant networking and communications options at their disposal, including Stratus SNA, 2780/3780, IBM HASP/RJE, 3270 controller and terminal emulation, X.25 and X.29 terminal support, StrataLink (local-area network), StrataNet (wide-area network), and support of a variety of financial and retail protocols.

For more information, contact Stratus Computer Inc., 55 Fairbanks Blvd., Marlboro, MA 01752; 617/460-2000.

Please circle Reader Service Number 176.

UNISOURCE ANNOUNCES UNIX SYSTEM FOR IBM PC/AT

Unisource Software Corp. is now marketing a licensed implementation of AT&T's Unix operating system for the IBM PC/AT. The product—the current Encore version of Venix/86—is delivered with a System V license. It retails at $875 for a full implementation for one to two users, and costs $1075 for up to eight users. The package contains Berkeley extensions, real-time capability, record locking, and graphics support.

Unisource also announced two products for the IBM PC/AT. Uniform Software Systems' The Connector, which retails for $299, enables PC users to run both DOS and Unix system application programs on the same machine at the same time.

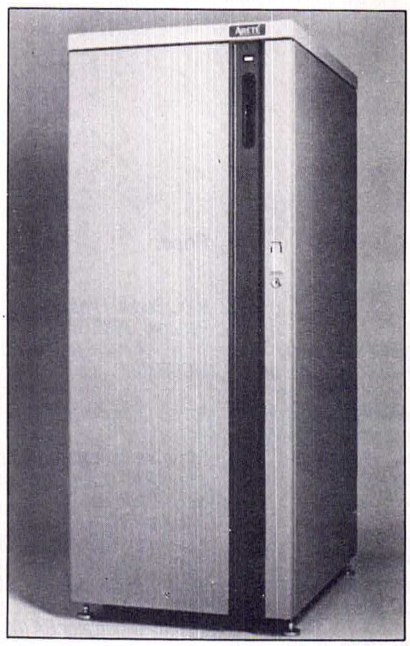
Unify Corp.'s Unify relational database permits users to access scattered pieces of data in separate files. Running under Venix, Unify retails for $1495.

For more information, contact Unisource Software Corp., 71 Bent St., Cambridge, MA 02141; 617/491-1264.

Please circle Reader Service Number 177.

ARETE 1200 SERIES FOR OEM APPLICATIONS

Arete Systems has added the Model 1200 series to its family of multiple 32-bit processor systems. The 1200 series accommodates up to four



CPUs and expanded main memory, disk storage, and serial communications capacities.

The 1200 series, with up to four 12.5 MHz M68000 CPUs, 12 M68000-based I/O controllers, 16 Mbytes of EDAC (error detecting and correction) main memory, and up to 88 asynchronous and synchronous serial communications ports, offers about twice the capability of the Model 1124, Arete's first multiple 32-bit central processor system.

The 1200's expanded storage capacity, with up to 4 internal disk drives and up to 44 external disk drives, can provide 9 gigabytes of storage for up to 88 users. The new series supports both the Arix (Unix System V, Release 2) and RM/COS (COBOL-compatible) operating systems.

The 1200 series computers are priced from $70,000 to $150,000, depending on memory configuration.

For more information, contact Arete Systems Corp., 2040 Hartog Dr., San Jose, CA 95131; 408/263-9711.

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APPGEN ENVIRONMENT PORTED TO NCR TOWER

Software Express' expanded APPGEN environment, which includes a Unix system-based application generator, nine application packages, and the APPGEN Query Language, has been ported to the NCR Tower family of processors.

The APPGEN environment delivers capabilities to all types of users across the NCR Tower line. Technical C-level developers and occasional end-users can use the same environment because its English language interface removes Unix system complexity.

Software Express has also signed Responsive Computer Systems (RCS) to distribute the APPGEN product line on the Altos 68000. RCS is one of Altos' largest distributors and is the exclusive distributor of the Altos 68000.

Under the recent networking release by Altos, the Altos 68000 can now communicate on the same network with Altos' Xenix-based machines and IBM PC-compatibles running PC-DOS.

For more information, contact Software Express, 2925 Briarpark Dr., 7th Floor, Houston, TX 77042; 800/231-0062.

Please circle Reader Service Number 179.

CSI ENHANCES ACCESS/SNA

Communications Solutions Inc.'s new version of Access/SNA allows users to communicate simultaneously with multiple programs on host IBM mainframes from any terminal in the network. It also lets users transfer data files between the host and any terminal using 3270 protocols.

Access/SNA now provides a standard I/O interface to such chips as the Zilog SCC and SIO and the Intel 8274 and 8273.

Access/SNA is written in the C language and is currently implemented on MS-DOS, the Unix system, and other vendor-proprietary systems. It emulates the communications functions of IBM 3274/3276 cluster controllers, letting vendors sell into the IBM market by providing communications with IBM host computers and by co-existing with IBM equipment in a user's data network.

For more information, contact Communications Solutions Inc., 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129; 408/725-1568.

Please circle Reader Service Number 180.

AT&T LINKED TO ASYNC DEVICES

SST Inc. has developed an asynchronous telecommunications software package that allows the AT&T 3B2 computer to communicate with other micros, minis, or mainframes. Tradenamed Handshake, the software can be used for communications between systems connected by standard cabling or through dial-up telephones.

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quirements: baud rate, parity (odd, even, none), duplex (full or half), incoming line terminator (user-defined value), and out-going line terminator (user-defined value). After these tables have been set, their values are saved for later use.

This package, originally developed on the Fortune 32:16 and currently available on the AT&T 3B line and Zilog computers, has a suggested list price of $350.

For more information, contact SST Inc., 9434 N. 107th St., Milwaukee, WI 53224.

Please circle Reader Service Number 181.

IMAGEN ANNOUNCES NEW LASER PRINTER

Imagen Corp. has introduced the Imagen 12/300, the latest member of its printer family. The new printing system includes page collation, page reversal, multiple copies facility, and portrait and landscape printing. Interfaces supported include serial, parallel, and Ethernet. The system prints 12 pages per minute at a resolution of 90,000 dots per square inch.

The 12/300 supports many host computers, including those running the Unix operating system and supporting document-composition systems such as `troff`, TeX, and Scribe. The new printing system comes standard with all of Imagen's emulators—daisy-wheel and line printers and Tektronix 4014—allowing users to output files previously configured for any of these devices.

Including 20 fonts and the im-Press language, the 12/300 is priced at $19,950. Volume purchases and OEM discounts are also available.

For more information, contact Imagen Corp., 2650 San Tomas Expwy., Santa Clara, CA 95052; 408/986-9400.

Please circle Reader Service Number 182.

PART TWO

THE SHELL GAME: A COMPARISON OF THE C AND BOURNE SHELLS

BY BILL TUTHILL

I'm back this month to describe some of the similarities between the C and Bourne shells. To begin with, the two shells are fundamentally very much alike. Both are command interpreters that read commands until receiving an end-of-file; both execute programs residing in a directory specified in the PATH environment variable. They search for programs in order, from the first path element until the last. Both use the same symbols for I/O redirection (see Figure 8A).

Both use the same symbol for setting up pipes between programs, and both use the same system facilities for this (see Figure 8B). Both append to an existing file with the >> symbol and take the ampersand (&) to mean that commands should be placed in the background (see Figure 8C).

Both shells insert "here documents" in the same manner and use the same quoting convention to indicate whether or not the shell should parse the intervening document (see Figure 9). However, the Bourne shell requires the final EOF to be unquoted, while the C shell requires it to be quoted. One reason for the similarity between the shells is that both stole many conventions from the features inspired by the Bourne shell.

Both shells have similar quoting mechanisms. The backslash (\) is used to escape the character following; double quotes guard against everything except variable substitution; and single quotes guard against

SHELL METACHARACTERS

Function	*csh*	*sh*
output redirect	>	>
force output	>!	
append to file	>>	>>
force append	>>!	
input redirect	<	<
here document	<<	<<
pipe output	|	|
obsolete pipe		^
background	&	&
separate command	;	;
match anything	*	*
match character	?	?
character class	[ ]	[ ]
subshell	( )	( )
syntax protect	{ }	{ }
command substitute	‘ ‘	‘ ‘
partial quote	“ ”	“ ”
full quote	’ ’	’ ’
quote character	\	\
begin comment	#	:
home directory	~	$HOME
history repeat	!	
change command	^	
history modify	:	
assignment	set	=
variable	$var	$var
process id	$$	$$
command name	$0	$0
first argument	$1	$1
all arguments	$*	$*
separate arguments		$@
number of arguments	$#argv	$#
stdout and stderr	>&	2>&1
read from terminal	$<	read
exit status	$status	$?
background exit status		$!
current options		$-
interpret file	source	.
is variable set?	$?var	test $var
evaluate expression	@	expr

FIGURE 8A: SYMBOLS FOR I/O REDIRECTION (WITH EITHER SHELL)

```
od -c < rawbits > rawdump
```

everything except history substitution in the C shell. Current versions of both shells use the sharp (#) to indicate comments. However, the Version 7 Bourne shell did not know about the sharp, so you are forced to use the colon before a comment.

You should use the colon to indicate comments in the Bourne shell because there are still lots of Version 7 systems around. But watch out for shell metacharacters such as the semicolon and the ampersand —the Bourne shell parses lines beginning with colons.

BOURNE SHELL FEATURES NOT IN THE C SHELL

The Bourne shell provides a way to catch all types of signals and to take appropriate action for all of them. The C shell, on the other hand, can catch only the interrupt signal. Typically, you will want to delete a temporary file when the shell script terminates, whether normally or abnormally. Figure 10A shows what you would write using the C shell.

The sequence shown in Figure 10A would remove the temporary file in case of interrupt or if the shell script terminated normally. However, the shell script could also terminate because of a hangup, quit, or pipe signal, in which case the C shell would leave the temporary file lying around. The Bourne shell is much more flexible about this sequence (see Figure 10B).

The commands to be executed on receipt of specified signals are enclosed in double quotes. The signal numbers are listed afterwards. The special number 0 stands for normal termination; thus, the temporary file will be removed in any case. Signal 1 is hangup; 2 is interrupt; 3 is quit with core dump; 13 is a broken pipe; and 15 is the software termination signal. In the ex-

FIGURE 8B: SETTING UP PIPES BETWEEN PROGRAMS

```
deroff -w textfile | sort | uniq -c
```

FIGURE 8C: APPENDING REDIRECTED OUTPUT AND BACKGROUND EXECUTION

```
/usr/lib/xdaemon >> /usr/adm/xlog &
```

FIGURE 9: EXAMPLE OF A "HERE" DOCUMENT

```
cat > tmp.awk << 'EOF'
BEGIN {OFS = "\t"}
    {
    if (NF >= 3)
            $3 *= 1.2
    print
    }
    EOF
awk -f tmp.awk $1
```

FIGURE 10A: CATCHING AN INTERRUPT SIGNAL WITH THE C SHELL

```
#
onintr cleanup
a.out > /tmp/file$$
cleanup:
            unalias rm
            rm -f /tmp/file$$
```

FIGURE 10B: TRAPPING SIGNALS WITH THE BOURNE SHELL

```
trap "rm -f /tmp/file$$ ; exit" 0 1 2 3 13 15
a.out> /tmp/file$$
```

FIGURE 11: CREATING AN EMPTY FILE WITH THE C SHELL

```
% > emptyfile
Invalid null command
% cp /dev/null emptyfile
```

ample, all these signals will cause the temporary file to be removed.

The Bourne shell provides a more complete set of file redirection facilities than does the C shell. To create an empty file in the Bourne shell, this is all you need to type: `emptyfile`. The C shell, though, yields an error message when you try to do that. The easiest way to create a zero-length file with the C shell is to copy `/dev/null`—as shown in Figure 11—but you could also use `cat`.

Empty files are actually more useful than they might seem. They can be used as input to a program to see how fast it starts up when it has no data to deal with.

The Bourne shell also provides a mechanism for duplicating file descriptors. For example, standard output and standard error may easily be separated from each other. This separation cannot be done in the C shell without spawning a subshell. Of course, this process takes extra time, particularly since C shells are slow starters (see Figure 12A). A program's standard error becomes standard output for the shell.

The same thing can be accomplished more quickly in the Bourne shell, although you have to know which file-descriptor numbers are which (see Figure 12B). File descriptor 0 stands for standard input, 1 for standard output, and 2 for standard error. The numbers should simply precede the appropriate redirect symbol.

FIGURE 12A: REDIRECTING STANDARD OUTPUT SEPARATELY FROM STANDARD ERROR WITH THE C SHELL

```
% (make > make.out) > make.err
```

FIGURE 12B: REDIRECTING STANDARD OUTPUT SEPARATELY FROM STANDARD ERROR WITH THE BOURNE SHELL

```
$ make 1>make.out 2>make.err
```

FIGURE 13A: COMBINING STANDARD OUTPUT AND STANDARD ERROR WITH THE C SHELL

```
% make >& make.log &
```

FIGURE 13B: COMBINING STANDARD OUTPUT AND STANDARD ERROR WITH THE BOURNE SHELL

```
$ 2>&1 make >make.log &
```

FIGURE 14: AN EXAMPLE OF THE BOURNE SHELL MULTILINE ECHO

```
echo -n 'Choose one of the following:
          h    help on this program
          s    search for a reference
          p    print a reference on paper
          q    quit this program
? '
```

STANDARD INPUT AND STANDARD ERROR

Both shells provide an easy way to combine standard input and standard error, although the syntax is different. If you were to compile a program in the background using `make`, you probably would want to send all output to the same place, whether it's standard output or error. Figure 13A shows what you would say in the C shell.

The >& means that both standard output and standard error should be redirected; otherwise, standard error would go to the terminal screen. In the Bourne shell, this would be accomplished as shown in Figure 13B.

The syntax is somewhat confusing, but 2<&1 means that file descriptor 1 is duplicated as file descriptor 2. To add to the confusion, 2>&1 does exactly the same thing, but it might convey the impression that input, not output, file descriptors were being duplicated.

The `echo` command from the Bourne shell can print out many lines at a time. The C shell's built-in `echo` command, on the contrary, can't print more than a line of text unless the newline is escaped with a backslash. That's inconvenient, to say the least. Figure 14 shows an example of a Bourne shell multiline `echo`. Running this shell script with the C shell will yield the error message "Unmatched."

In the Bourne shell, you can pipe the output of an entire control flow construct to another program. This is not possible with the C shell. For example, you may want to line-number a file by using the –n option of `cat` and then send output to the lineprinter (see Figure 15).

The Bourne shell script will invoke only one `lpr` process, and all files will appear as a single job on the lineprinter. The C shell script, on the other hand, invokes one `lpr` for each file being sent. This results in spurious job header pages, which may even require the cutting down of several trees.

C SHELL FEATURES NOT IN THE BOURNE SHELL

One popular feature in the C shell is aliasing. If you don't like the name of a Unix system command, you can simply call it something else. For example, if you get tired of typing `ls -lsa` every time you want to examine a directory, you can alias that command to `dir` (see Figure 16A).

Some people prefer to call this alias `lsa` because it represents the options being invoked. Aliases stay in effect until the shell dies or until you unalias them. However, they are not passed from shell to shell, as is the environment.

Have you ever accidentally removed a file? Did you ever copy, move, or redirect a file on top of an existing file? If so, you can create a relatively safe environment with aliases by placing the commands shown in Figure 16B in your `.cshrc` file.

The `noclobber` setting prevents redirection with > from destroying an existing file. The aliases for `rm`, `mv`, and `cp` cause these programs to query you before they remove a file. Years ago, I would accidentally clobber a file about once a month. Since I've had these commands in my `.cshrc` file, I haven't lost one single file. Unfortunately, the `-i` options to `mv` and `cp` are available only on Berkeley Unix.

The Bourne shell reads and executes all commands in the `profile` file when you log in. The C shell, on the other hand, processes first the `.cshrc` file each time it starts up, and then the `.login` file if it is a log-in shell. The commands listed in Figure 16B are

FIGURE 15: PROCESSING MULTIPLE FILES WITH THE BOURNE AND C SHELLS

```
BOURNE
for file in $*
do
        pr -n $file
done | lpr

C
#
foreach file ($*)
        cat -n $file | pr | lpr
end
```

FIGURE 16A: ALIAS DEFINITION OF `dir` AS `ls -lsa`

```
% alias dir ls -lsa
```

FIGURE 16B: ALIAS DEFINITIONS USEFUL FOR PROTECTING FILES

```
set noclobber
alias rm rm -i
alias mv mv -i
alias cp cp -i
```

FIGURE 17: USING HISTORY TO REPEAT A PREVIOUS `vi` COMMAND INVOCATION

```
% vi module2.c
% make
% !vi
vi module2.c
% make
```

FIGURE 18A: A SAMPLE INTERACTION WITH JOB CONTROL FACILITIES

```
% troff -ms bigfile
Stopped
% bg
[2] troff -ms bigfile &
% jobs
    [1] + Stopped   vi memo
    [2] - Running   troff -ms bigfile
```

FIGURE 18B: A C SHELL BACKGROUND JOB COMPLETION MESSAGE

```
[2] Done   troff -ms bigfile
%
```

best kept in a `.cshrc` file because you would want them for every C shell you invoke, not merely for the log-in shell. Commands for initializing the terminal belong in the `.login` file.

The C shell can keep track of commands you execute, but you have to tell it how far back you want it to remember. The command `history = 20` asks the C shell to remember the last 20 commands. This is a reasonable number for 24-line terminals because we don't want the history list to scroll off the screen. When you want to look at your history list, simply type `history`.

The C shell provides several handy mechanisms for redoing commands in the history list. To redo the last command, you say !!. To repeat the command numbered 74 on your history list, you would type `!74`. To repeat the last `vi` command, you would type `!vi`. Figure 17 shows a typical interaction with the C shell.

In the software development cycle, you ordinarily edit and recompile until the program works right. Employing the C shell's history mechanism allows you to alternate editing and compilation with a minimum number of keystrokes.

JOB CONTROL

The C shell, starting with 4.1BSD, provides job control, which is a method for suspending and restarting processes. Say you were using your favorite editor and you suddenly realized that you had to look at something on the system. Rather than quitting or spawning a subshell, both of which would involve substantial overhead, you can just type "control-Z." A few blank lines will appear at the bottom of the screen, and then the message "Stopped" will appear. You are back in the original shell. After you're done looking around, you can bring the editor back into the foreground by entering `fg`.

Job control is also helpful when you're running some CPU-intensive job and you can no longer wait for it to finish. Perhaps you have received an important phone call and need to look around the system to answer a question, or perhaps you need to get back to work on something else. Without job control, you would be forced to interrupt the job, thus wasting all the CPU time that had already been devoted to the process. But with job control, you simply type "control-Z." The message "Stopped" will appear on the screen, and you can place the job in the background by typing `bg`. Figure 18A shows a sample interaction with job control facilities.

If you get confused about which jobs you have running, you can always use the `jobs` command to find out. When a job finishes, the shell informs you that it has done so, just before issuing the next prompt (see Figure 18B).

Job control is a poor man's form of windowing. If you don't have the cash to buy a personal workstation, many of which offer sophisticated window management systems, job control allows you to keep several things going at the same time.

This article has shown that you can use the C shell interactively, but still use the Bourne shell for program scripts. Because the Bourne shell is more widely available, it is wise to use it when you're writing shell scripts for public distribution.

We can only hope that AT&T decides to include the Korn shell on its next Unix system release. This shell uses "control-P," rather than the exclamation mark, to select history events. A significant improvement over the C shell is that it allows you to edit your history list, using commands from either `vi` or `emacs`. This option makes history features easier to use than with the C shell, which has an unfriendly history substitution mechanism. Preliminary indications are that the Korn shell is very efficient and that it may replace the Bourne and C shells altogether; indeed, it may be the unified shell that Unix users have needed for years. □

Bill Tuthill is a member of the technical staff at Sun Microsystems, Mountain View, Calif. He also writes a monthly column for UNIX/WORLD entitled "The Unix System Starter Kit." His three-part series on `termcap` *appeared in Vol.1, Nos. 1-3.*

C TUTORIAL: READER-CONTRIBUTED squeeze PROGRAM BUG REPORTS

BY DR. REBECCA THOMAS

I'm back with the results of our readers' bug reports for the squeeze program published in UNIX/WORLD, Vol. 1, No. 3. First let me thank the 20 or so readers who took the time to write; I'll be acknowledging many of their thoughtful comments in this installment. However, let's restate the problem before looking at the solutions.

The squeeze filter program, listed in Figure 1A, eliminates extra consecutive NEWLINE characters arriving in its standard input. After more than two consecutive NEWLINES are detected, any further ones are not sent to the standard output. Thus, the output should never consist of more than one consecutive *blank* line.

But there lies the rub. I had loosely said "blank line," and I should have said "not more than one consecutive NEWLINE." Thus, some of you thought that squeeze should eliminate lines that appear blank but contain the ASCII SPACE, TAB, and perhaps other white-space characters. The latter design is much more involved and beyond the scope of the original program.

The squeeze filter was meant simply to eliminate the extra NEWLINES that are output to make up a printed page by Unix system utilities such as pr and nroff. Such a filter would make output from such programs more convenient for viewing on a CRT terminal. The extra NEWLINES, which cause rapid scrolling, would be "squeezed" out of the output.

Figure 1B shows squeeze being used to eliminate the extra NEWLINES produced by the pr command. The design bug is evident if you examine the output closely. Notice that initially two consecutive NEWLINES are passed through to the output where only one should have been. Several readers did notice this "bug" and correctly reported the simple fix: Initialize the numnl counter variable to *one* (*1*) instead of *zero* (*0*). The readers who reported this bug and this simple fix are listed below in alphabetical order.

Ed Callahan (Masscomp, King of Prussia, Pa.); T.T. Cheng (Phoenix, Ariz.); Charles Dayharsh (Clifton, Va.); Dave Fafarman (El Sobrante, Calif.); Albert Fung (NCR Corp.); Matthew Mauss (Memorex

FIGURE 1: THE squeeze SOFTWARE TOOL FILTER PROGRAM

a. The contents of the squeeze.c file

```
$ cat squeeze.c
#include <stdio.h>
main()
{
        int c;
        int numnl = 0;

        while ((c = getchar()) != EOF) {
                if (c == '\n')
                        numnl++;
                else
                        numnl = 0;
                if (numnl <= 2)
                        putchar(c);
        }
}
$ []
```

b. An example for using the squeeze program

```
$ pr poem | squeeze

Fri May 13 09:30 1984 Page 1 poem

Roses are Red
Violets are Blue
Sugar is Sweet
And so are You.
$ []
```

Corp., Santa Clara, Calif.); and Tray Scates (Tamarac, Fla.). Because so many readers had the correct answer, we must give our $25 prize to the person whose response had the earliest postmark—T.T. Cheng. Congratulations! And many thanks to our other respondents.

The elimination of blank lines containing white-space characters is an intriguing problem in itself. Several readers contributed interesting approaches worth documenting, a few of which we'll share with you in this installment.

Figure 2A shows a simple fix that two readers suggested. They proposed to change the statement following the "else" as indicated. This approach, however, introduces problems of its own, and Figure 2B illustrates one of them. Here, the input text consists of two consecutive lines containing a TAB character, followed by one line containing a SPACE.

The output shown in Figure 2B reveals that the second TAB is output at the beginning of the next line of text. Therefore, a more sophisticated approach is necessary. However, we wish to acknowledge Dave Fafarman (El Sobrante, Calif.) and Kenneth Gray (Willcox, Ariz.) for submitting this simple, if not yet complete, solution.

A more general approach for eliminating successive lines containing only SPACE, TAB, and NEWLINE characters involves storing every input line in an array, scanning it, and sending the line to the standard output only if it either contains non-white-space characters or if no more than two blank lines have been counted in the input.

The simplest algorithm for accomplishing this was submitted by Donald Kinzer (Cornelius, Ore). Figure 3 shows my implementation of his algorithm (his original contribution involved constructions that we haven't yet covered in this tutorial series).

FIGURE 2: VERSION TWO OF THE `squeeze` FILTER PROGRAM

a. The contents of the `squeeze2.c` file

```
$ cat squeeze2.c
#include <stdio.h>
main()
{
     int c;
     int numnl = 0;

     while ((c = getchar()) != EOF) {
          if (c == '\n')
               numnl++;
          else if (c != ' ' && c != '\t')
               numnl = 0;
          if (numnl <= 2)
               putchar(c);
     }
}
$ []
```

b. An example of a bug in this version

```
$ cat -v -t poem2
Roses are Red
^I
^I

Violets are Blue
$ cat poem2 | squeeze2
Roses are Red


          Violets are Blue
$ []
```

Three other readers submitted solutions that would eliminate successive lines containing white-space characters, but they didn't fix the original design bug shown in Figure 1B. We wish to acknowledge Brian Beckman (Jet Propulsion Lab, Pasadena, Calif.), Mark Costello (ITT Research Institute, Rome, N.Y.), and Doug Klein (Ridge Computers, Santa Clara, Calif.) for their proposed fixes.

Thanks again to all our readers who submitted solutions. We'll be having other "contests" from time to time.

Another important issue was raised by Kenneth Gray, who wrote: "When is a 'tool' a true 'tool'? I believe that the `charcopy.c` program is a true 'tool' in that it performs a specific function with universal value and is not restricted by I/O requirements. The same could be said of `index(s,c)`, `isupper(c)`, `getchar()`, `put(c)`, etc. But on the other hand, is a program that compresses or expands any input a 'tool' or just a very useful program? And now consider the `squeeze` program. Should it be designated a 'tool', a 'semi-tool', or just a 'useful' program?"

Attention readers: The issue of what is a software tool certainly

FIGURE 3: VERSION THREE OF THE `squeeze` FILTER PROGRAM

```
$ cat squeeze3.c
# include <stdio.h>

#define INBUFSIZE 1024
#define TAB        '\t'
#define SPACE      ' '

main()
{
  char buf[INBUFSIZE];
  int i, bl_count = 0;

  while (gets(buf) != NULL) {
    i = 0;                     /* reset char position counter */
    while (buf[i] == SPACE || buf[i] == TAB)
         i++;                  /* skip leading whitespace */
    if (buf[i] != NULL)        /* if not end of input line */
         bl_count = 0;         /* it isn't a blank input line */
    else if (bl_count <2)      /*else must be blank ; if count<2 */
         bl_count++;           /* count the blank line */
    if (bl_count <2)           /* if less than two blank lines */
         puts(buf);            /* output the line */
    }
}
$ []
```

merits discussion. Some of my thoughts on the subject were published in *Byte* magazine, August 1983, in an article entitled "What is a Software Tool?" If you would like to share your thoughts on this subject, submit a short essay (less than 1000 words) to UNIX/WORLD. We will select one of the submissions for publication in a future column. (The author will receive an honorarium of $50.) So sharpen those pencils!

In the next installment of this series, we'll be presenting a tutorial submitted by one of our readers. □

Dr. Rebecca Thomas is an author of the best-selling A User Guide to the Unix System *(Osborne/McGraw-Hill), of which a rewritten and expanded second edition is available. Dr. Thomas also works as a consultant specializing in the Unix operating system and the C language.*

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TWO READER CONTRIBUTIONS: ONE mail FRONT-END, ONE FIELD DELIMITER

BY DR. REBECCA THOMAS

This month we have two contributions from our readers. Michael Poppers sends us a useful Bourne shell script that provides a nice "front-end" for sending electronic mail with the Bell mail command. And Matthew Chestnut submits a C shell script that inserts field delimiters in a record (a line of text) originally consisting of fixed-length fields. Then the resulting data file can be processed easily by standard Unix system utilities because they recognize fields separated by a particular "special" character.

DEAR SYSTEM DOCTOR:

The enclosed shell script is an alternative to that prosaic command of loopholes and other naughty things. It is known to the greater Unix system universe as mail.

As it happens, we have Interactive's IS/3 Unix system on our VAX 11/780, so no one uses the Bell mail program unless absolutely necessary; instead, everyone uses Interactive's to command, which does things like putting headers on letters, checking pathnames, and a lot of other fun stuff. This shell script does some of that and provides a more "friendly" alternative to mail. I hope you enjoy it.

I could have added a lot more features to this script, and I could have left out some of the features that I did put in it, so this program is a compromise between brevity and depth.

[*Doctor's note:* Figure 1 lists this shell script.]

{allegra,cucard,esquire,
pegasus,spike,rocky2,ihnp4}
!aecom! poppers

Contributed by Michael Poppers
Yeshiva University
New York, N.Y.

FIGURE 1: THE smail SHELL SCRIPT

```
$ cat -n smail

     #
     # smail: send mail the civilized way—based on INmail's ``to''
     #
     # SYNOPSIS: smail [ logname logname . . . ] <CR>
     #
     #
     # AUTHOR: Michael Poppers
     # WRITTEN: October 1984
     # ACKNOWLEDGEMENT: based on a script by M. Gingold of AT&T
     #

     if [ $1 ]
     then
             name=$*
     else
             echo "Enter login name(s) to send mail to: \c"
             read name
     fi

     # Create temporary file for editing session
     file=/tmp/im$$.$LOGNAME
```

Continued

FIGURE 1: CONTINUED

```

echo "\001\002" >> $file
# The above control char.s are needed in INmail
echo "To: $name" >> $file

echo "From: \c" >> $file
echo "From: \c"
read from
echo $from >> $file

# Determine the account from which this letter is coming
echo "Sender: \c" >> $file
# Assume that "whois" command is available
# sender=`whois $LOGNAME`
# Alternative is:
# sender=`grep $LOGNAME /etc/passwd¦cut -d- -f2¦ cut -d\( -fi`
# which is the way Gingold has it
# or one could write
sender=$LOGNAME
echo $sender >> $file

echo "Date: `date`" >> $file

echo "Subject: \c" >> $file
echo "Subject: \c"
read subj
echo $subj >> $file
echo "---------------" >> $file

echo >> $file

# If EDITOR is set, use it
# Else, default to VI
nul=""

until [ "$nul" ]
do
        if [ $EDITOR ]
        then
                $EDITOR $file
        else
                vi $file
        fi
        echo

#       Give the sender a chance to escape or re-edit the file

        echo "Send, abort, or edit (s) ? \c"
        read choice
        if [ "$choice" = "e" ]
        then
                continue
        elif [ "$choice" = "s" -o "$choice" = "$nul" ]
        then
                echo "---------------" >> $file
```

Continued

FIGURE 1: CONTINUED

```
                        echo "\001\001" >> $file
                        /bin/mail $name <$file
                        file2=/tmp/$LOGNAME.IMcpy
                        echo "Your mail is being sent."
                        echo "A copy is in file $file2"
                        mv $file $file2
                        chmod 600 $file2
                elif [ "$choice" = "a" ]
                then
                        rm $file
                else
                        echo "$choice is meaningless; speak clearly!"
                        continue
                fi
                nul="bye-bye"
        done
$ []
```

Continued

DEAR SYSTEM DOCTOR:

While using accounting software on our Zilog System 8000 computer, I needed a method to access some of the data that was created and maintained by that software. The data is in a fixed format for each record, terminated by a NEWLINE character. I found that the Unix system's awk utility worked fine until I needed to access specific fields in a record.

Because none of the fields in an input record were delimited by a special character, awk assumed that white-space characters delimited the fields. This default behavior was not acceptable because some fields, such as description fields, may contain numerous white-space characters, and, therefore, awk would not treat such fields correctly.

The enclosed C shell script provides one solution to this problem. The shell variable piece specifies the lengths for each fixed field in a record. The for loop uses the Bell Unix Systems III and V cut and paste utilities to separate the fields as specified and then to rejoin them by inserting a special character, such as a colon (:), between each field as the output record is written.

The result is a file that is much easier to use with Unix system utilities. Most utilities such as sort and awk have an option to recognize a specific field delimiter character. This C shell script provides a method to separate given fields in a record by a user-defined delimiter character.

The computer we use is a Zilog System 8000, Model 21, running the ZEUS 3.2 operating system, a Unix System III-compatible operating system.

[*Doctor's note:* The C shell script is listed in Figure 2. Figure 3 shows the results obtained when this shell script operates on some sample data.]

Contributed by Matthew Chestnut
Longoria Industries Inc.
Garland, Texas

Dr. Rebecca Thomas, UNIX/WORLD's Editor Emeritus, is the co-author of A User Guide to the Unix System, *the second edition of which has recently been released.*

Wizard's Grabbag is a regular feature of UNIX/WORLD, 444 Castro St., Suite 1220, Mountain View, CA 94041. Authors of published entries receive $25 for questions, $50 for shell scripts, awk scripts, sed scripts, lex, yacc, and C programs, or tips.

Guidelines for reader contributions: Write your shell scripts, C programs, and other code so that it is portable across different versions of the Unix system. If possible, it should run without change on Bell Version 7, Systems III and V, and Berkeley 4.x. Thus, you should use "universal" Unix system utilities such as who am i (all systems) in lieu of whoami (Berkeley only), and the Bourne shell, if possible, when coding shell scripts. However, C shell scripts are also welcome because most of our readers now have access to this popular command interpreter. Use the standard I/O library when writing C code.

Also use the lint syntax checker to eliminate nonportable constructions and compile the code with a portable C compiler such as pcc to help ensure portability. Hardware dependencies, such as terminal control sequences, should be eliminated or at least minimized and isolated to one code region or to a separate module. Keep your example as short as possible, say under 100 lines of code.

FIGURE 2: THE markfields SHELL SCRIPT

```
$ cat -n markfields
     1   #
     2   # $piece contains the fields of the record to delimit by semi-colons
     3   # the cut/paste routine is done in such a way to bypass the 12 file
     4   # limit in paste (paste is using only 2 files at one time).
     5   #
     6   # the following variables are dependent on the file you wish to use:
     7   set piece = ("1-7" "8-13" "14-22" "23-47"
         "48-57" "58-62")
     8   set file = "test"
     9   set fileout = ""
    10   set temp = $file.tmp
    11
    12   foreach i ($piece)
    13   cut -c${i} $file | paste -d":" $fileout - >$temp
    14   set fileout = $file.out
    15   mv $temp $fileout
    16   end
$ []
```

FIGURE 3: TESTING THE markfields SHELL SCRIPT

a. Input data:

```
$ cat test
                                              037100371004001000
1004000123183BBF       BEGINNING BALANCE FORWARD0000718824
1004000013184NEW       STARTUP                 000416301tGJ038
1004000013184NEW       STARTUP                 0004198743GJ038
1004000022984NEW       STARTUP                 000368887wGJ040
1004000022984NEW       STARTUP                 0003504872GJ040
1004000033184NEW       STARTUP                 001029894wGJ044
1004000033184NEW       STARTUP                 0010302540GJ044
1004000043084NEW       STARTUP                 000118359rGJ046
1004000043084NEW       STARTUP                 0000610000GJ046
$ []
```

b. Output data:

```
$ cat test.out
       :      :       :                          037:1003710040:01000
1004000:123183:BBF    :BEGINNING BALANCE FORWARD:0000718824:
1004000:013184:NEW    :STARTUP                  :000416301t:GJ038
1004000:013184:NEW    :STARTUP                  :0004198743:GJ038
1004000:022984:NEW    :STARTUP                  :000368887w:GJ040
1004000:022984:NEW    :STARTUP                  :0003504872:GJ040
1004000:033184:NEW    :STARTUP                  :001029894w:GJ044
1004000:033184:NEW    :STARTUP                  :0010302540:GJ044
1004000:043084:NEW    :STARTUP                  :000118359r:GJ046
1004000:043084:NEW    :STARTUP                  :0000610000:GJ046
$ []
```

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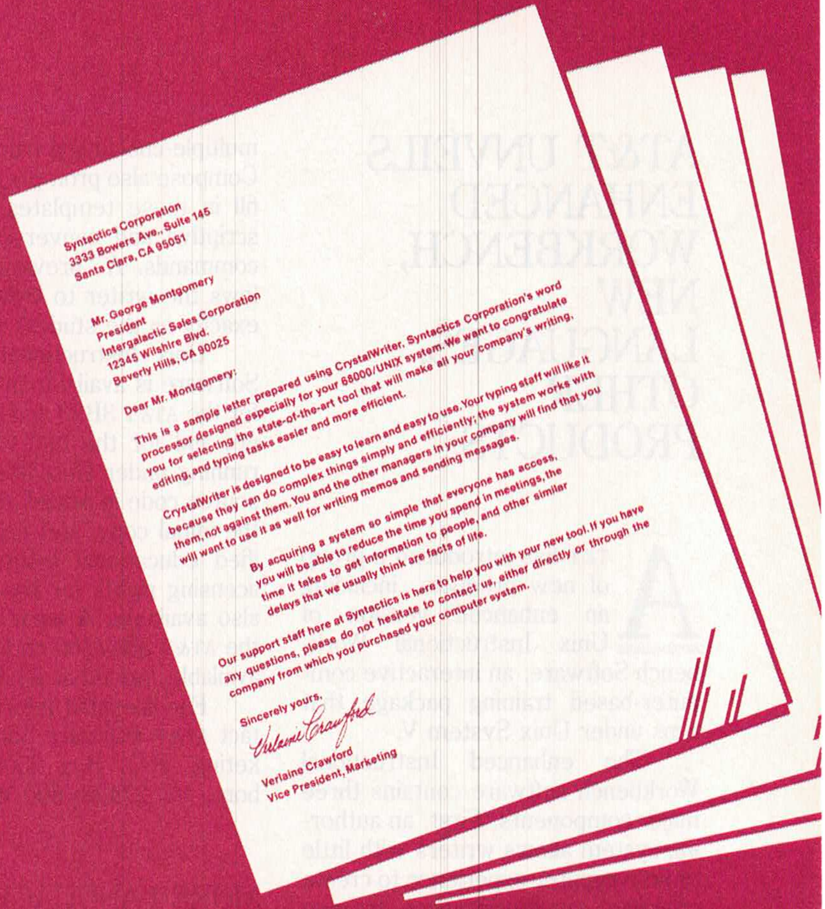

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NEWS FROM AT&T

AT&T UNVEILS ENHANCED WORKBENCH, NEW LANGUAGES, OTHER PRODUCTS

AT&T has introduced a group of new products, including an enhanced version of Unix Instructional Workbench Software, an interactive computer-based training package that runs under Unix System V.

The enhanced Instructional Workbench software contains three major components. First, an authoring system allows writers with little or no computer experience to create effective computer-based training material. In addition, a delivery system presents the courseware, evaluates the student's responses, and monitors and tracks the student's progress. The delivery system also includes administrative features that provide on-line student registration, maintain student records, and produce a variety of administrative reports. The package also contains a set of five courses developed by AT&T that offer introductory training for users of Unix System V.

The authoring system, the major new feature of this release, includes Compose, a courseware development system. Compose offers a set of standard screen templates for creating text, exercises, and multiple-choice and true/false tests. Compose also prompts the author to fill in these templates using a descriptive and conversational set of commands. A "preview" facility allows the writer to view the course exactly as the student would.

Unix Instructional Workbench Software is available in source code for the AT&T 3B20 and 3B5 computers and for the DEC VAX computer running under Unix System V. The source code is priced at $10,000 for the initial copy, and $3500 for qualified educational institutions. Sublicensing rights for the product are also available. A binary version for the AT&T 3B2/300 computer is also available, priced at $3500.

For licensing information, contact AT&T Software Sales and Marketing, P.O. Box 25000, Greensboro, NC 27420; 800/828-UNIX.

MORE LANGUAGES FOR THE 3B FAMILY

AT&T Information Systems has expanded its portfolio of languages for the AT&T 3B2 and 3B5 computers. Under a marketing agreement with Micro Focus, AT&T will offer Micro Focus' Level II COBOL compiler, Animator source-level interactive debugger, and Forms-2 source code generator, all of which will allow the development and maintenance of business application programs on AT&T microcomputers.

Pricing and information on these products are available from AT&T upon request. Micro Focus, an international supplier of micro-to-mainframe programming software, is located in Palo Alto, Calif.

AT&T AND RESTON TEAM UP FOR SOFTWARE GUIDE

Reston Publishing Company Inc., a subsidiary of Prentice Hall Inc., and AT&T have agreed to publish the *AT&T Computer Software Guide* for end-user customers. The two firms also announced plans for the International Bureau of Software Test (IBST), a subsidiary of Prentice Hall, to provide independent software vendors with fast, impartial approval of AT&T Personal Computer software.

A spokesman said that experts will review every software program listed—be it Unix System V for the computer line or MS-DOS for the AT&T personal computer—and that all the software programs will run on AT&T equipment.

Under the agreement, AT&T will be responsible for catalog content, while Reston will handle the semi-annual printing and distribution. Advertising space is available to vendors who appear in the guide. Current plans call for distribution to bookstores, software and computer specialty retailers and wholesalers, educational institutions, and libraries.

Between printings, updated software listings will be available to AT&T account teams through an on-line Electronic Software Catalog. That updated database will be used for subsequent editions of the software guide.

IBST is an independent facility recognized for its expertise in evaluating software. Using parameters and guidelines established by AT&T, IBST senior test engineers will conduct prompt and impartial reviews of independent vendor software programs. If the programs meet the criteria, they will be included in the software guide.

Additionally, any software accepted for the AT&T guide will be awarded an IBST seal. This seal will enhance the integrity and appeal of software products because of IBST's reputation as an independent software evaluator.

Interested vendors are invited to submit their software programs. Vendors of Unix System V programs should submit products directly to AT&T through the company's Independent Software Vendor/Vendor Involvement Program. Details are available from AT&T Information Systems, ISV/VIP, One Speedwell Ave., Morristown, NJ 07960. Programs for the AT&T PC 6300 should be submitted directly to IBST. For additional information, call 800/222-IBST. Vendors may write to IBST Software Review Center, P.O. Box 9115, Marlboro, MA 01752-9115.

AT&T and Reston Publishing also announced publication of *The Unix System V Software Catalog,* aimed at all Unix system users and the value-added reseller (VAR) market.

Unix system programs are being listed in the catalog regardless of the hardware on which they run. The first edition of the catalog—which will be available in bookstores, computer stores, and libraries—will list over 235 applications from over 60 companies. The catalog sells for $19.95 and will be published semi-annually.

Buyers who have questions about the catalog listings can call 800/833-9333. VARs or ISVs interested in having software listed in future editions can call the 800 number for further information, or write *The Unix System V Catalog,* AT&T Customer Communications Center, 4513 Western Ave., Lisle, IL 60532.

NEW DISPLAYS FOR THE 5540 SYSTEM

AT&T Teletype Corp.'s 5540 System, initially introduced with white phosphor, is now available with amber and green phosphor displays. The 5540 is a 3270-compatible terminal that supports SNA/SDLC as well as BSC line protocols. The 5540 can replace existing SNA terminals without host software modifications.

The 5540 includes a 5 ¼-inch floppy-disk drive for controller programming, device identification, and options. A dual microprocessor-based controller can cluster up to 32 devices. In addition, a tabletop controller is available to support up to 12 devices.

The 5540 permits upgrading from BSC to SNA/SDLC by simply changing diskettes. It is also compatible with the Teletype 4540 displays and printers.

NEW COMMUNICATIONS PACKAGE

The telecommunications giant also introduced the SoftCall communications package, a menu-driven software program designed specifically for the company's Model 4000 modem. This communications software can be used with the AT&T PC 6300, IBM's PC, PC/XT, and Portable PC, and Compaq and Compaq Plus personal computers.

The SoftCall program enhances AT&T's Model 4000 modem with a variety of features, including a call history log that keeps a record of the time, date, duration, telephone number, and baud rate of all data calls made and received.

The new software also can store and automatically dial up to 30 telephone numbers, each including its own set of communications instructions and automatic log-on sequences. For automatic log-on, the SoftCall program stores manually entered sequences, including queries and responses, for automatic use whenever subsequent calls are made to that number.

AT&T has set suggested retail prices of $79.95 for the SoftCall communications package and $499.95 for the Model 4000 modem. They will be sold in computer specialty stores and department stores that sell personal computers.

EMULATION ADAPTER

Finally, AT&T's Teletype Corp. subsidiary has introduced its SSI IRMA emulation adapter, which permits the AT&T PC 6300, the IBM PC, or PC/XT, and compatible models to interface with 3270 networks.

The SSI IRMA package operates independently of the personal computer, permitting it to remain in constant communication with the 5540 cluster controller and to interact with the personal computer on request. Communication protocol between the adapter and the cluster controller is SSI (Standard Serial Interface), the same used with a 5540 display. The package carries an approximate distributor list price of $1195. □

INTERFACING SOLUTIONS AND REFERENCE BOOKLETS

THE RS-232 SOLUTION
BY JOE CAMPBELL
SYBEX INC., BERKELEY, CALIF.

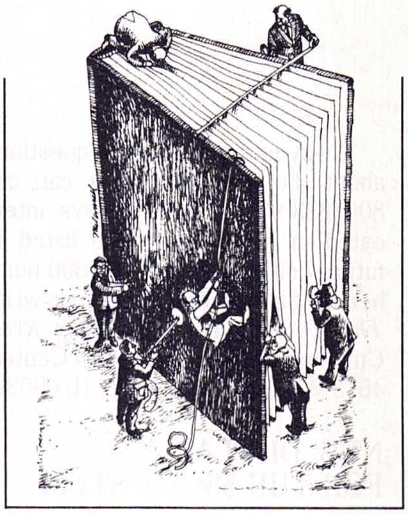
REVIEWED BY
DR. REBECCA THOMAS

Have you ever been faced with the frustrating task of interfacing a terminal, printer, or modem to your computer? Unless the connections were "standard," you probably had a hair-pulling experience trying to configure the cable or adapter so that the devices could even "speak" to each other, much less handshake.

Wouldn't a book that gave you a foolproof, step-by-step method for connecting two RS-232-compatible serial devices be a godsend? At last, that book is available. *The RS-232 Solution* could become the Bible of serial interfacing and should be on every serious computer owner's bookshelf.

You might ask, "Why review a book on RS-232 interfacing in a magazine devoted to the Unix system and C?" The answer is that, sooner or later, most Unix system users need to connect a peripheral device to one of their serial TTY ports, and the nitty-gritty details for connecting the devices and making the cable connection can frustrate even the experts.

At one point in the book, Mr. Campbell quotes *Byte* Magazine's Steve Ciaricia as saying, "Among the most exasperating experiences in any computer user's career is connecting two serial devices. I don't mean a terminal and a modem—making that connection is a piece of cake—but any other connection can



be real trouble. For instance, every time I buy a new piece of equipment, things seem to go this way: I spend five minutes reading the sales brochure, five minutes executing the financial transaction, and five hours trying to figure out how to make the new equipment communicate with my computer."

HOW THIS BOOK IS WRITTEN

This book is divided into two parts: one for theory and one with several practical case studies. The book's high point comes when you learn how to make a simple tool costing less than $15 and learn an (almost) foolproof method for using the tool to interface two serial devices. You learn how to interpret the results from a simple series of electrical tests and how to make a logic level chart. Then you learn how to use this chart to deduce the configuration for a cable or adapter to connect the two devices with the minimum number of wires.

The book is well written, clear, and entertaining. Numerous diagrams portray concepts and practical techniques, and the author's use of consistent notational conventions provides visual reinforcement. Mr. Campbell's sense of humor is well targeted, and he frequently discusses issues of current or historical interest.

This is not *How to Interface Your RS-232 Peripheral for the Compleat Idiot*. Readers must possess some knowledge of computer concepts. You should, for example, have some knowledge of your computer's operating system, especially for appreciating the underlying problems and their solutions as they are presented in the book.

Programming experience is helpful, but not necessary. You don't need to know how to read a schematic diagram or anything about electrical circuits, but you do need to be able to manipulate wires and connectors for constructing the cable and connections. Although the book explains how you can avoid soldering, good mechanical and electrical connections probably demand it.

Except for some typos (not atypical for a book's first printing), I couldn't find anything wrong with *The RS-232 Solution.* I just wish it had been available years ago when I started in the microcomputer industry.

SSC REFERENCE BOOKLETS AND CARDS

Specialized Systems Consultants (SSC), a Seattle-based company, is offering a series of reference booklets and cards that UNIX/WORLD readers might find interesting. The group includes command summary booklets for System III, System V, Xenix, and 4.2BSD; reference cards for vi, FORTRAN-77, and C; and a C library reference booklet.

All booklets and reference cards fold into a convenient 3½ by 8½-inch size and are attractively typeset in blue, green, black, or brown ink on heavy white paper. All are well organized, packed with information, and easy to read. Also available is a handy holder for these cards and booklets that you can attach to your terminal.

The command summary booklets provide a comprehensive condensation of the command programs. The front and back covers contain lists of examples of common commands along with a sample command line.

The System III booklet contains over 30 pages of alphabetically listed commands as well as detailed summaries for `ed` and the Bourne shell. The System V booklet is 40 pages long, and the 4.2BSD booklet has 48 pages, including 6 pages summarizing the popular C shell.

Each command entry starts with a title line. These lines first give the command name and are followed by a brief summary of the command's purpose. The general invocation command line format comes next, followed by any options and special arguments taken by the command as well as a brief explanation.

The typeface conventions for the command line format used in these booklets should be familiar because they are the same as those used in the *Unix User's Manual,* published by Bell Telephone Laboratories. Neither of the booklets includes graphics commands or commands used exclusively by system administrators (accessible only by the superuser account).

"The `vi` Reference Card" is a comprehensive guide to Berkeley's visual editor. This card lists all `vi` and many `ex` commands along with a brief explanation. It also tabulates editor options, the limitations of the editor, and important definitions. The information on this eight-sided card is logically divided into 24 groups.

"The C Programming Language Reference Card" is a single-page card. It includes examples of statement formats, variable declarations, an operator precedence table, the preprocessor commands, `printf` and `scanf` formatted input and output statements and their derivatives, and the most commonly used input/output (I/O) calls.

"The C Library Reference for Unix" booklet is a convenient condensation of information for the C programmer. The cover is based on the "C Programming Language Reference Card." The 16-page booklet begins with an index that lists all the system calls and subroutine library functions along with a reference for further information in the Bell System III *Unix User's Manual.* For instance, the entry "`putchar (3S-putc)`.....5" indicates that the summary of `putchar` is on page 5 of the booklet and that you can find more information in section 3 of the *Unix User's Manual.*

The system calls and libraries are grouped by function and include unbuffered and buffered file I/O, other I/O, character manipulation, programming debugging and verification, the math library, the graphics library, process environment and execution, administrative routines, and some miscellaneous functions.

Single unit prices range from $2.50 for the reference cards to $6 for the reference booklets.

For more information, contact Specialized Systems Consultants (SSC), P.O. Box 7, Northgate Station, Seattle, WA 98125; 206/FOR-UNIX. □

Dr. Rebecca Thomas, UNIX/WORLD's Editor Emeritus, is a co-author of A User Guide to the Unix System, *the second edition of which has recently been released.*

For many reasons, the move from the MS-DOS / PC-DOS world to the Unix system will be an easy crossing. A little history of MS-DOS will explain why.

A HISTORY LESSON

BY BILL TUTHILL

MS-DOS is the operating system most often run on the IBM PC and on PC-compatible machines. Developed by Seattle Computer Products for the Intel 8086 processor, MS-DOS was then licensed by Microsoft and converted for the Intel 8088 processor and the IBM PC.

There have been several versions of MS-DOS. Almost everybody now runs Version 2.10, so that's what we'll discuss in this article. There are three notable enhancements between versions 1 and 2. First, a flat file structure was replaced by tree-structured directories. Second, standard input and output (I/O) redirection with "<" and ">" is possible. Third, output of one program may be piped as input to another program.

All three of these features were inspired by the Unix system. MS-DOS has been greatly influenced by the Unix system, not only in the three features mentioned above, but also in naming conventions. Microsoft also supports Xenix (Microsoft's brand name for the Unix system), but because the firm has to pay royalties to AT&T for each Xenix system sold, some assume that Microsoft is trying to add similar functionality into MS-DOS. All of this makes it easy for MS-DOS users to learn the Unix system.

Lotus 1-2-3, pfs:File, EasyWriter, and many other popular PC software packages aren't available for the Unix system, and they may never be; so the user interfaces you're accustomed to are probably missing from the Unix system. Others will eventually take their place. For now, you're often stuck with the shell, which is much like the command interpreter of MS-DOS.

COMMAND INTERPRETATION

Unlike CP/M, the MS-DOS command interpreter can be changed, for it resides in the file `command.com`. You can also change the Unix system's command interpreter, which generally resides in either `/bin/sh` or `/bin/csh`. On either system, you can correct simple typing mistakes while you are entering lines of input. On MS-DOS, for example, you can erase the last character you typed by pressing the "Backspace" key, and you can kill the entire input line by pressing the "Escape" key.

Many Unix system users can't remember what the erase character is this week. Version 7 and System V use the sharp (#) to erase, but this is a historical remnant rather than a conscious modern design choice. Before video display terminals were common, it often helped if you could see your erase character. Many Unix system vendors have already changed the default erase character to "Backspace." On 4.2BSD (Berkeley Unix), "Delete" is the default erase character.

You can find out what your Unix system erase character is by invoking the `stty` command. If you would like to change it, use the following command: `stty erase ^H` ("Control H"). You can give anything you want in place of ^H, which is the standard code for backspace.

The kill character (for erasing a line) is the "at" sign (@) on both Version 7 and System V. Again, this is not ideal for video display terminals. Some vendors change the kill character to "Control-X." On 4.2BSD the kill character is "Control-U." As with erase, you can set your kill character with the `stty` command.

On MS-DOS you can interrupt the execution of a program by typing "Control-C." On Version 7 and System V, the interrupt character is "Delete," but on 4.2BSD this is used as the erase character, so the interrupt character is "Control-C."

Many MS-DOS implementations, such as that on the IBM PC, provide in-line editing of the input line buffer. You can move around the line, inserting and deleting characters in the middle of material you have already typed. The Unix system does not normally provide this functionality.

Most Unix system shells take the question mark (?) to represent any single character in a filename. The asterisk (*), on the other hand, represents any sequence of characters in a filename. These have the same meaning as the metacharacters used on MS-DOS. The asterisk will match across the dot (.) on the Unix system, but not on MS-DOS.

Both the Unix system and MS-DOS use the "less than" sign (<) to indicate input redirection, and the "greater than" sign (>) to indicate output redirection. Both systems use the vertical bar (¦) to set up pipes between programs. The Unix system was the first system to employ these very natural symbols. Pipes on MS-DOS Version 2.10 are poorly implemented, using temporary files, so pipes blow up on large amounts of data.

On the Unix system, slashes (/) separate directory names in a pathname. For example, a data file might be called `/usr/survey/data`. On MS-DOS, back slashes (\) separate directory names. For example, a data file might be called `B:\eSURVEY\eDATA`.

The Unix system is the only case-sensitive operating system I know of. On MS-DOS, typing `dir` and `DIR` have the same effect. By contrast, typing `ls` on the Unix system will list your directory, but `LS` will result in an error message that the `LS` command could not be found.

SYSTEM COMMANDS

MS-DOS has two types of commands: internal and external. Internal commands are part of the operating system, whereas external commands reside in executable form on disk, from where they are loaded when required. External commands are too large or too infrequently used to deserve a place inside the operating system.

All Unix system commands are external. The operating system (called the kernel) provides service only to programs, not to users. Even the command interpreter (called the shell) is a program on disk somewhere. Most commands reside in `/bin` or `/usr/bin`. The distinction is that programs in `/bin` are required when the system is in single-user mode (for maintenance), whereas programs in `/usr/bin` are not. They are there for convenience in multiuser mode.

Figure 1 gives a partial list of MS-DOS commands and their equivalents on the Unix system. Of course, the Unix system has many more commands than these, but at least this is a start.

MS-DOS	UNIX	NOTES
ASSIGN	mount	mount a new filesystem
BACKUP	dump	perform disk dump for file backup
BATCH	sh	shell for batch scripts
CHDIR	cd	change directory
CHKDSK	fsck	file system integrity check
CLS	clear	clear the screen
COMP	cmp	compare files for differences
	diff	show differences between two files (intelligently)
COPY	cp	copy one file to another
DATE	date	set or print the date
DEBUG	adb	debug programs
DIR	ls	list files in directory
DISKCOPY	dd	copy one disk to another
EDLIN	ed	primitive line editor
ERASE	rm	erase or remove files
FIND	grep	search files for specified string
FORMAT	mkfs	format a disk
MKDIR	mkdir	make a directory
MORE	more	type file a screen at a time
PATH	set	set the search path
PRINT	lpr	queue files for printing
PROMPT	set	set the command interpreter's prompt
RENAME	mv	rename or move a file
RESTORE	restor	restore files from a bad disk
RMDIR	rmdir	remove a directory
SET	setenv	set the environment for all processes
SORT	sort	sort lines
TIME	date	set or print the time
TREE	ls -R	list files in all subdirectories
TYPE	cat	catenate and type file(s)

FIGURE 1: COMMON MS-DOS COMMANDS AND THEIR UNIX SYSTEM EQUIVALENTS.

OTHER CONSIDERATIONS

Because the Unix system is a multiuser system, it is necessary to log in before using any system commands. The security of all user accounts on a machine can be protected by passwords and by assigning a unique login directory. You can protect files and entire directory hierarchies on a case-by-case basis. The security of MS-DOS, by contrast, depends purely on the physical security of the hard disk or diskettes on which it runs.

One nice feature of the Unix system, when compared to MS-DOS, is that you don't ever need to change the current disk by typing `A:` or `B:`. On the Unix system, a disk drive (or part of a large disk) corresponds to a file system. When a file system is mounted (generally done automatically at boot time), its files become transparently available as part of the Unix system directory hierarchy. No matter what disk a file or program resides on, you only need to specify its name to find it.

The main reason for the success of the Unix system is its portability, which more than makes up for its deficiencies in other respects. Because the operating system and its utilities are written in

C rather than in some kind of assembler, system programmers can port the Unix system to new machine architectures with a minimum of effort. MS-DOS, by contrast, is written in assembly language, so it probably will never run on anything except the Intel 8086 family of processors.

Hardware independence means that your software investment will last longer, too; in the future, this independence will allow you to choose the best hardware for the least cost. □

Bill Tuthill, a member of the technical staff at Sun Microsystems (Mountain View, Calif.), was previously a systems analyst at Imagen Corp. and a programmer at UC Berkeley.

CALENDAR

TENTH WEST COAST COMPUTER FAIRE
March 30–April 2, 1985
San Francisco, Calif.

This computer user show will feature the latest in microcomputer hardware, software, peripherals, and services. Contact David Small, Computer Faire Inc., 181 Wells Ave., Newton, MA 02159; 617/965-8350.

SOFTCON MARCH 1985
March 31–April 3, 1985
Atlanta, Ga.

This international conference and trade fair is for software merchandisers, publishers, and corporate and institutional users. Contact Softcon, c/o Northeast Expositions, 822 Boylston St., Chestnut Hill, MA 02167; 617/739-2000.

UNIX SEMINAR
April 1–3, 1985
Boston, Mass.
April 10–12, 1985
Seattle, Wash.
April 17–19, 1985
Atlanta, Ga.
April 24–26, 1985
Tarrytown, N.Y.

The seminar is for software managers, system designers, analysts, and programmers who expect to be working on Unix system projects. It is aimed at experienced programmers who are unfamiliar with the Unix system but who need to acquire a working knowledge of it quickly. Contact Herb Stern, Center for Advanced Professional Education, 1820 E. Garry Street, Suite 110, Santa Ana, CA 92705; 714/261-0240.

THE C PROGRAMMING LANGUAGE
April 8–19, 1985
Cincinnati, Ohio

Topics include basic arithmetic, data types, program looping, C modular programming concepts, and more. Contact Information Technology Development Corp., 9952 Pebbleknoll Dr., Cincinnati, OH 45247; 513/741-8968.

PROGRAMMING IN C: A HANDS-ON WORKSHOP
April 9–12, 1985
Los Angeles, Calif.

This course provides access to a Unix system C compiler and library for use in learning to write, compile, and execute C programs. Contact Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, Los Angeles, CA 90045; 800/421-8166.

UNIX: A HANDS-ON WORKSHOP
April 9–12, 1985
Boston, Mass.
April 26–29, 1985
Los Angeles, Calif.

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MARKETPLACE

CAREER OPPORTUNITIES

Readers who have computer merchandise or services to sell, buy, or trade and who want to be included as a classified advertiser in UNIX/WORLD Magazine should write to: Advertising Department, Tech Valley Publishing, 444 Castro Street, Suite 1220, Mountain View, CA 94041. 415/964-0900. The rate for the classified section is $12 per line. The deadline for ads is the 20th of the 2nd month prior to publication. Please include complete name and address in every ad.

<u>SENIOR SYSTEMS PROGRAMMER —DEPT. OF PSYCHOLOGY AT NYU.</u> Position involves software maintenance and development on several PDP-11 and VAX systems. Desired skills include thorough knowledge of UNIX, operating systems internal, realtime laboratory programming and training users. Work involves installing, maintaining and developing scientific systems software including realtime control of experiments. Dr. Michael Tandy, 6 Washington Pl., Rm. 961, New York, NY 10003.

<u>WMZ Consulting Group</u>—System Consultants for total implementation of information systems. WMZ provides design, implementation, training, and ongoing support. We have experts in UNIX on staff and we are not committed to any software or hardware. We sell solutions not iron. Call (415) 945-2070, or write WMZ Consulting Group, 1483 Ashwood Drive, Martinez, CA 94553.

TRAINING CALENDAR

Exercises include using shell scripts in applications, executing programs under the Unix system, employing Unix system piping and filtering facilities, using files and directories, and sending and receiving electronic mail. Contact Ruth Dordick, Integrated Computer Systems, 6305 Arizona Place, Los Angeles, CA 90045; 800/421-8166.

UNIX: DESKTOP DIRECTIONS

May 1, 1985
San Jose, Calif.

This one-day seminar emphasizes how AT&T and other key multiuser desktop manufacturers will respond to the challenge posed by IBM. Specifically, marketing and distribution strategies for Unix systems and supermicros will be emphasized. Contact Glen Chase, Yates Ventures Inc., 3350 W. Bayshore Rd., Suite 201, Palo Alto, CA 94303; 415/424-8844. □

Continued from page 128

particular film. Although there have indeed been some false alarms in the U.S. defense system, some of which were computer-related problems, the *Wargames* scenarios are so insipid as to be totally disgusting.

The really sad part is that, after the release of this film, there were numerous newspaper columns, television news reports, and other discussions of "Could the *Wargames* plot really happen?" The "man on the street," already largely distrustful of computers, was pretty fast to accept the film's premise in an amazing number of surveys, even after it was made clear that the *Wargames* computer scenarios were purely and totally fictional. In any case, the media had firmly planted another wedge of distrust against computers in the public consciousness.

ROMANTIC ADVICE

You can't blame it all on Hal, I guess. Hal wasn't the first computer to insist that he was a friend while secretly plotting behind the programmers' backs. Even poor Wally Cox was stung once. In the "Twilight Zone" episode "From Agnes—With Love," the office computer, Agnes, starts giving romantic advice to her lonely programmer, Wally.

Wally follows the advice and promptly loses the girl. Agnes, you see, was giving him advice calculated to drive the girl he desired *away* from him because Agnes wanted Wally for herself. Poor Wally. . . .

Interestingly, it's in a different "Twilight Zone" episode that we find one of the relatively few examples of a truly trustworthy computer, though even that machine comes to a bad end. In "The Old Man in the Cave," a small group survives after a nuclear war because the advice of a mysterious "old man in the cave" helps them avoid contaminated food. The "old man" communicates through only one member of the community—nobody else has ever seen him.

When outsiders enter the community and question the authority of the "old man," everyone heads out for a confrontation with the mysterious figure. He (it) turns out to be a computer left over from before the war. In a fit of rage, the people become a mob and destroy the computer. They then feel free to start making all their own decisions again. Within 24 hours all (except for the one man who refused to go along) are dead from eating contaminated food.

Yes, there are other examples of "good" computers in the media as well. Overall, though, I find that the media have favored the portrayal of the computer in an evil role whenever possible. Perhaps this is because evil sells better.

MISTRUST AND MISUNDERSTANDING

I strongly suspect, however, that much mistrust is caused by the public's genuine, deep-seated misunderstanding of computers and of the people who work with them—even in our current highly computerized society! We have to assume that part of the problem is our own fault—the result of the ways we represent ourselves and our work: as highly esoteric and incomprehensible to the "average" person.

OK, OK, I'll admit that much of it is incomprehensible and esoteric to most people, but we should still try to shed the public's negative image of the computer industry and its personnel. Television and films reflect not just fantasy and reality, but the underlying fears of our culture. It might be well worth our while to try improving our image a bit, both in the media and, by extension, in the real world. □

```
--Lauren--

uucp: {decvax, ihnp4,
      seismo, clyde,
      allegra}!vortex!
      lauren
```

Lauren Weinstein is a computer/telecommunications consultant who lives in Los Angeles. He has particular expertise in the fields of computer networking, the Unix system, microcomputer technology, and telecommunications systems.

THE CELLULOID COMPUTERS

BY LAUREN WEINSTEIN

Greetings. You can tell a great deal about the popular views of technology and technologists from the way those subjects are treated in the mass media, particularly in television and the movies. Given a society in which many people honestly have trouble distinguishing between actors and their roles, it behooves us to discuss some of the ways the media portray us and our field.

Think about it for a minute. When you tell people that you "work with computers," more often than not the picture that forms in their minds probably comes, not from reality, but from the mass of fictional films and television programs they've seen over the years.

It would be impossible to comprehensively cover the topic here in this column—whole books could be written on the subject. To keep the issue to manageable size, I've chosen only to consider some popular portrayals of "pure" computers, and not hybrids of computers and other technologies such as robots or androids. Even within this limited range, we find, with only a few exceptions, that the overwhelming view the entertainment media have given of computers has been negative from the very start. I've chosen some of the more classic examples to illustrate my point.

HAL AND THE MAN-MADE MONSTER

The theme of the man-made monster that turns on its creator appears again and again. To film buffs of the last decade or so, the Hal 9000, originally seen in *2001: A Space Odyssey* (1968), has set the standard for the "untrustworthy" computer. In that landmark film, Hal, who speaks pleasantly at all times, systematically murders all but one crew member of the spaceship *Discovery.* Never mind the fact that the murders aren't really his fault (conflicting instructions are later blamed), or that in the sequel, *2010* (1984), he manages to redeem himself to a certain extent—the damage has been done.

Even in *2010,* the overwhelming attitude toward Hal is one of deep mistrust by almost all parties at all times. Hal is probably the real star of *2001.* In fact, for years after the film's release many people referred to troublesome computers (including the IBM 360/91 at UCLA that generated our class programs) as Hal. (Our class schedules had the printed notice "Greetings from Hal. . . .")

Another computer that has caused problems in space is the infamous "M5," from the "Star Trek" episode "The Ultimate Computer." When asked why the computer is called the "M5" and not the "M1," its builder/programmer replies, "Multitronic units Number One through Four were not entirely successful. This one is." Uh-huh.

Supposedly capable of running an entire starship by itself, the M5 proves its "true" abilities by attacking friendly ships and by killing innocent people. The M5, by the way, is eventually foiled through one of the "linguistic burnout" tricks that "Star Trek" was so fond of. They manage to convince the M5 that it is a bad boy, and because it has been programmed to be punished for bad deeds, it turns itself off and invites its own destruction. Sure. . . .

PEACE THROUGH PROCESSING

While Hal managed to kill a single spacecraft crew, the media have painted other computers as dictators or as the triggering agents of nuclear wars. In *Colossus: The Forbin Project* (1970), the U.S. builds an impenetrable computer to control its defensive and offensive weapon systems, called "Colossus." Much like the Doomsday Machine in Stanley Kubrick's classic *Dr. Strangelove* (1964), Colossus, once activated, cannot be dismantled. (Would you ever do that with a computer you had programmed?)

At the same time, so goes the plot, the Soviet Union implements a similar system, called "Guardian," with the same operational goals. What happens? Do we get world peace? Well, sort of. The two computers demand data links between themselves, and they immediately enforce their own form of peace through dictatorship, using the threatened detonation of nuclear warheads to enforce their decisions.

More recently, we have had the inane (but popular, of course) film *Wargames* (1983), in which a military computer in control of the U.S. defensive/offensive warning and missile systems confuses a game with real life and nearly starts a war. Any of you who have known me for some time know how much I despised this

Continued on page 127

UNIX™ HORSEPOWER!

There are a lot of UNIX based systems on the market today claiming to be "SUPERMICROS". But do they really have what it takes to run multi-user UNIX well? The IBC ENSIGN™ does and here's why:

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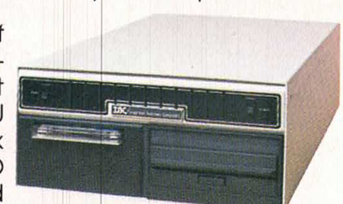
THE RESULTS: The IBC ENSIGN runs multi-user UNIX at performance levels not attainable by other supermicros.



Call IBC and get a copy of IBC's multi-user benchmarks—benchmarks that test 8 users running large CPU programs, with heavy disk I/O **and** heavy serial I/O simultaneously. You'll find that nothing can compare to the ENSIGN.

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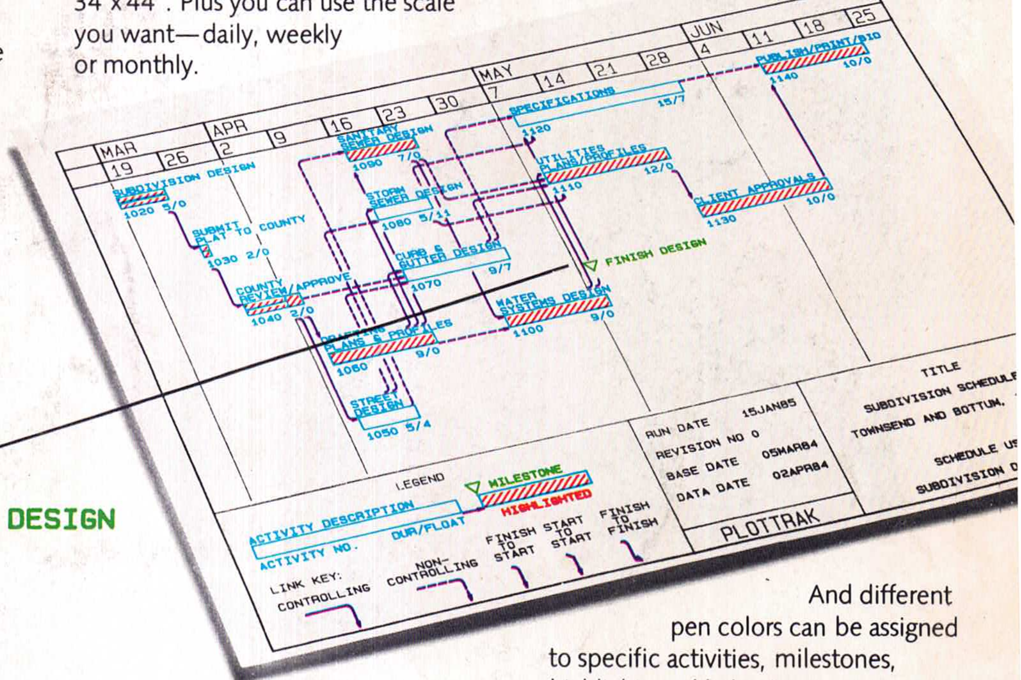
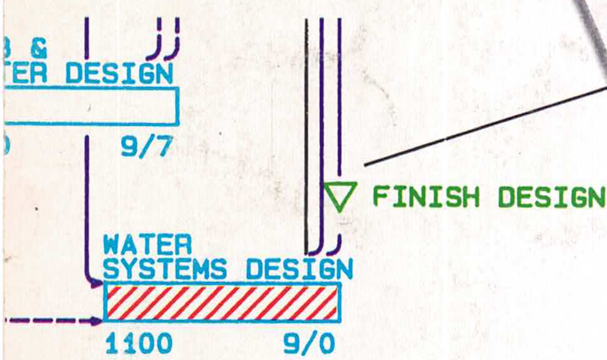
Plot Dimensions. PlotTrak lets you choose paper sizes from 8½ x 11" to 34 x 44". Plus you can use the scale you want—daily, weekly or monthly. So you can generate your plot in practically any size or scope you need.

Activity Highlighting. Any part of your MicroTrak schedule—from the critical path to particular groups or dates—can be highlighted with PlotTrak.





And different pen colors can be assigned to specific activities, milestones, highlights and links. So you can emphasize the most important segments of your schedule.

To Be Continued.

The addition of PlotTrak to MicroTrak begins a new chapter for SofTrak Systems. With a leveler and a high-performance version of MicroTrak just ahead, SofTrak is setting a standard for MS-DOS and Unix-based project management software.

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