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UNIX™ WORLD

THE MAGAZINE FOR MULTIUSER, MULTITASKING SYSTEMS

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Zilog System 8000
Zilog's Mac Connection

Is The Unix System Retailable?

Graphics Extensions: GKS, PHIGS, VDI

Tutorial: Terminal Lines, Cron

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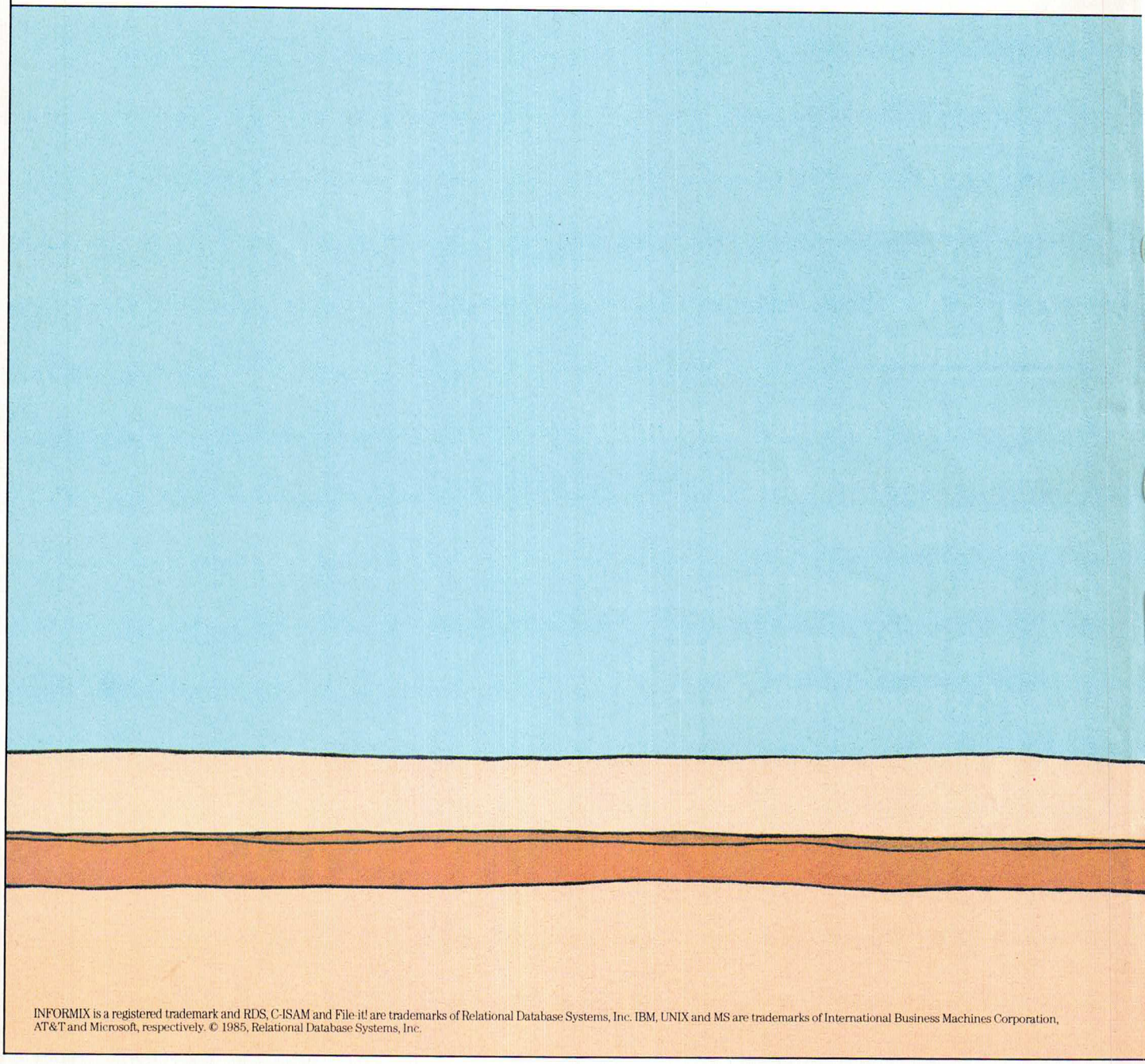

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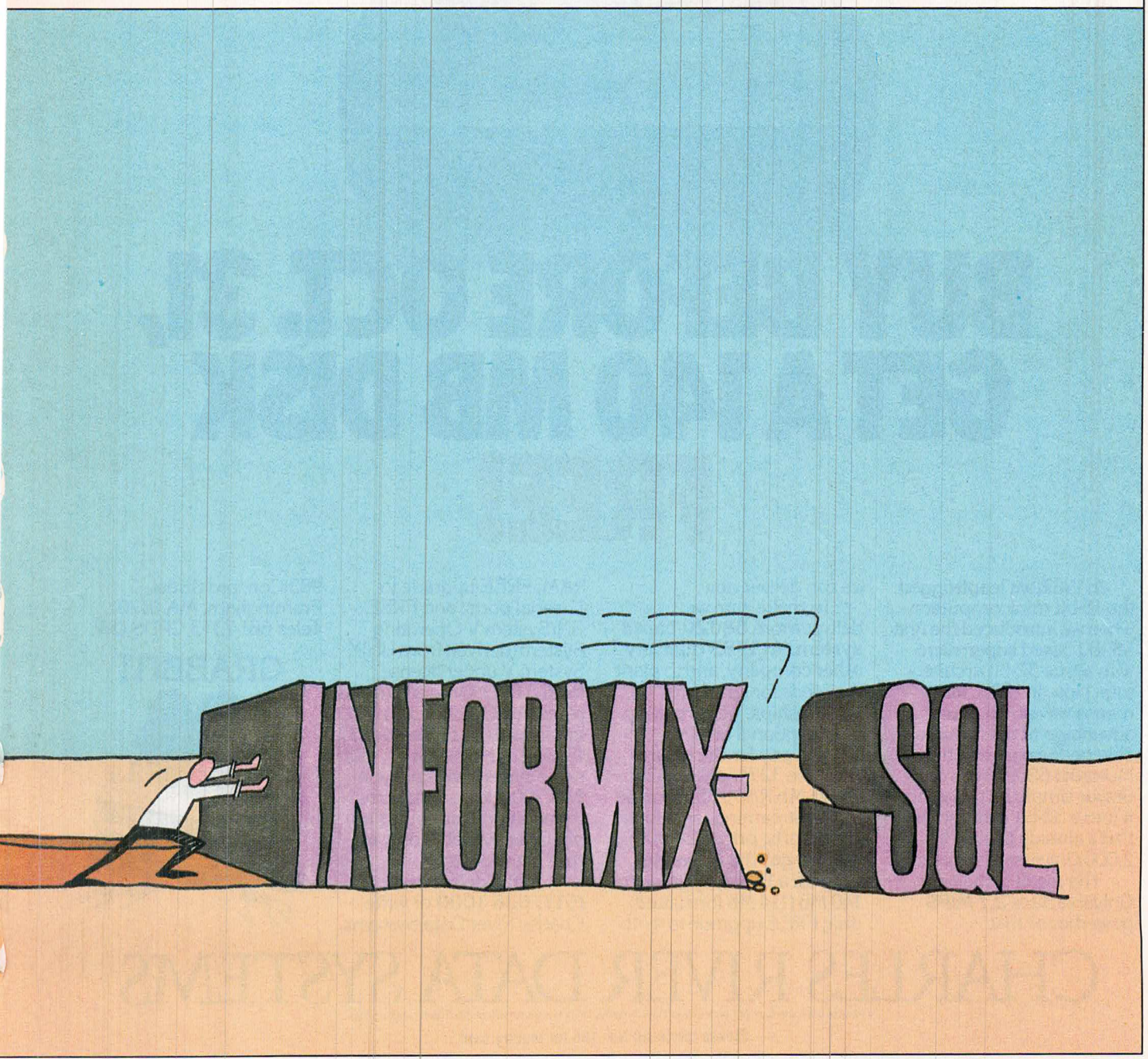

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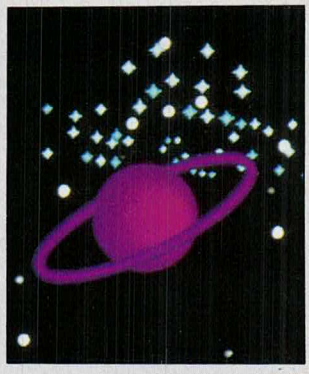

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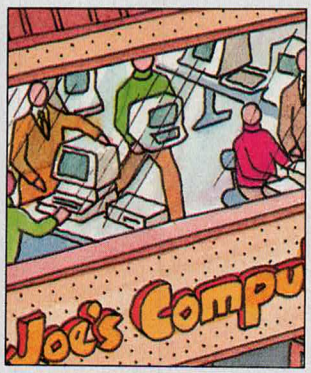

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NEXT MONTH: COMMUNICATIONS

- **STATE OF THE LAN MARKET**
- **STREAMS VS. NFS**

This month's cover incorporates studio photography by Jim Cummins, Jim Cummins Photography, Seattle, and computer graphics by Focus Communications Group, San Jose. Composite merging of the photography and computer graphics onto one final sheet of film was done by photographer Brad Milliken, also of Focus.

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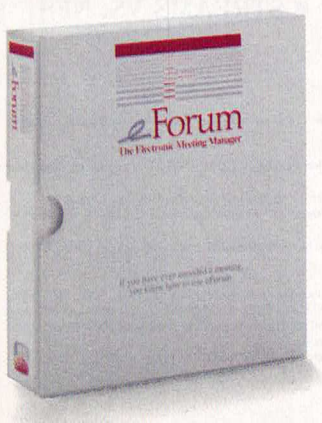

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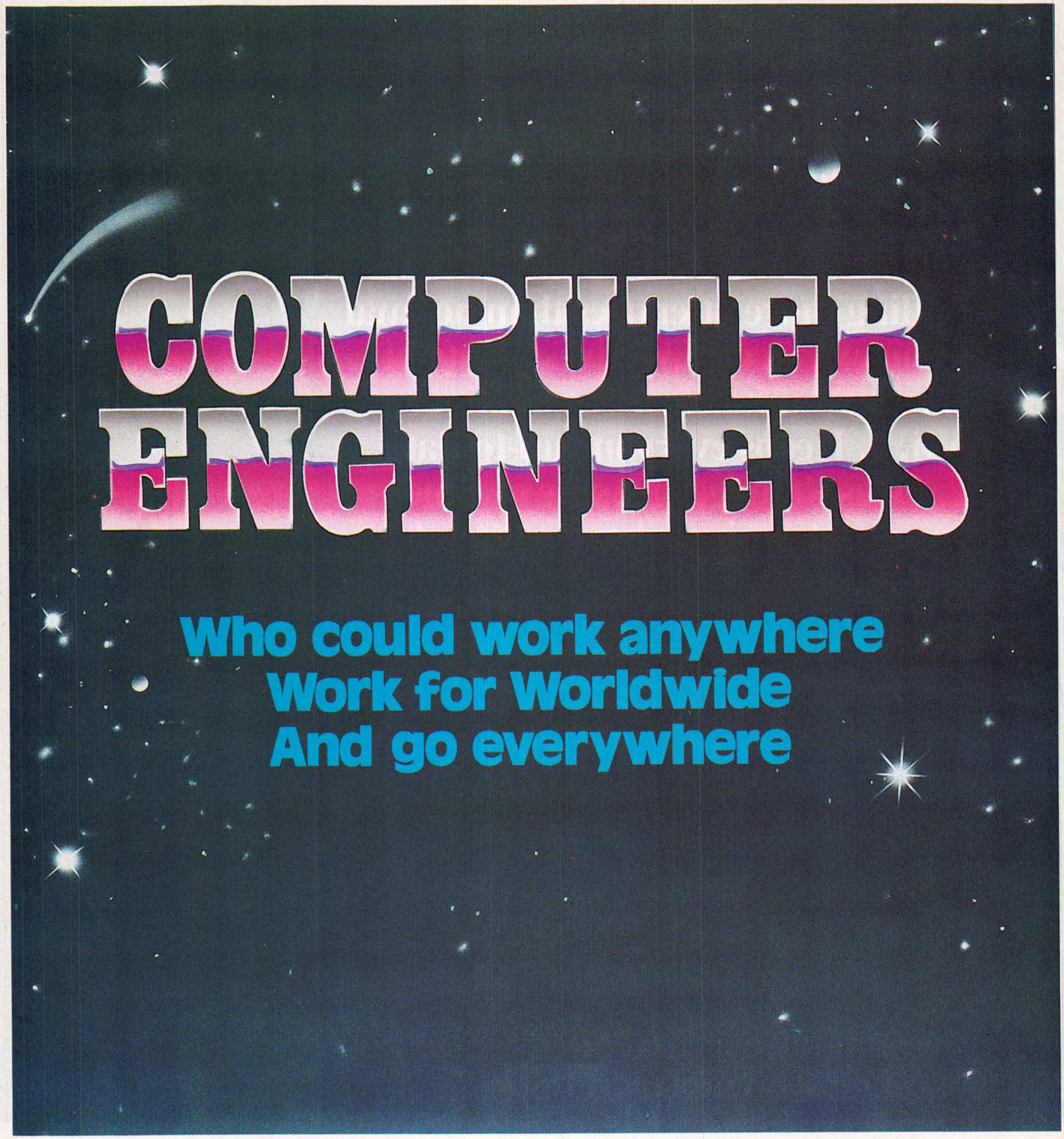

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TRENDS

EDITOR'S CONSOLE

The Unix system marketplace has a penchant (perhaps even a fixation, some might say) for certain key words. One of them you hear time and again is "standards." You know—Unix system standards, communications and networking standards, graphics standards . . . The list seemingly goes on. And so does the list of standards committees and organizations formed to debate, stipulate, formulate, and promulgate these standards.

Ironically, these very committees and organizations may be the single greatest barrier to industry standards yet conceived. Why? History has shown again and again that at least in the computer industry, standards are set *de facto*, not *de jure*. CP/M came out of nowhere to become a *de facto* industry standard for 8-bit micros. No standards organization was needed to stipulate and promote it to industry standard status—CP/M got there on its own. Granted, the history of PC/MS-DOS's rise to prominence is different; it had IBM to bless it. Nevertheless, it was the users in the marketplace that set this industry standard, not some bureaucracy.

I could go with this list indefinitely but I don't have the space. My point, however, is simple: In the Unix system marketplace, it will be the users who set the standards, not `/user/group`, not AT&T, not even IBM. It's not to say that these firms and organizations won't help shape the eventual standard; they most certainly will. But they will shape that standard according to what their customers want to buy. And what customers are buying more than anything else is XENIX. For this reason, we focus this month on XENIX—by far the favorite flavor of Unix systems available—and its future. It is very likely that XENIX will set the Unix system standard most users will know and acknowledge. To do the honors, we thought it only appropriate to go straight to the source: Microsoft Chariman Bill Gates. □

Philip J. Gill
Editor-in-Chief

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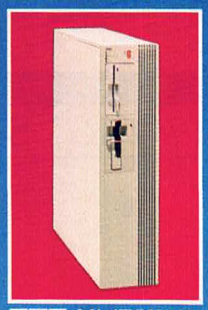
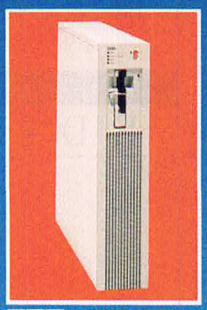


NCR MiniTOWER



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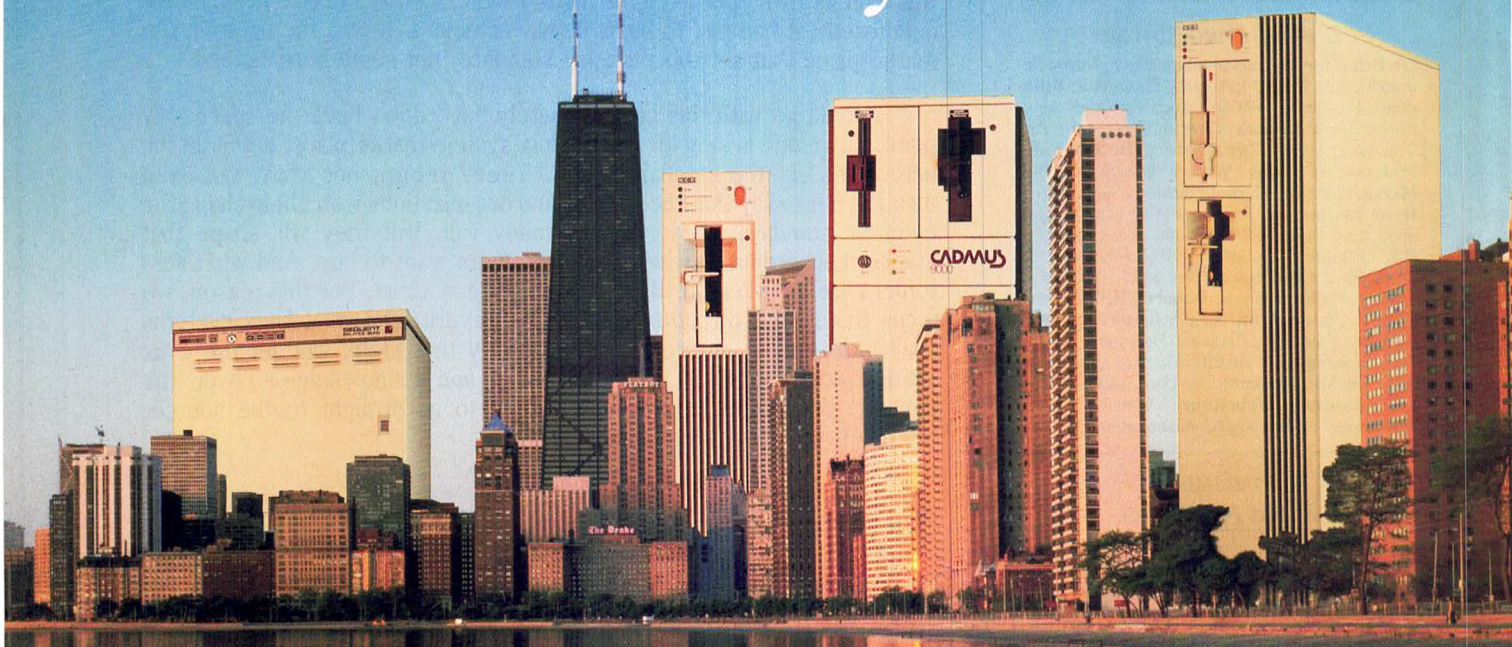

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FOR THE RECORD

Top of the News . . . Detente, of sorts, is the byword not just in Washington but in Unix system circles as well. **Sun Microsystems Inc.**, Mountain View, Calif., and **AT&T Information Systems** have agreed to cooperate with each other in bringing System V and 4.2BSD together. In effect, the agreement promises to bring about a cross pollination of both System V and 4.2BSD, though it appears that Sun is moving closer to System V than System V is to 4.2BSD. A Sun spokeswoman said the two firms will jointly develop the necessary software over the next 12 to 24 months. Full System V Interface Definition conformance on Sun's part is expected by early 1986, just in time for UniForum, the commercial Unix system users' show, in Anaheim, Calif., the spokeswoman indicated. Full Base Level System V Interface Definition compliance will follow in the summer of next year. However, Sun added that software written for the current Sun Operating System software—including those using Sun's Network File System (NFS), Sun Windows, Sun's multi-window screen management packages, and the SunCore graphics library—will remain compatible with future operating system releases. As part of its strategy to co-exist with System V, Sun said it will port NFS—which it has proposed as an industry standard—over to System V. In addition, Sun said the two companies would continue to meet periodically "to discuss future directions of System V and the Unix system marketplace. . . ."

Hoping for a rebound, troubled **Fortune Systems Corp.**, Belmont, Calif., has unleashed a barrage (25 +) of new products—including the new high-end four-member, Super Expanded Performance (SX) series systems, capable of connecting up to 24 users. In addition, a local-area network, new graphics products, and window management and communications software were also debuted. While the SX series performance improvements are much-needed and long-overdue, perhaps the most intriguing of the new Fortune products is Fortune: Windows, the new window management software package—and a nicely done one at that. According to the firm, Fortune: Windows allows users to create and display up to eight windows of data simultaneously, each spun out as a separate process under the Unix system. Moreover, and perhaps more to the point, Fortune: Windows permits data to be transferred from one active window to another via ASCII data streams. Fortune: Windows also permits a high-level of user customization. . . .

On the financial front, however, Fortune continues to be a money loser, although the firm reported a profit of $222,000 for its most recent quarter, that ended June 30 . . . The reason for the discrepancy between what Fortune says and the financial community says about Fortune's second quarter performance is that Fortune is counting as revenue some $350,000 or so in interest income off its $25 million cash reserve (the net still leftover from its initial public offering). Hence, the firm as an on-going business is still losing money. Moreover, the quarter would have looked much, much worse were it not for $2.2 million received from **Kirloskar Computer Services Ltd.** of India for Fortune source code. . . .

On the Integration Front . . . Elsewhere on the integration front, Motorola's **Four-Phase System** subsidiary has also brought out window management software that integrates the major office productivity tool applications in a single environment. Called the Business Assistant, the new window management software seeks "to hide the Unix system from the user" but still give them all of its power, according to Four-Phase executives. The product provides a series of windows and menus that guide the user through almost all major steps in word processing, data base management, spreadsheet, *et al.* including a nice set of menus for systems administration functions. . . .

On the Multiprocessor Front . . . We all know that multiprocessor architectures are one among many of the industry's current fads, for better for worse. While it's still too early to tell if multiprocessor architectures are just a passing fancy or are here to stay (consider that two multi-processor companies that made a lot of noise—**Auragen Systems** and **Synapse Computer** are now out of business permanently)—we've yet to find one who makes so bodacious a claim as a company named **Icon Systems & Software,** Orem, Utah. What makes Icon all the more intriguing is its recently disclosed connection with Japan's **Sanyo Group** of companies, including Sanyo Electric Co. Ltd. of Osaka, Japan, whereby Sanyo poured in a large sum of money (seven or eight figures, according to some reports) in exchange for 40 percent of Icon. Under the agreement, Icon will research and develop a computer family based on 32-bit microprocessors under the "MultiMicro/Mainframe Architecture" monicker. Sanyo will manufacture the hardware in Japan, Icon will sell them in the U.S., Sanyo will sell them in Japan. They will all bear the Sanyo/Icon brand name.

The Sanyo/Icon MultiMicro/Mainframe Architecture family will incorporate multiple 68020's (two in the base model), multiple concurrent operating systems (both 4.2BSD and Unix System V, of course, but also MS-DOS and VM and MVS (!!) and maybe even Pick). And there's still more—the base, two processor machine, rated at 3.0 MIPS (million instructions per second), will list for a market-busting, entry-level price of $15,000. It will be followed up by a 5.0 MIPS machine with a real-time version of the proprietary operating system kernel (it's the glue that ties together multiple operating systems), and an ultra-high performance, expandable multiprocessor with up to 32 symmetrical processors and a claimed 64 MIPS capability. Although we've got no reason to doubt the Icon folks at this time, we anxiously await the shipment of their first products. . . .

Tandem and C . . . One of the last major holdouts on the Unix system, **Tandem Computers,** Cupertino, Calif., officially remains so, though the firm has endorsed the Unix system as a programming and development environment with the recent introduction of a Lattice Inc. C compiler for Tandem NonStop and TXP systems. . . .

Rumors of the Month . . . Right about now **Oracle Corp.,** the Menlo Park, Calif., relational data base management system software house, is planning to launch two or three major new software products that will head it off in new, strategic directions including a tightly integrated spreadsheet/DBMS package called SQL Calc networking capabilities. . . . Meanwhile, despite the naysayers gloom and doom forecasts for its top-to-bottom, micro-to-mainframe Unix system strategy, one software developer in the know says the **Sperry Corp.** sales force sold 600-plus Unix system boxes in the first 90 days they were being shipped by the Blue Bell, Pa., computer maker to its customers. We don't know how Sperry has fared since then, but we understand it is a key player in a major federal government bid that could "keep it in business into the next century," joked one informed source. . . .

Contracts . . . **Philon, Inc.,** New York, a developer and marketeer of language compilers, has signed a major agreement with **Digital Equipment Corp.** to supply Philon compilers for DEC VAX, MICROVAX I, and recently introduced MICROVAX II computer (operating under Ultrix). Philon will supply its Philon FAST/Compilers to DEC under the Digital Classified Software (DCS) program. . . . **Pacific Microcomputers, Inc.,** a San Diego-based manufacturer of high-density single-board computers, has been awarded a $1 million, 18-month contract by **Texet Corporation** of Arlington, Mass. Under the contract, Pacific Microcomputers will supply Texet with PM68D Multibus single-board computers, MX68 memory expansion boards, and software support to be used in the Texet Live Image Publishing System, which integrates text, graphics, live page preview, design, and composition capabilities. . . . **Imagen Corp.,** Santa Clara, Calif., a manufacturer of intelligent, non-impact page printing systems, has signed a major OEM agreement with photographic equipment giant **Eastman Kodak Co.** that totals more than $1 million. Kodak has agreed to purchase several hundred of Imagen's image processors over the next year for use in the Kodak Ektaprint electronic publishing system. . . . **Marc Software International,** Palo Alto, Calif., said it has sold 32 WordMARC software licenses to the Water Resources Division of the **United States Geological Society** (USGS) for use on **Prime Computer Inc.** minicomputers. 32 programs will be installed immediately, and up to 75 programs may be installed over the life of the contract. . . .

News From AT&T . . . **NETI Technologies Inc.'s** wholly-owned U.S. operating subsidiaries, Network Technologies International, Inc., and **Huron Leasing, Inc.,** both of Ann Arbor, Mich., have entered into a major agreement with AT&T to become a Value Added Reseller (VAR) in the U.S. for AT&T products and systems. In a separate accord, NETI has also joined AT&T's **Vendor Involvement Program** (VIP) as an approved Independent Software Vendor (ISV) for NETI's proprietary Forum 2000 electronic meeting system. . . . Also, NETI has announced that one of the company's major proprietary product/systems, docuForum, has passed all final product evaluation by **AT&T Communications, Inc.,** Basking Ridge, N.J., and will be marketed by AT&T starting in September. . . . Under a major co-venture agreement signed in January between AT&T Communications and **Network Technologies International Inc.,** NETI's operating subsidiary, AT&T obtained the right to market docuForum to corporate legal organizations in the U.S. However, the implementation of that agreement was contingent on AT&T's review and acceptance of the product. AT&T Communications is AT&T's long-lines unit. . . □

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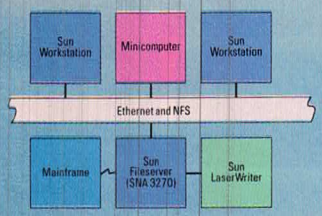

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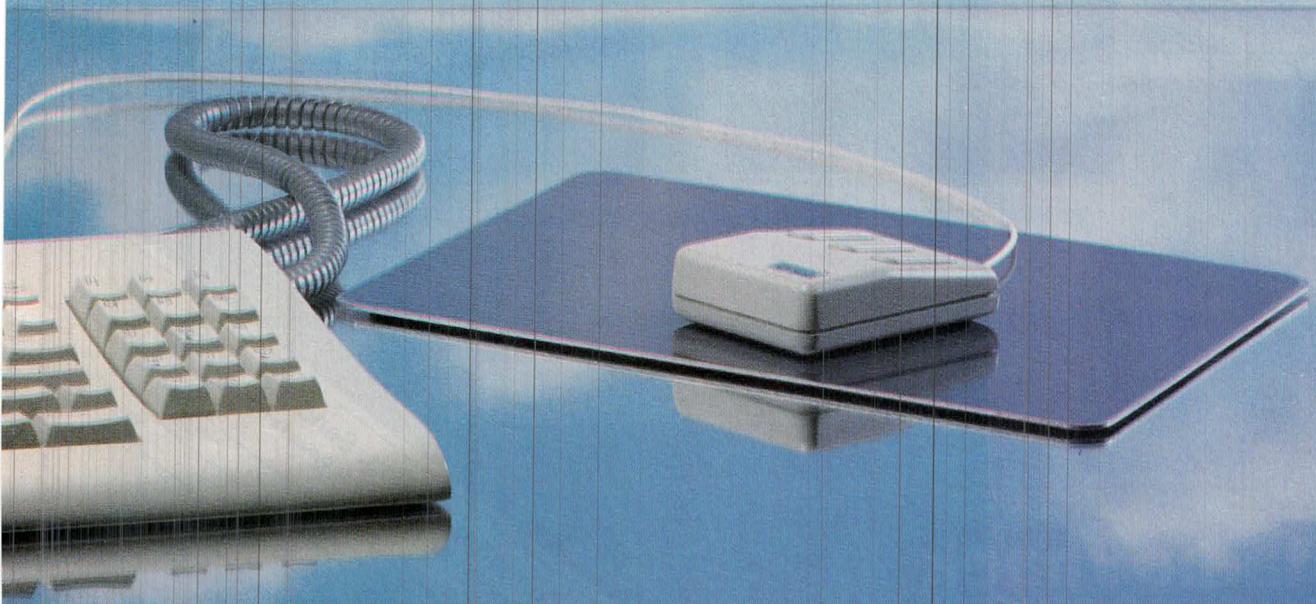

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AN OVERSIGHT?

Dear Editor:

As a continuing subscriber, let me offer my compliments on a job well done. I look forward to every issue. However, there is something which irks me that I believe you should be made aware of.

As an involved user of Tandy Radio Shack, it does concern me that Tandy is rarely mentioned in your magazine. That's odd, given that the Tandy 6000 (and its predecessor, the Model 16) run Microsoft's XENIX, with an installed client base in excess of 100,000. Tandy really has brought the world of Unix/XENIX to the general public with system prices starting as low as $8000 (Cdn).

In one issue, you carried a review of Multiplan. Tandy had sold it for XENIX for several months at that time. In another issue, the merits of Basic on a Unix system were discussed. Again, Tandy had carried Microsoft's MBasic for some time. In your August issue, you compared various word processors, but our Scripsit-16 was ignored.

In another issue, a focal point was training, but you ignored Tandy's educational network. Not only do most of their Computer Centres boast a classroom and a full-time instructor, but the repertoire of courseware includes the Xenix operating system and our multiuser applications such as Scripsit-16, Profile-16, and Unify (our DBMS packages), Multiplan and a complete, fully integrated accounting system.

I believe that you do a disservice to the Unix/Xenix community by ignoring Tandy's large client base. While there are larger, more costly systems, Tandy has managed to keep Unix affordable and relevant for businesses of any size.

Take a look at Tandy—I believe you'll be impressed, and pleasantly surprised.

Sincerely,
Doug Frith

Editor's Reply: The oversight has not been intentional. Moreover, I hope I may allay your concerns by letting you know that our regular reviewer, Bruce Mackinlay, has a Model 6000 in his hot little hands right now.—Philip J. Gill

[MORE] KIDS AND KEYBOARDS

Dear Editor:

Bouquets to Lauren Weinstein for his much-needed caution regarding the new generation of "computer nerds": today's children.

When a child's best friend is a computer terminal and one's exercise consists of strenuous finger tapping, then we better prepare ourselves for a population of overweight, emotionally illiterate adults. While some children may be computer whizzes, if they are lacking in that very human training in love, conflict, and laughter, then what have we as a society gained?

Don't get me wrong—I'm not on a crusade against computer competence. I think it's great that a ten year old can out-perform me on a PC anytime. I'm all for healthy intellectual training, but a healthy balance is what's needed and sorely lacking. Maybe we need to relearn the wisdom of the ancient Greeks: Health and happiness come only when the mind, body, and soul are equally well developed. Let's start applying this lesson before our whiz-bang expertise strips away part of our humanity.

Sincerely,
Cindy L. Scharf
Information Concepts, Inc.

WHATEVER HAPPENED TO THE SUPERMICRO MARKET? PART 2

BY OMRI SERLIN

Unfortunately, as I explained last month in Part 1 of this article, the supermicro has yet to live up to its expectations; in fact, the market now seems hopelessly stalled.

The problems of the supermicro market are several: price point and distribution channels, service and support, competition from proprietary supermicros and LANs, and the double-edged connection to the Unix system.

Price Point and Distribution Channels. By far the most fundamental problem supermicros face is that they are positioned in an awkward price range. With typical system tags running $15-$30,000, a supermicro system is far too expensive to be handled properly through the retail channel; at the same time, it is too low in price to justify direct sales.

Fortune Systems is one company that clearly suffered from a wrong choice of distribution channel. The company originally concentrated on pushing its 68000-based, Unix system-running desktops through retail, partly because the company wanted the better margins, and partly because it failed to sign up any high volume OEMs.

While the situation was complicated by a series of unfortunate technical problems, it is probably fair to say that the machine was basically unsuited for retail. The price was too high (Fortune never delivered the floppy-based, $5000 system it promised originally); the type of customer drawn to the stores wasn't interested in multiuser capability; and the store personnel found it hard to understand the Unix system.

Fortune later officially abandoned the retail channel altogether (by that time, only 'problem accounts' carried the product anyway). Today, about 15 percent of Fortune's output goes through VAR's and distributors; 45 percent to large corporate accounts; and 40 percent to international large accounts and OEM's. Fortune reckons it has about 40-45,000 units installed, with a ratio of about 1:3 CPU's to intelligent terminals.

On the other hand, Tandy has been reasonably successful in moving its 68000-based, Xenix-running desktop (Models 16, 16B, and now 6000) through its own extensive Computer Centers retail outlets. This has been possible for two reasons. First, the Tandy product, which supports a maximum of three users (one on the main system and two attached via dumb terminals), has always been priced beginning below $10,000. Secondly, Tandy owns most of its computer stores; shelf space for the product can be mandated, whereas in independent chains and stores, virtually all such space has been taken since the personal computer boom that followed the introduction of the IBM PC in late 1981.

NEWS SUMMARY

When supermicros began to hit the market in 1981-1982, their prospects seemed unlimited. Based on advanced microprocessors—the Intel 8086, Motorola 68000, and Zilog 8000—the supermicros appeared headed for success as they challenged traditional minis and superminis with equal or superior performance at 1/2 to 1/5 the price.

Other reasons for Tandy's relative success include the fact that Tandy's stores provide post-sales service and support. Also, Tandy's Radio Shack chain logo was an established, recognized entity, while other now-familiar computer retail chains were then just beginning to get national recognition.

Tandy does not release installed base figures; this author now estimates that since the product was introduced in January, 1982 through December, 1984, Tandy sold a grand total of about 50,000 units. Assuming an average of 300 carrying stores (Tandy had about 225 Computer Centers in early 1982 and has since doubled them), this translates to about 55 units per store per year-not bad, but hardly a smashing success.

It's interesting to note that whereas Fortune now derives nearly half of its revenues from large corporate accounts, Tandy's 1982 attempt to establish a direct large account program appears to have fizzled badly. This may have been due partly to the consumer-oriented connotation of the Radio Shack name, even though Tandy Corp. studiously avoided that term in its large account work, used the Tandy Corp. name exclusively, and even painted the corporate equipment a more business like ivory.

Convergent Technologies is the only supermicro supplier that has succeeded in moving its product through large-volume OEM channels (Burroughs, NCR). In fact, CT has been so successful in recruiting large OEMs as to preclude other supermicros from reaching this channel. This may be changing now, as Sperry Corp. mounts a major Unix system thrust using gear from NCR, Arete, and Computer Consoles.

CT owed its initial success to several factors. It was one of the early 8086/8088-based supermicro suppliers. Its product concept—a network of powerful, individual workstations sharing disk and gate-

way functions at a "master" station—is now model which several LAN suppliers are adopting. It willingly gave OEMs both equity stakes in itself and manufacturing licenses (Burroughs for one has exercised this license, and is manufacturing CT gear in the U.S. with plans underway for manufacturing in mainland China). Finally, it offered extremely attractive OEM pricing. Over the past year or so, it became evident that prices on the NGEN line were set so low that CT was actually losing money on every unit shipped of some models.

Other OEM channels for supermicros have since opened up. In particular, as noted earlier, Sperry has launched a major Unix system-based effort. Nixdorf appears to be the next major computer manufacturer planning a Unix system thrust based in part on supermicros acquired from independent suppliers.

With the OEM channel being monopolized by CT on the one hand, and the retail channel proving itself unequal to the task on the other, supermicro makers had to turn to small VARs as their main outlet.

The key problems with the VAR channel are corporate credibility and service and support. These supermicro VARs are typically even less well-capitalized than mini and supermini resellers. They generally have only a short operating history, and hence are unable to command confidence. Furthermore, as discussed below, they are often unable or unwilling to provide comprehensive service and post-sales support. In addition, they have to deal with the problem of supporting direct sales efforts on systems which, even after adding premiums for vertical software, are too low in price.

Probably the most promising solution is the Businessland-type retail chain. Unlike other computer retailers, this chain specializes in business selling, both in-store and via direct sales operations. Key to the differentiation is the emphasis placed on pre- and post-sales support and service. A number of such chains are now developing; as they gain competence with larger systems, and as they gain national name recognition, they could become a key channel for

distributing supermicros to small businesses.

Service and Support. Industry experience up to now has shown that users were willing to pay about 10 percent of the total if-bought value of a computer system for a one-year, M-F, 8-5 maintenance contract. This allowed for reasonable margins in mainframes ($250,000 and above), but became economically questionable with minis, and absolutely unprofitable with supermicros (where typical base hardware prices range over $15-20,000, and total end-user price with vertical software is roughly $35-50,000). It is just not possible to support onsite, quick response service at 10 percent of such low prices.

Furthermore, most small VARs upon which supermicro vendors came to rely were barely able to offer meaningful maintenance on their own vertical software packages; they were unable or unwilling to underwrite the investment required to establish a competent hardware service organization.

Supermicro vendors were therefore forced to assume responsibility for basic hardware and software maintenance, without being able to charge appropriate fees to the end user nor trim discount schedules to their VARs proportionately. This is one of the key reasons why most supermicro suppliers are not profitable today.

It has now become obvious that new support strategies are required for equipment in the supermicro price range. The best model for this strategy could be derived from the small copier business, where a significant number of local resellers are offering effective on-site service at reasonable ratios to the selling price. One key factor in making this possible is simplicity of maintenance: easily understandable illustrated indicators pinpoint the great majority of common problems (jams, out-of-toner, etc.) which office workers with minimal or no specific training can then fix.

One company that is experimenting with new service strategies is Parallel Computers of Santa Cruz, Calif. Parallel sells a 68000-based, Unix system-running supermicro that has a number of fault-tolerant features, including a dual-processor CPU. While the fault-tolerant aspect strengthens the story, it isn't a mandatory element.

The key element in the service story is "labor free" maintenance—a design so simple and so effective in self-diagnosis as to allow office workers in the user's organization to fix, without tools, virtually any anticipated problem by replacing such components as printed circuit boards, disk drives, and power supplies. Needed parts can be ordered via a hot-line for next-day delivery using Federal Express.

New Competition. Generic supermicros are also encountering increasing competition from two new developments. One is the proliferation of locally networked personal computers, a configuration which is being perceived by many organizations as an alternative to a multi-user supermicro (see UNIX/WORLD May 1985).

The other competitor is the proprietary supermicro, i.e., a system priced on par with generic supermicros, but which implements a specific vendor's minicomputer architecture and typically supports a proprietary operating system. Some recent prime examples include the DEC microVAX II, the AT&T 3B2, 3B5, and 3B15 lines (especially notable since they run Unix, of course!), and the IBM System/36 PC.

Proprietary supermicros are especially effective in convincing existing VARs and VADs to stick to their current hardware supplier. Not only is the architecture and the operating software already familiar, but also much of the substantial available base of cross-industry and vertical software can often be used "as is." These advantages, combined with the comfort of doing business along already familiar administrative patterns with a known—safe supplier—are depriving the generic supermicro suppliers from recruiting some of the best resellers in the industry today.

On a $60,000 basic configuration, Parallel charges $9000 for a five-year warranty, which supports the next-day parts shipment. Note that this very low three percent per year of the list price is made possible only by employing the "labor free" maintenance concept. IBM has been moving in this direction for a number of years now, establishing hot-line support centers for most of its product lines, and relying more and more on "customer set up" and self-maintenance.

The Unix System Connection. With a few exceptions, most supermicro suppliers chose some dialect of the Unix system as their operating system. They did so not because of any specially-attractive features in the software, but mainly for economic reasons: it was infinitely cheaper to use the Unix system than to develop a proprietary system. AT&T sold source licenses to the Unix system at about $40,000; the additional porting effort, in-house or farmed out, added perhaps another $100,000 and 6-12 months. Developing a proprietary system would, in most cases, have taken two to five times as long and possibly have cost ten times more.

Thus the Unix system became a classic "push" case, with manufacturers and VARs trying to entice users with promises of eventual availability of a large selection of software as well as with "portability" arguments. Both promises are taking much longer to become a reality, although clearly much more Unix system-based software is available today.

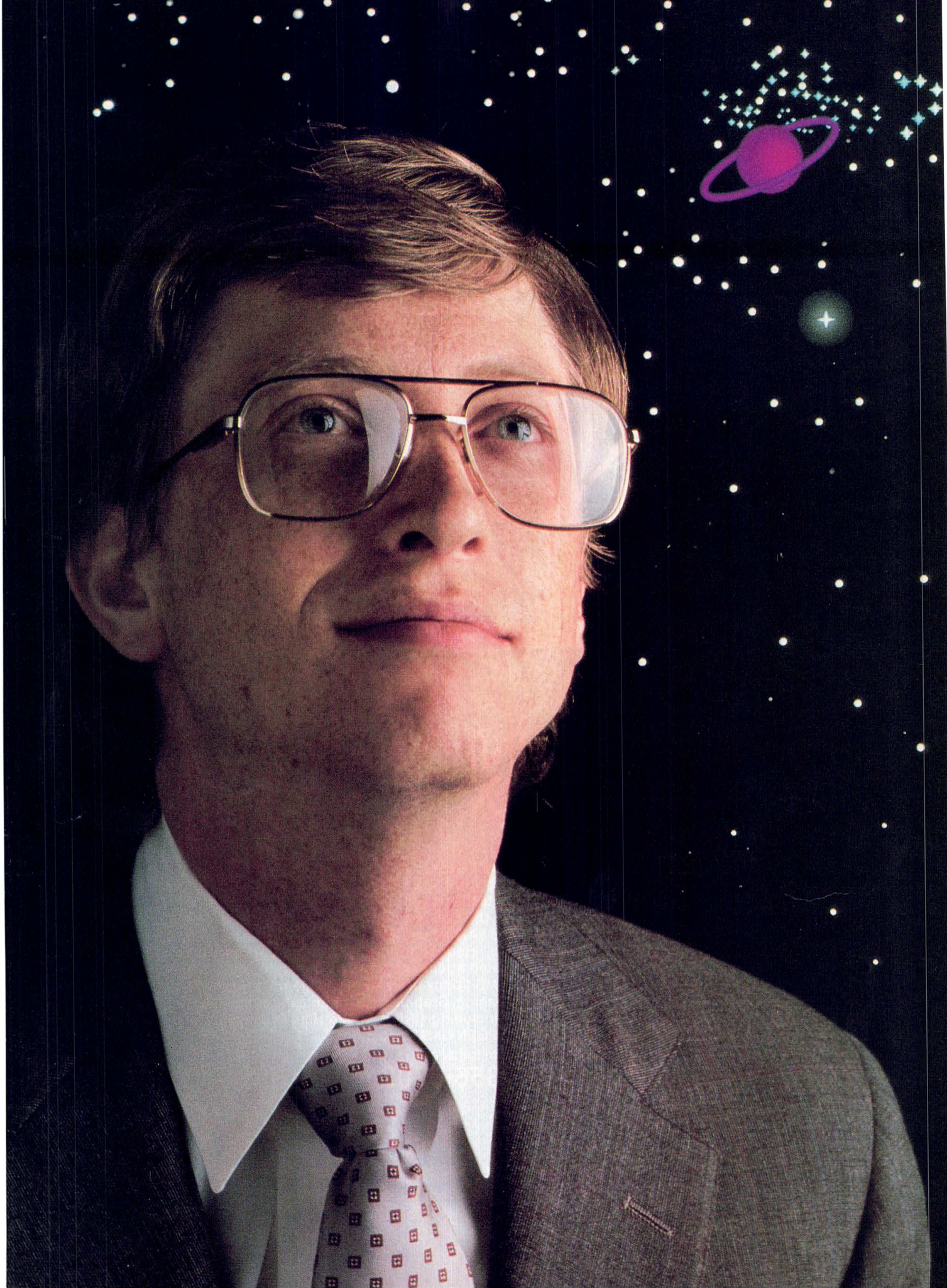
The wide variety of incompat-

ible Unix system versions still cripples portability. Besides, the level of portability offered by the Unix system is just at the high-level language layer, and is only slightly better than that already available with FORTRAN or COBOL. Thus the Unix system contributed nothing to the promotion of supermicros. On the contrary: the key component of the apparent "success" of the Unix system is the number of supermicro vendors using it.

In the longer term, the reliance on the Unix system creates an insidious problem for the supermicro suppliers. The problem has two aspects. First, if indeed a standard Unix system emerges (which will almost certainly be based on AT&T's System V with Xenix and 4.2BSD features thrown in), then the market for Unix system-based machines will become a classic commodity market. In such a market, brand recognition is the key differentiation tool. Most supermicro vendors lack the resources to undertake the promotional campaigns needed to establish such recognition.

One supplier with the necessary deep pockets is AT&T, which is the other part of the problem. AT&T, which controls the Unix system, would like to see all hardware manufacturers adopting the system; while at the same time, AT&T intends to compete with them head-on for the hardware business. This presents a no-win situation for the small fry. The only suppliers who can afford to stay in the Unix system game with AT&T are the likes of IBM, Sperry, HP, Nixdorf, and similar established companies. That is probably just fine with AT&T. It doesn't care a hoot what happens to the likes of Altos, Fortune, Plexus, and their ilk. □

Omri Serlin heads ITOM International Co., a research and consulting firm in Los Altos, Calif. He writes the Supermicro *and* FT Systems newsletters, *which analyze technical and business developments in the computer industry, in which he has been involved since 1962.*



THEME

THE FUTURE OF XENIX

BY BILL GATES

XENIX may well set the program standard for Unix systems. Microsoft's Bill Gates explains the possibilities.

Since the introduction of the IBM PC, the microcomputer industry has learned several valuable lessons, the most important of which is this: To achieve a high level of success in the microcomputer market, a single binary program standard must be established.

A binary program standard means that a single version of an application product can be developed, distributed, and maintained that will run on a variety of different computers. The establishment of a source level program standard is significantly less important in order to achieve success in the microcomputer market. Since 1983, Microsoft has committed all XENIX development resources to establish a version of the system that we believe will set a binary program standard for Unix systems. This version, developed for Intel's 286 microprocessor, has been licensed by many manufacturers and is sold today on some of the most popular microcomputer systems, including the IBM PC-AT.

To set a binary program standard similar to MS-DOS in the personal computer market, XENIX must achieve what we call "critical mass." This may be defined as a

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market situation where there are enough software manufacturers developing applications for XENIX that end-users will demand to buy XENIX-based applications that work on it. This in turn will lead to greater volume, which will fuel greater development activity.

A good example of a program that has achieved critical mass by setting a binary standard is the MS-DOS operating system. Today, more people do DOS-type development than any other operating system, including systems like MVS or VM.

UNDERSTANDING COMPATIBILITY

It's important to realize that you can't compare operating systems based on pure technical merit. An operating system is, after all, a foundation that facilitates certain standards and provides access to the hardware. The ideal operating system allows hardware to evolve and improve without impacting the significant investments made in application software. Hardware changes that require applications to be rewritten stand little chance of being successful unless they improve the product by at least an order of magnitude.

> **"The ideal operating system allows hardware to evolve and improve without impacting . . . application software."**

A good operating system insulates the application software from the specifics of the hardware and permits hardware evolution without software obsolescence. That is, it should offer *compatibility* to software developers and end-users alike. To the software developer, compatibility offers the benefit of a larger market; to the end-user, it offers a more risk-free purchase.

There are a number of ways to assess compatibility—they run the gamut from forcing users to have totally identical machines to a very loose source-level standard. Clouding the issue of Unix system compatibility is the sheer number of different types of the Unix operating system. In fact, there are probably more forms of the Unix operating system than any other. And yet trying to distinguish between these forms, to derive the benefits from any similarities that may exist, is often a difficult task.

THE LIMIT OF SOURCE-CODE COMPATIBILITY

One level of compatibility is some form of source-code compatibility. Here, multiple processor architectures are a consideration. Although there may not be very many architectures, there's certain to be more than one. Being able to move one version of the source code between them is beneficial but not so significant that it determines the overall success of an operating system. Actually, source-level compatibility only benefits the software developer, and the actual development cost of a package is a minor factor in ensuring the success of that package.

Having many different binary forms means greater effort on the part of the manufacturer: If the manufacturer has to produce several different versions, each step in the production process must be repeated for each version. This includes getting each version out in the distribution channel, updating it, putting it on different media, and verifying it when any changes are made. Thus, with the exception of the original programming effort, as much time and effort is involved as if

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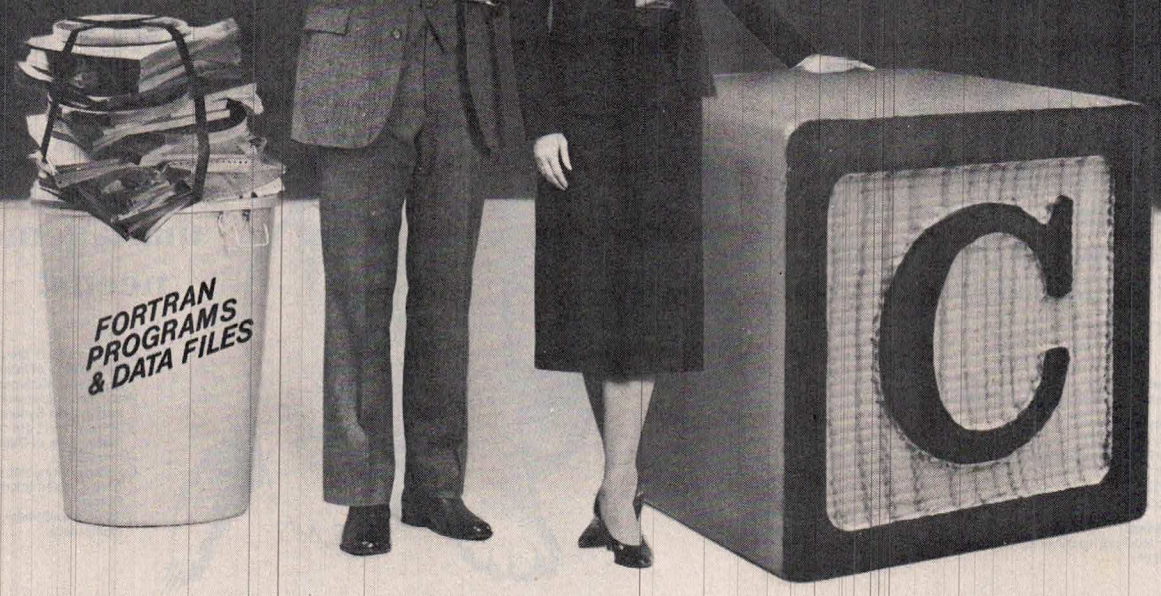

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several different applications were being produced.

In addition, a user cannot be expected to walk into a dealer and find a piece of source code with instructions that say "The first thing to do is compile this code."

Moreover, when people discuss source level compatibility, they generally ignore the difficulties of porting applications. Factors like the syntax of the `open` command or whether the file name has eight or nine characters are trivial. Instead, the variety of matrix printers, the many types of cut-sheet feeders, the different keyboards with keys in various positions, and the diverse international character sets are among the difficult factors to be dealt with. Here's where costs really increase, especially in terms of training support personnel, knowing how to respond to the many configurations, and creating the libraries of drivers. Operating system calls have little effect here.

As far as source-level transportability goes, considerable benefit can be drawn from a very strict definition of high-level languages. Efforts of the ANSI committee to clearly define the language will go a long way toward helping lower software development costs.

ACHIEVING CRITICAL MASS

According to the market presentation we have today, Unix systems do not have a large enough installed base to create a critical mass, and software vendors are not making large enough profits in the Unix system market.

The projections, however, for Unix/XENIX system shipments are quite large. Most companies that are concentrating on Unix system development assumed that the Unix system market would be large already. Their goal is to make their companies large, successful, and profitable; but Unix system-only software companies are rarely over $2–3 million dollars in size.

The installed base that would fulfill the ambitious goal of Unix system software companies would have to be amazingly large. A five million dollar company would have to sell 20,000 packages a year at $500 each. This assumes the company is selling through channels where there is a fifty percent discount (a typical percentage) between the company and the end-user. It is impossible to sell that volume directly to end-users, and to date no company has accomplished this.

> "The true measurement of an operating system's success is the variety of quality applications that run on top of it."

In fact, penetration of any individual software package is very low. Beside the few atypical cases like MS-DOS, Lotus 1-2-3, or Flight Simulator, most companies fall below a ten percent penetration. Moreover, there are many packages that have only a one to two percent penetration and are considered quite successful.

Achieving critical mass for XENIX is going to take more effort than merely declaring a market size that we wish to achieve, e.g., 400,000 systems. This is particularly true in an environment where venture capitalists are becoming more reluctant to fund software companies.

In the next 18 months, there is a good chance that XENIX system installations will be able to surpass the 400,000 system mark and achieve critical mass. There are a number of reasons for this optimism.

One significant factor is that IBM has announced XENIX as the multi-user operating system for the IBM

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PC-AT. This version of XENIX is available for $995 and includes a run-time system, software development tools, and a text processing system.

Another important step in achieving critical mass is to convince software developers of the benefits of getting behind the standard early in the game.

As we've seen in the DOS marketplace, developers who come in early and make serious investments are the ones who will be most rewarded after critical mass is achieved. The newer applications have a tough time achieving market share. One reason for this is that users feel more comfortable with a familiar product. They may even go so far as to use it for purposes for which it wasn't intended. Thus, you find users using their spreadsheets for databases or project scheduling tools rather than buy another application dedicated to the new task.

The agreement between Microsoft and AT&T for a precise methodology to fully verify XENIX as a Unix System V product is also an important step toward obtaining critical mass. Achieving this verification while maintaining 100 percent binary compatibility with the current release will ensure upward compatibility for existing XENIX applications.

SYSTEM V VERIFICATION OF XENIX

AT&T has published a detailed specification of the components of a Unix system called the *System V Interface Definition*. The primary purpose of this specification is to provide a rigorous definition of the Unix system for application software developers and end-users. Based on the specification, AT&T will complete verification for Unix system-derived products that it does not own, or certification for Unix system-based products owned by AT&T.

Verification consists of a comprehensive set of tests that check a Unix system for functional adherence to the System V Interface Definition. The areas tested include the system call interface, the library interface, the C compiler, and the commands in the base category that are essential to running the system.

At the same time, AT&T will be applying stringent tests to certify its own Unix system-based products. These tests include comparisons of source code of the product with the Unix system baseline. To be certified, all hardware-dependent function differences must be justified.

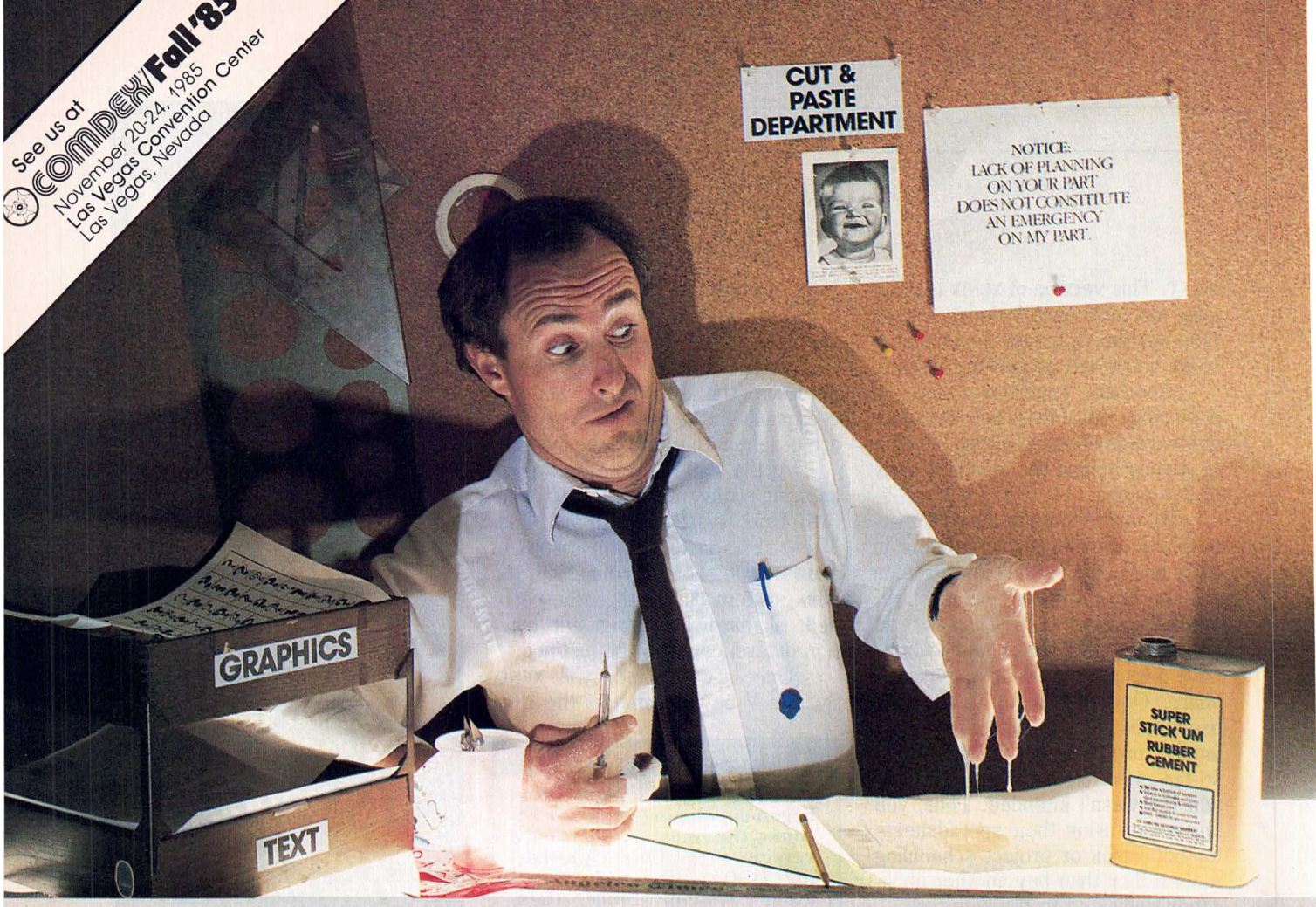
Once it's verified, will XENIX System V be the same as the Unix

A HISTORY LESSON

In mid-1980, Microsoft Corp. began developing what has become the most widely used version of the Unix Timesharing System—the XENIX Operating System. Since then, XENIX has been implemented on many different microcomputers and sold by major microcomputer suppliers, including IBM and Tandy Corp. Today, there are well over 100,000 XENIX systems in the marketplace.

Microsoft's original objective in developing XENIX was to provide a strong operating system foundation for the new generation of 16-bit microprocessors. That foundation would become the base for new Microsoft language and application products. More importantly, the operating system implemented on each 16-bit microprocessor would provide compatible facilities, thus reducing the cost of porting products between different microcomputers running XENIX. To achieve this, XENIX had to establish a source level program standard across different microcomputer architectures.

Significantly, at the time the XENIX project was started, the IBM Personal Computer had not been announced, and market dominance of Microsoft's MS-DOS operating system and Intel's 8086 chips had not yet been established.



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system? In some ways it will, but there will be important differences. Most significantly, XENIX will provide a very strong binary program standard whilst Unix System V will provide source code portability across different processor architectures. It's therefore likely that XENIX will be the first target system for software developers to develop their application products.

XENIX VERSUS MS-DOS

There are several significant reasons for choosing the XENIX operating system instead of MS-DOS.

First of all, the 286 architecture is a consideration. The processor has two modes: a real mode and a protected mode. The real mode is binary compatible with the 8086, while the protected address mode provides extended address features for up to 16 Mbytes of address space. The protected mode is not binary compatible with the real mode; thus, applications cannot take advantage of extended addresses (i.e., more memory) without a new operating system.

Because of the allocation of address space in the IBM PC, only a maximum of 640K bytes of RAM is allowed. In order to take advantage of a 286-type machine and have large data structures (like the more exciting applications), it's necessary to use the XENIX OS to avoid the 640K byte limitation.

Other XENIX advantages include its multitasking capabilities and especially multiuser capability. Multiuser capability will *never* be a feature of MS-DOS, because by the time it could be achieved, the single-user network approach will be just as effective.

XENIX AND PC-AT CLASS COMPUTERS

It's important to understand that the AT class of microcomputer is really only the first of what will be a whole new generation of personal computers that are effective for executing a Unix system-like operating system. Putting the Unix system on an 8088-based PC still results in a single-user machine. This type of system is available from Microsoft, but in terms of matching the hardware and being appropriate for a broad class of applications, the AT is one of the first computers available through retail channels offering multiuser capabilities.

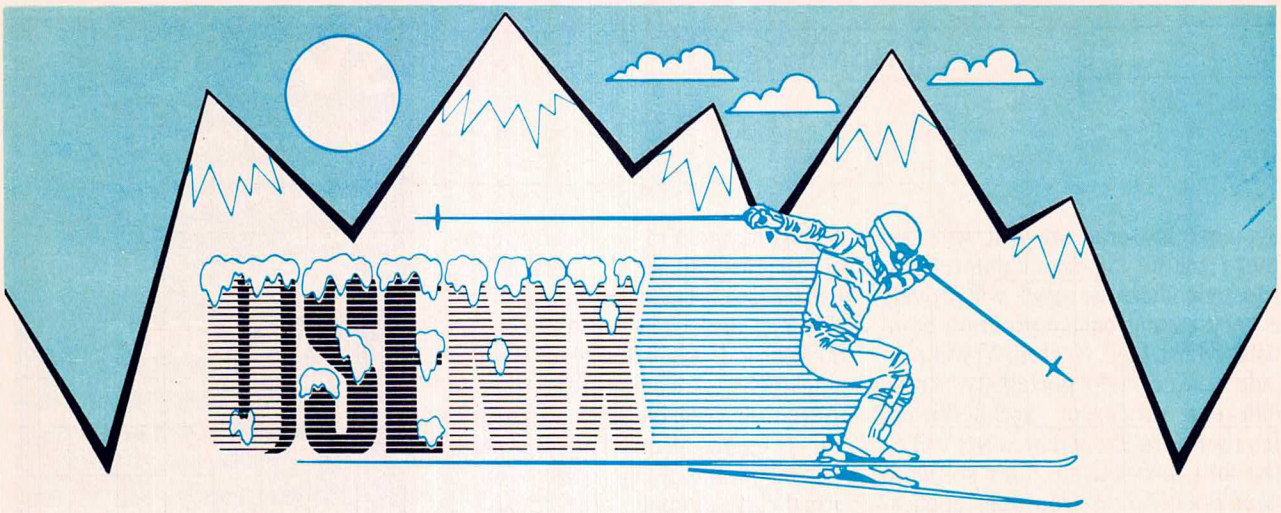
In addition, because the 286 has memory management on chip, a standard environment has been defined for application programs. So each version of XENIX on each 286 machine will run the same applications programs. This eliminates the problem of trying to exchange binary programs within one CPU class.

The 20-Mbyte hard disk is about the minimum size that is necessary for a run-time system and decently-sized database. Although 10 Mbytes will suffice, it is barely adequate. Likewise, the AT's 10.2-Mbyte floppies are a distinct advantage. A basic distribution of a Unix system-like operating system on 360K-byte floppies would require at least 12 diskettes—an intimidating thought for prospective end-users.

ADVANCES IN USER INTERFACES

An effective operating system should be a strong but silent foundation for the computer system. By strong, we mean it should be rich in function. By silent, we mean it should be transparent.

Microsoft believes that the XENIX operating system should provide all the functions that a sophisticated user interface would require. At the same time, we believe the operating system must not be bound to a particular environment, such as restricting the operating system to only those systems having high-resolution graphics capabilities.



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The 1986 Winter USENIX Conference will consist of workshop-oriented technical sessions in three topic areas:

WINDOW ENVIRONMENTS AND UNIX
WEDNESDAY, JANUARY 15, 1986
A thorough exploration of the design and integration of UNIX-based window systems and their applications.

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THURSDAY, JANUARY 16, 1986
An analysis of issues raised by the implementation and operation of UNIX on very large, powerful mainframes, including those with multiple processors.

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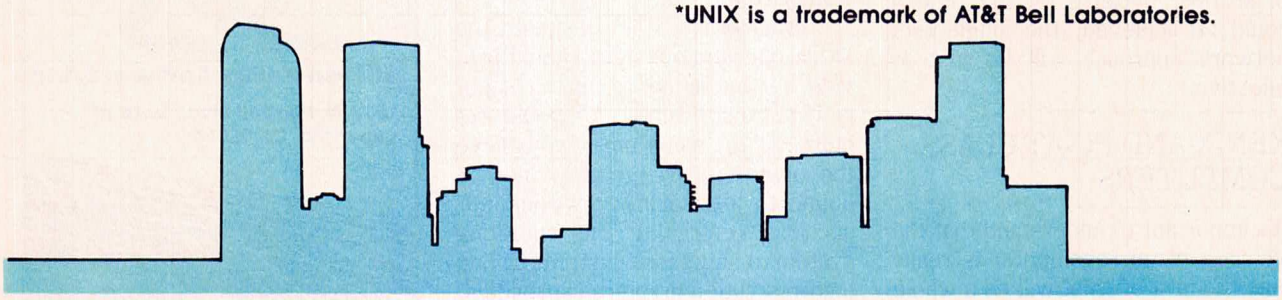

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Instead, Microsoft intends to have XENIX provide all the functions necessary to support a windowing environment (or indeed any other environment). That is, XENIX will provide a rich set of functionality that will allow software developers to build environments to sit on top of XENIX. In this way, the end-user will be able to choose the environment that best suits his or her application and hardware.

WHATS AHEAD FOR XENIX

Today, a certain degree of compatibility already exists between XENIX and MS-DOS. After all, both operating systems were developed by Microsoft and can co-exist on the same disk on 286-based machines. Still, they are separate products that address different markets: DOS addresses the single-user workstation market while XENIX addresses the multiuser, small business system market. Although there will be more areas of compatibility in the future, Microsoft does not intend to merge them into one OS.

However, more areas of compatibility are planned. For example, certain common utilities and concepts based on XENIX design concepts have been added to DOS 2.0 and 3.0. These include the `sort` and `more` utilities, pipes, I/O redirection, and device-independent I/O. Hierarchical file systems have also been added to DOS 2.0 and 3.0. Conversely, MS-DOS cross-development tools and subroutine libraries were added to XENIX System III to facilitate development for a DOS target environment.

In addition, existing disk utilities allow file exchange between MS-DOS and XENIX file systems, including a directory command, copy command, make directory command, and remove file command.

The introduction of XENIX System V will open up several important new areas of compatibility. For example, the standard Microsoft

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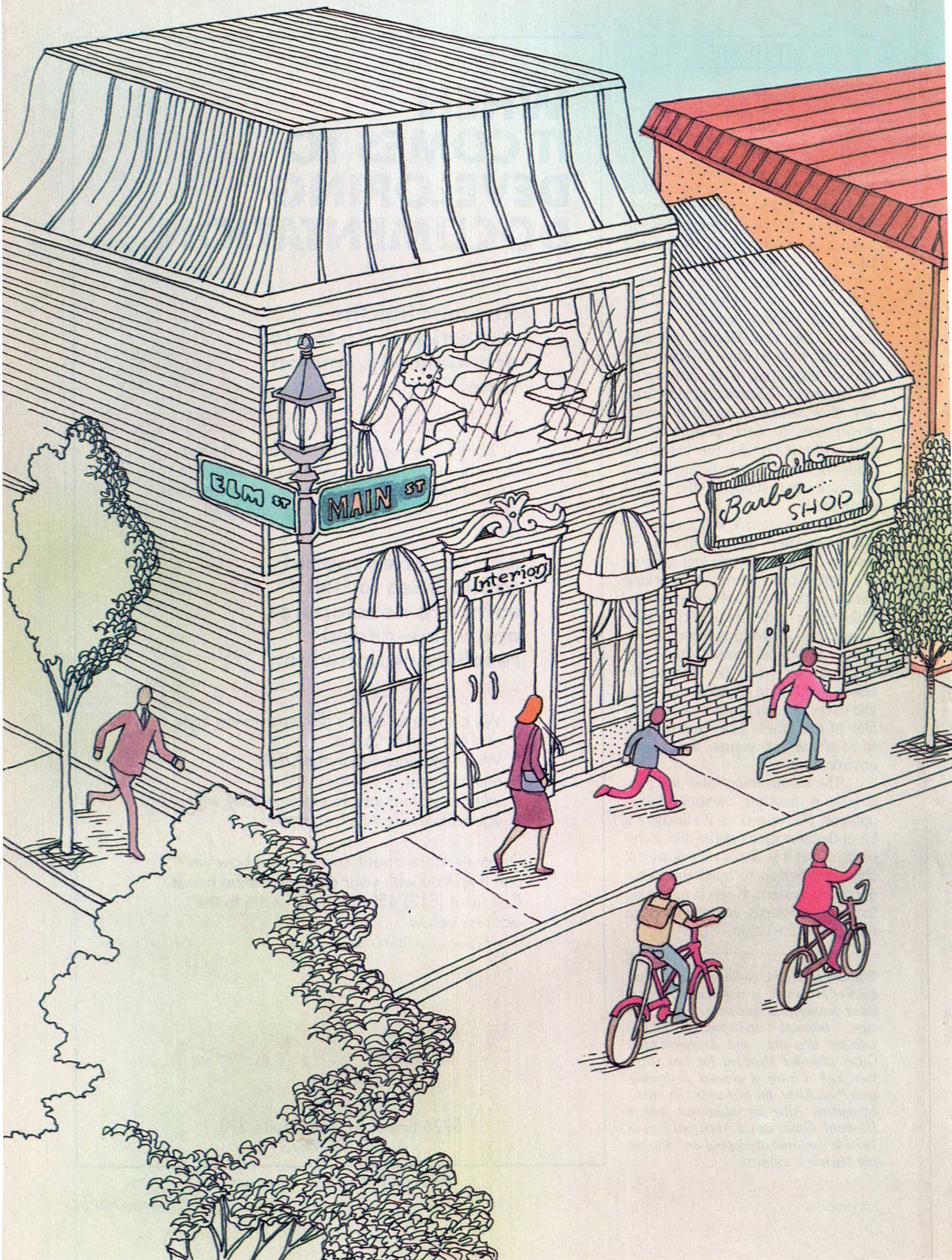
family of languages including COBOL, Pascal, FORTRAN, C, the BASIC interpreter, and the Macroassembler will each be available as compatible implementations for both XENIX and MS-DOS.

Another new feature of XENIX System V was first introduced for DOS 2.0. Called loadable device drivers, this new feature will support the wide variety of hardware options expected to be introduced for the PC-AT. Loadable device drivers allow users to install a device driver for a new peripheral at system start-up. As the computer loads the OS, it automatically installs software that supports the added peripheral.

XENIX System V will also be offering another major advance in MS-DOS capability in the last quarter of 1985—transparent networking between XENIX and MS-DOS systems. This will provide users with a fully compatible networking interface for XENIX and DOS. XENIX and DOS machines will then be able to be linked within one physical network, and users of each system can access files of the other. They will be able to execute programs across OS environments.

The forthcoming Intel 386 processor is another exciting development. Not only does it eliminate a lot of the limitations of the 286 architecture, but it is also a very powerful chip upon which to build the XENIX operating system. Keep in mind also that it is upwards compatible from the current 286 chip. □

William H. Gates, co-founder and chairman of Microsoft, is responsible for technical development, including product design, internal development, outside software licensing, and documentation. Gates attended Harvard for two years, then took a leave of absence to develop, with Paul Allen, the first BASIC for microcomputers. After an additional year at Harvard, Gates joined Allen full time in 1976 to continue developing and marketing Microsoft software.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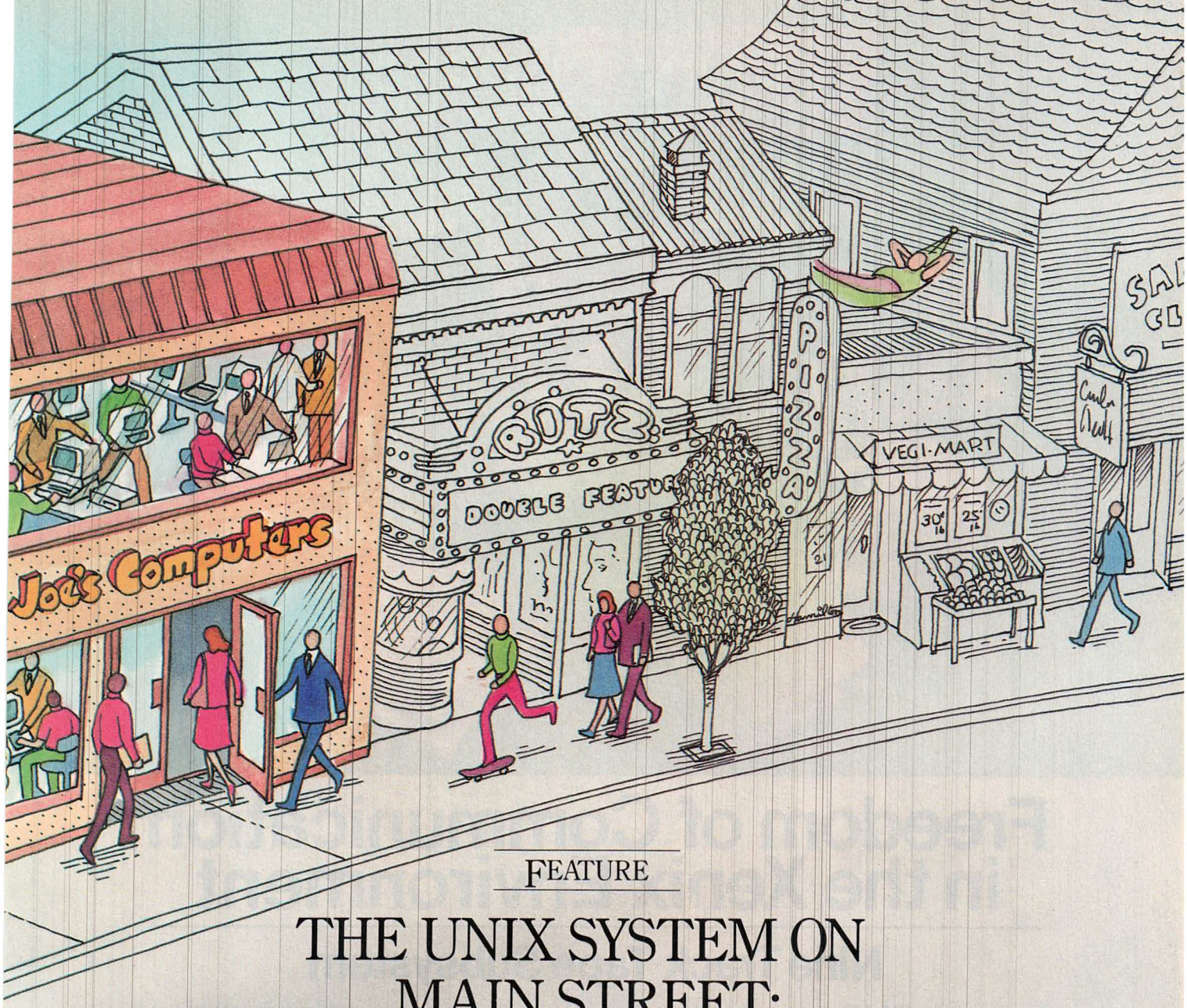

FEATURE

THE UNIX SYSTEM ON MAIN STREET: IS IT RETAILABLE?

The results of our poll of computer retailers will probably surprise you.

BY ROD TURNER

Flushed with success and hungry for new markets, survivors of the PC bloodbath are eyeing the market for Unix system-based hardware and software products. Only time will tell if the Unix system market is indeed the next wave beyond PCs. Meanwhile, computer retailers, an important distribution channel that contributed to the personal computer's overwhelming success, are toying with selling Unix system-based multiuser computers in their stores. Many vendors believe that these retailers will be a key ingredient in the success or failure of the Unix system in mass markets, yet little has actually been known about how retailers perceive the Unix system—until now, that is.

With the research assistance of Bob Novick of Impulse Research in Los Angeles, I set out to poll computer retailers for their views of the Unix system and its chances for success in the retail market.

In order to assess whether the Unix system and Unix-based applications are retailable, we must first agree on the definition of a retailer. Many categories of retailers exist, ranging from

Illustrations: Marcus Hamilton

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Fortune 1000 full-service dealers that have a retail storefront only to satisfy their suppliers to small "Mom and Pop" independents and even to mass merchandisers. For the purposes of this research, we focused our attention on the following three categories of computer specialty stores:

(one) Large retail chains having nationwide outlets, such as ComputerLand, Businessland, or Entre.

(two) Small, tightly controlled retail chains ranging in size from 2 to 50 stores.

(three) Independent retailers and software-only stores.

Of the dealers surveyed, 61 percent currently sell multiuser systems, and 80 percent currently sell networking systems. Fifty percent of the stores surveyed employ fewer than six people.

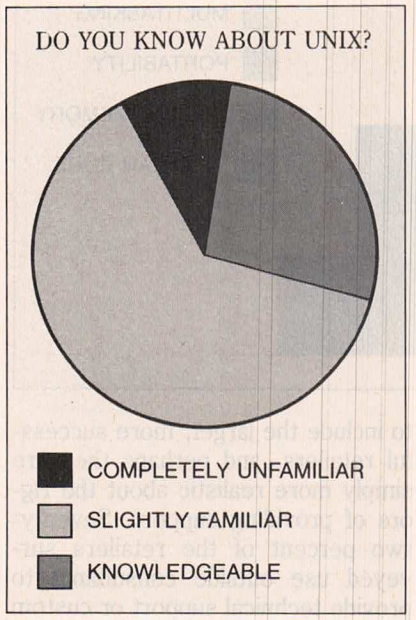
RETAIL AWARENESS

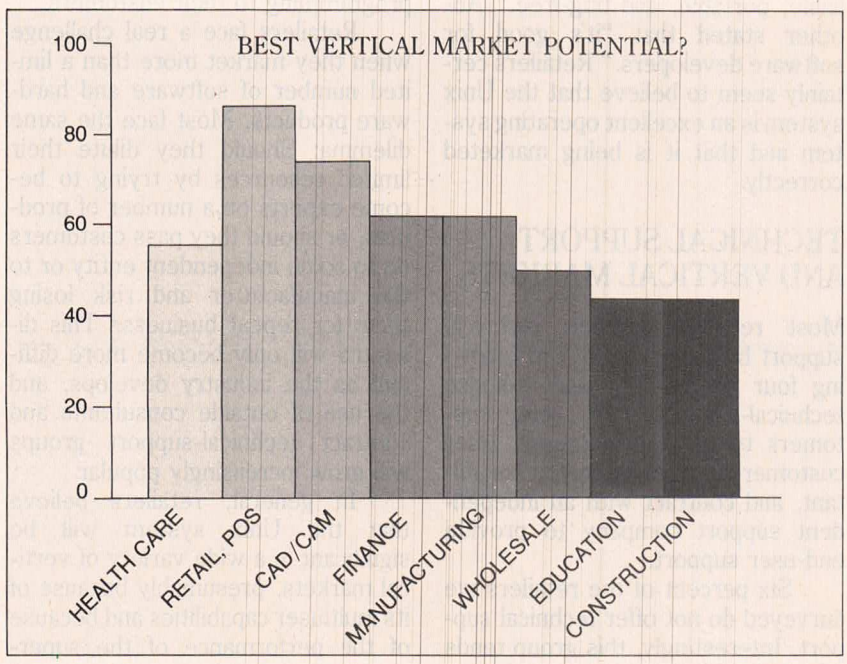
Interestingly, almost all retailers (89 percent) are aware of the Unix system and know something about it. A majority of these retailers learned about the Unix system from an article in a trade magazine (50 percent), while only 6 percent said they first became aware of the Unix system through an advertisement.

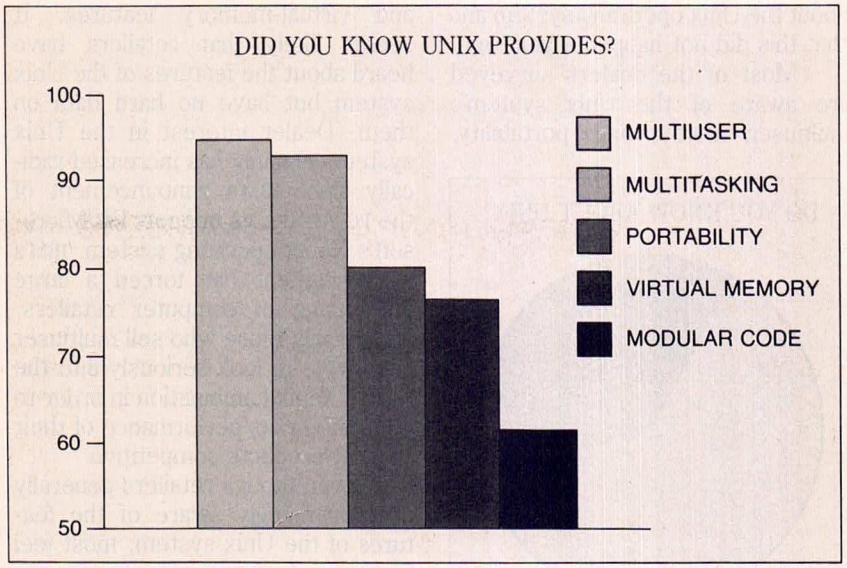
The Unix system has been around for some time, and there has been a fair amount of speculation about the significance of the Unix system to the microcomputer industry, speculation that has increased over the past two years. Although AT&T has significantly stepped up its marketing of the Unix system over the last 12 months, it appears that AT&T's advertising is increasing awareness only in the end-user community. In fact, one-third of retailers surveyed said that end-users are now walking into their stores asking about the Unix operating system and that this did not happen a year ago.

Most of the dealers surveyed are aware of the Unix system's multiuser, multitasking, portability, and virtual-memory features. It seems likely that retailers have heard about the features of the Unix system but have no hard data on them. Dealer interest in the Unix system certainly has increased radically since IBM's announcement of the PC/AT and its support for Microsoft's Xenix operating system. IBM's announcement has forced a large percentage of computer retailers, particularly those who sell multiuser hardware, to look seriously into the PC/AT/Xenix combination in order to keep the price/performance of their current products competitive.

Even though retailers generally are surprisingly aware of the features of the Unix system, most feel that these features are not unique to the Unix system and that other operating systems offer the same capabilities. The retailers made several positive comments about the Unix system, however, including "It will be the next big thing, next to MS-DOS."







Fifty-three percent of retailers that are knowledgeable about the Unix system rate it as very good, while 92 percent of retailers that are only familiar with the Unix system rate it as good, very good, or excellent. One dealer said that "it's reliable, portable, and bug-free." Another stated that "it's good for software developers." Retailers certainly seem to believe that the Unix system is an excellent operating system and that it is being marketed correctly.

TECHNICAL SUPPORT AND VERTICAL MARKETS

Most retailers provide technical support by using one of the following four approaches: use in-house technical-support staff, refer customers to the manufacturer, refer customers to an independent consultant, and contract with an independent support company to provide end-user support.

Six percent of the retailers we surveyed do not offer technical support. Interestingly, this group tends to include the larger, more successful retailers, and perhaps they are simply more realistic about the rigors of providing support. Seventy-two percent of the retailers surveyed use outside consultants to provide technical support or custom programming to their customers.

Retailers face a real challenge when they market more than a limited number of software and hardware products. Most face the same dilemma: Should they dilute their limited resources by trying to become experts on a number of products, or should they pass customers on to some independent entity or to the manufacturer and risk losing them for repeat business? This dilemma will only become more difficult as the industry develops, and the use of outside consultants and contract technical-support groups will grow increasingly popular.

In general, retailers believe that the Unix system will be significant in a wide variety of vertical markets, presumably because of its multiuser capabilities and because of the performance of the supermicrocomputers on which the Unix system is usually sold today. High-performance hardware has traditionally been the domain of mainframe and minicomputer systems. Now, though, the advent of supermicrocomputer technology combined with the Unix system has made it practical for these machines to displace minicomputer sales to both new and established vertical markets.

When asked in which vertical markets the Unix system would play a major role, retailers picked the following areas: retail point of sale, CAD/CAM, finance, and manufacturing control.

A LIST OF DEMANDS

Despite retailers' generally favorable impressions of the Unix system, they have a list of demands that they said would make it truly palatable in retail markets. These include the following:

Unbundling. No retail purchasers in their right minds are going to buy the Unix system at retail when they need six feet of shelf space for the manuals and when it takes three hours to load the software onto their hard disks. Retailers said the Unix system must be unbundled so that end-users can purchase the components they really need to run their programs separately from the rest.

Along with this approach, the Unix system must be packaged to conform with PC industry standards and documented so that the manual is easy to use and understand. Unbundling allows a manageable Unix system product, while simplified documentation would help it assume a proud role on retailers' shelves.

A standard version. A great deal of discussion about the standardization of the Unix system has

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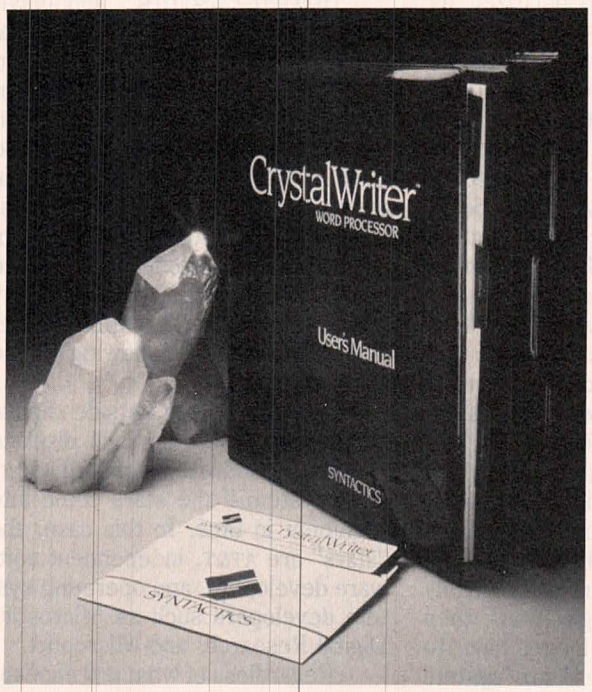

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been taking place. Retailers have more fundamental and practical concerns about standardization, however. They require that Unix system applications be object code compatible and use a consistent disk format between various machines. This, for the first time, would allow application software vendors to develop and sell software to retailers safe in the knowledge that the software can be used simply in any one of a variety of machines. To date, some versions of the Unix system running on different machines have been source code compatible, but this is of no use to retailers. Remember, retailers cannot recompile a program with customers breathing down their necks. Also, the source code to the Bell Unix system itself is very expensive—costing more than $40,000.

The Intel 286 microprocessor may make standardization of the Unix system a distinct possibility. First, the 286 has an on-chip memory management unit (MMU) that prevents individual manufacturers from developing proprietary MMUs, therefore making object-code compatibility between 286-based microcomputers relatively straightforward. Second, IBM has "blessed" the 286 by incorporating it into the PC/AT, leading a series of manufacturers to develop PC/AT-compatible machines that will, by definition, use the same disk format, operating system options, and so on.

Application software. Once the standardization referred to above has been achieved, the relatively large number of Unix system programs that currently have been developed or that are under development will be available in that standard format. Enough software has probably been written for the Unix system today to support it at retail, provided that all the software can be standardized into one format and package.

"Friendly" user interface. Retailers said that a single, standard user-friendly operating system shell should be built for the Unix system. This user interface must be state of the art by personal computer standards, which means that it must support windowing, icon graphics, and the desk metaphor popularized by the Apple Macintosh. Existing PC technology could be used—that is, GEM from Digital Research, TopView from IBM, or the new AT&T user interface for the 7300 machine.

Everything end-users need to do must be possible within the desktop metaphor, but programmers will need access to the Unix system directly through its existing shells.

A bridge from DOS. A major hurdle for the Unix system today is that customers must choose between a computer running the Unix system and a computer running PC-DOS, the current industry standard for which thousands of applications have been developed. If software developers could find a way of allowing DOS applications to run interchangeably with Unix system applications, then end-users would no longer have to choose between the Unix system and DOS; instead, they could buy the Unix system and get "the best of both worlds."

PROGNOSIS FOR RETAIL UNIX SYSTEMS

Comments from the retailers surveyed included "It is excellent," "It has been tested for a long time," "There are no bugs," and "Unix is definitely going to become the standard operating system."

Certainly there has been a substantial upswing in interest in the in the Unix operating system and in Unix system-based applications in the retail channel. This current upswing has been fueled by the IBM PC/AT and Xenix and by AT&T's aggressive marketing programs. Another influence is preliminary exposure of the AT&T Unix PC Model 7300 computer, which many expect to be the first computer to make the multiuser Unix system retailable.

Hewlett-Packard's announcement of the Integral Personal Computer, which offers unparalleled price/performance and portability in a Unix system machine, has focused attention on the capability of the Unix system to deliver practical power and ease of use to end-users. If IBM continues to support the Unix system (which remains an open question at this point), it seems certain that the Unix system will develop a substantial following in the retail area.

There is still an outside chance that the Unix system will displace DOS as the industry-standard operating system if the stars come into alignment in time. In this case, the "stars" are AT&T, independent software developers, and operating system developers such as Microsoft, Digital Research, and Microport.

Regardless of what IBM chooses to do, a strong industry ground swell is moving toward the Unix system, and AT&T has the resources to continue to promote, develop, and change it so that it becomes a very significant factor. □

Rod Turner is chairman of Microport Inc. of Monterey, Calif., provider of porting and development services for Unix System V. He is also executive VP of Marketing and Sales for Symantec, a start-up microcomputer software publisher in Cupertino, Calif. *Research assistance was provided by Bob Novick of Impulse Research, Los Angeles, Calif.*

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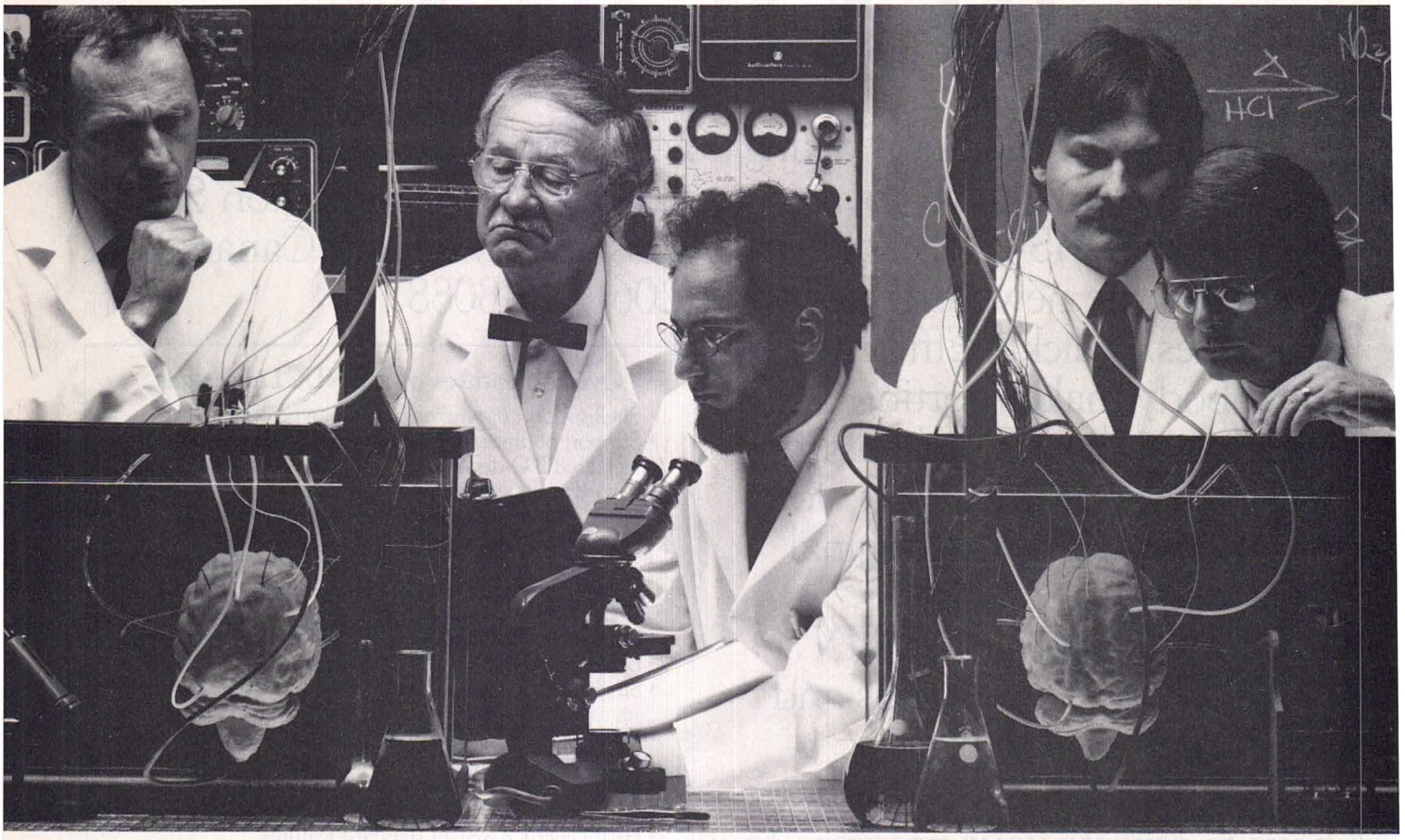

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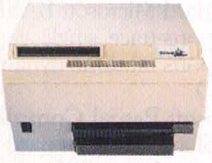

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GRAPHICS EXTENSIONS TO THE UNIX SYSTEM

Device independent interfaces are causing excitement and controversy in the world of graphics and implementation.

BY THOMAS CLARKSON AND RICHARD SKRINDE

The original AT&T Unix system user interface was a single cryptic dimension of command line and string editor. The university environment added `termcap` and `vi`, and gave the Unix system further dimensions of screen editing, display attributes, and menu systems—enhancements which helped increase the user base by an order of magnitude.

AT&T and graphics interest groups have propelled the Unix system user interface to the threshold of the bit-mapped display environment. The Unix system must be able to interface with contemporary graphics hardware and software technologies if it is to gain widespread acceptance in the commercial market. The issue of directly linking a standard graphics interface to the Unix system kernel must be resolved before the Unix system can be a high-performance graphics environment.

HISTORY

The Unix system and graphics were wed in the university environment. In addition to `termcap` and `vi`, the Berkeley implementation was extended to include a library of graphics primitives called `plot`. These primitives consisted of `move`, `point`, `label`, `arc`, `circle`, `erase`, etc. A set of filters allowed these primitives to be displayed upon a few graphics devices. `plot` allowed output to plotting devices, but had no interactive capabilities.

The CAD/CAE industries shied away from the Unix system until recently, as their software was designed around commercial hardware configurations or highly customized hardware and operating systems. Device interfaces were constructed either by writing directly to the hardware at the application level, by writing a set of filters to control a limited number of devices, or by embedding the device drivers in the kernel of the operating system. Commercial Unix based CAD/CAE systems began to appear in the Unix system environment with the introduction of 68000-based computer systems from vendors such as Sun, Daisy, Valid Logic, and ComputerVision.

Business graphics applications were first brought to the Unix system environment by vendors who ported their existing mainframe applications written in FORTRAN. A few vendors pioneered graphics applications written in C. Graphic Software Systems (GSS) developed a complete graphics application environment including interfaces, tools, and end-user applications, while Graphic Communications Inc. (GCI) developed a premier business graphics application.

SOFTWARE DEVELOPERS' APPROACHES

Application code can be written to directly access the display hardware, can be split into a functional user front-end with a series of filters for each display device on the back-end, or the code can be written to a device independent interface.

Writing application code to directly access the display hardware is similar to programming in assembly language. There can be a noticeable performance advantage with a tremendous decrease in adaptability. Any change in the display hardware means recoding, recompiling, relinking, and retesting the application program.

Application developers have usually chosen to implement a front-

end program to accomplish the desired functionality, with an I/O consistent linkage to a back-end program which consists of a filter for each device. This allows for some device flexibility. The limitations of semi-device independent interfaces are several: A decrease in performance caused by an added loop in the logic flow and increased memory usage, less interactivity with the peripheral due to the complication of interpreting device-specific information from the peripheral, and more steps for the end-user who must either install or select the desired peripheral before executing the application. The application software architecture becomes more and more complex to maintain as more devices are supported. Application designers usually have more expertise in the area of application design than in driver optimization, which also affects performance.

DEVICE INDEPENDENT INTERFACES

Device independent interfaces are the new wave of excitement and controversy in the world of graphics implementation. These interfaces exist at both the application program and operating system level. They offer the application designer an industry standard approach to graphics interfaces. Application developers must learn the conceptual and semantic differences between writing to high-level interface and writing directly to the display hardware. Once these differences are understood, application development is greatly simplified. There are currently three emerging graphics standards targeted to many different scale computers, ranging from mainframes to PCs (see Figure 1).

Programmer's Hierarchical Interactive Graphics System: The Programmer's Hierarchical Interactive Graphics System (PHIGS) is an emerging standard specifying a programmer's interface to a rich, device-independent graphics environment. PHIGS is designed to support such important applications as CAD/CAE/CAM, command and control, molecular modeling, simulation, and process control. PHIGS emphasizes the support of applications needing a highly dynamic, highly interactive operator interface requiring rapid screen update of complex images to be performed by the display system. One advantage offered by PHIGS for sophisticated

Illustrations: Robert Bryant & Assoc.

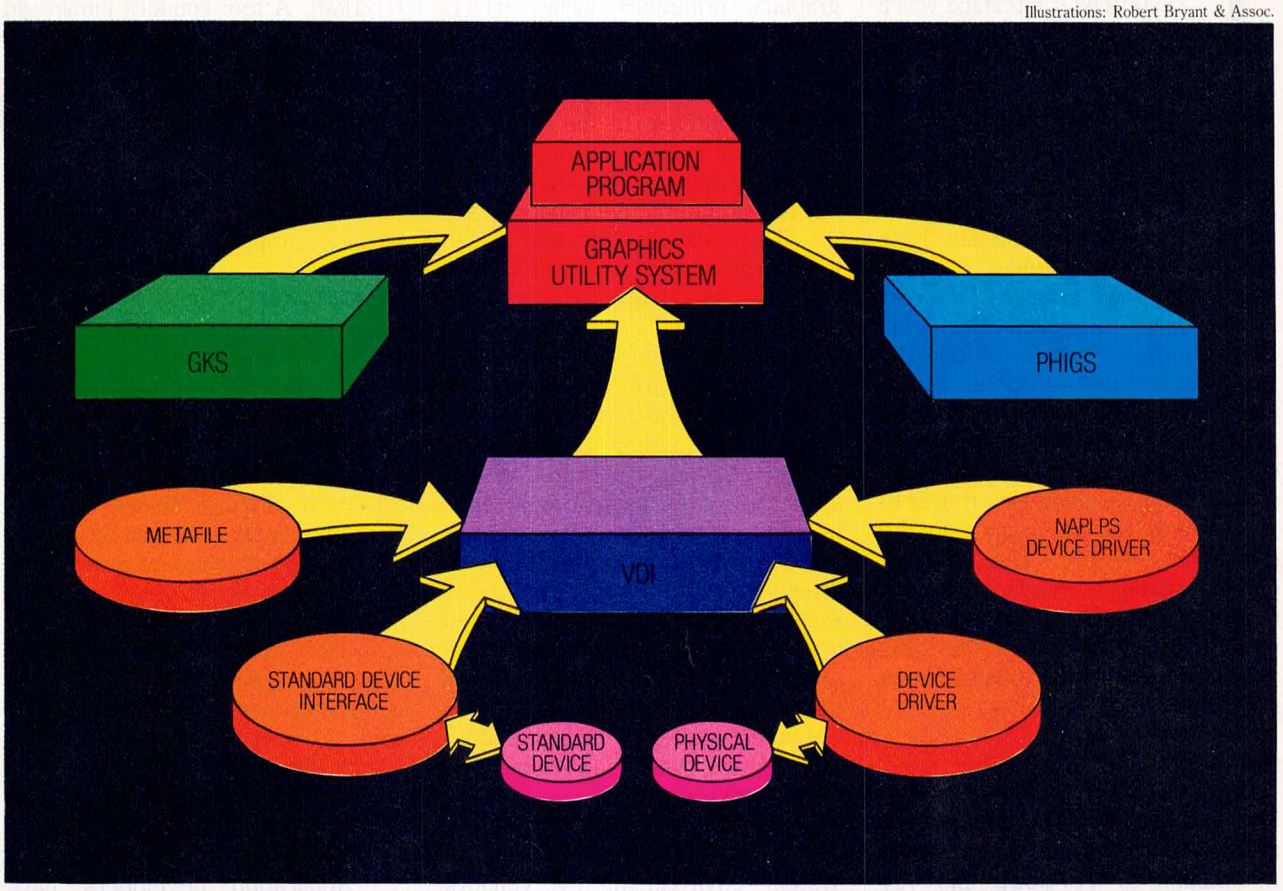

FIGURE 1: SCHEMATIC SHOWING SOFTWARE LAYERS OF DEVICE INDEPENDENT GRAPHICS INTERFACES.

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CAD/CAE applications is its support for three dimensional graphics.

The current state of technology dictates that the initial implementations of PHIGS will be designed to run on nothing smaller than IBM 4300 class and DEC VAX-11/780 class machines with very high performance graphics workstations.

Graphical Kernel System: The Graphical Kernel System (GKS) is the principal systems standard at the application program level. GKS allows portability of graphics application programs between different computer installations by providing a consistent interface to high level languages. It provides a common graphics model and syntax to make programmers more productive. GKS provides graphics-primitive commands for data input and drawing, support for multiple workstations, and device-independent picture segments. It also supports raster graphics through a set of area-fill and pixel-array primitives.

Future implementations of GKS will support three-dimensional graphics (3-D). The initial work in GKS 3-D is being done at the Rensselaer Polytechnical Institute in Troy, N.Y. GKS is an interface at the application language level, not at the operating system level, and requires a substantial graphics engine (floating point hardware). For this reason, many systems developers have turned to the VDI.

Virtual Device Interface: The VDI (also called Computer Graphics Interface or CGI) is being developed by the ANSI X3H3 Technical Committee as a standard interface between device-independent software and graphics devices. It is the emerging operating system level graphics standard. It is rich in primitives, as it has been developed with graphics hardware in mind. Both PHIGS and GKS can sit "on top of" VDI making it a "root level" interface. IBM and AT&T have licensed the Graphic Software Systems GSS version of the VDI as their PC graphics standard. A companion metal file interpreter allows hard/soft copy and disk storage of images.

VDI makes all devices appear as identical virtual graphics by defining a standard input/output protocol. The unique characteristics of the physical graphics devices are isolated in device-driver software modules. The big advantage of VDI is its potential for industry-wide compatibility under many operating systems on different scale computers.

A fifteen percent performance overhead is a small price to pay for the advantages of the VDI.

The VDI structure is composed of two distinct units. The *control software* associated with the application program is coupled with the *device driver software* associated with an input or output device. It is possible to install many device drivers at one time, for input or output to a number of devices. The exact number of devices that can be operated at the same time depends on memory size and other system parameters.

The language binding portion of the VDI accepts input from the application in the form of run-time library sub-routine calls and translates the graphics request into code for use by the device driver portion. The code consists of several arrays containing the operation code (opcode), the device "handle" specifying which driver receives the code, and a number of integers and points in the integer-in (*intin*) and points-in (*ptsin*) arrays. The *intin array* contains all data required by the opcode, while the *ptsin array* contains the graphics data that the opcode may require.

The binding routines then route the code to the VDI control software, which uses system dependent inter-process communication to pass the data to the requested driver using the device handle obtained when the requested device was initially accessed.

The interface portion of the device driver accepts the input data from the application and passes it to the device driver. By doing so, it transforms normalized coordinated space into device coordinate space, which defines the physical limits of a specific device. The effect produces a graphic image on a scale appropriate to the device on which it will appear.

The opcode interpreter portion reads the now device-specific code and sends it to the waiting peripheral. It also returns device-specific information to the application. The I/O portion of the driver handles all I/O functions such as accessing a communications port, setting the port characteristics, or reading and writing data.

Any data returned by a device is passed to the interpreter portion of the device driver, where it is converted from device coordinated space back to normalized device coordinate space. The interface portion of the driver to which it is returned uses interprocess communications to route the data to the application program. Arrays *intout* and *ptsout*, similar to the input arrays, are used to contain the data.

When the graphics input device is accessed for use by the application (for example, when moving the cursor on the screen using a mouse), its echo device (in this case the screen) is specified and also accessed. When data is requested from the input device, the actual device values are converted into normalized coordinate space. This data is passed back to the echo device, which converts back into the normalized coordinate space and a cursor is positioned by the input device (in this case the mouse). The application could query the screen to find out the location of the cursor to determine if an icon, for example, is positioned under the cursor echoed from the graphics

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input device (the mouse). This echo loop removes the burden from the application of coordinating the position of the input device, the position of the cursor, and the position of the icon.

PERFORMANCE TRADE OFF

Interprocess communication varies on the 30 odd versions of the Unix system. Pipes, message queues, and shared memory are three communication methods. Performance is linked to the speed of these communications methods in common use. Available system memory is the trade-off against speed as throughput increases with increased memory. Of course, the structure of application code that interfaces with the VDI can alter the performance. Surprisingly to many skeptical application developers, programs properly using the VDI interface often run as fast as programs directly accessing the hardware, and should create no more than a 15 percent performance overhead in any case. This is a small price to pay for the many advantages provided by the VDI.

HARDWARE VENDORS' APPROACHES

Computer manufacturers gain significant advantages from standard graphics interfaces. Without the standard interface, every application requires a different device driver for every device. Thus a computer manufacturer supporting five different graphics applications, each supporting the twenty different input and output devices used by their customer base, must support 100 distinct device drivers. Production overhead becomes unmanageable (and expensive) for tracking, updating, and producing the myriad of drivers.

It is impossible to keep up with, let alone control, the technology explosion of graphics peripherals which are cutting prices and increasing features throughout the industry. State-of-the-art peripherals help sell computers. Companies have had to limit the number of peripherals they can support due to the significant support expense. Standard interfaces drastically reduce this cost, making it feasible to support many more peripherals.

Software solutions also help sell computers. Without standard graphic interfaces, porting a new graphics application ties up valuable in-house resources developing and testing the port. It is prohibitively expensive to pay the application developer to do dedicated hardware ports, and it is a long and painful process to eliminate the hidden bugs. Standard interfaces make many more software solutions available to the hardware manufacturer, helping them sell more hardware. Here is a look at some computer manufacturers graphics interface strategies.

AT&T: Historically, graphics applications in the Unix system environment have been limited to CAD/CAM. Today, few software developers offer graphics as a part of their application packages due to the custom development required to implement graphics in the Unix system environment.

AT&T bundles a copy of the VDI with every Unix PC. This is a strong statement of commitment to a standard graphics interface and will resolve industry confusion over differing graphics proposals. AT&T's stance will also encourage software developers to start integrating high-quality graphics into their Unix system-based applications.

SUN MICROSYSTEMS: Sun Microsystems manufactures a Unix workstation featuring a high-performance graphics-oriented user inter-

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face and an open systems architecture. Sun is committed to the VDI. Dr. Jack Porterfield, a member of the graphic software technical staff, is responsible for the implementation of VDI in the Sun environment. He says, "I am excited about PHIGS, understand the value of GKS, but feel that the VDI is the graphic standard that is really going to take off. The IBM endorsement coupled with the technological advantages of VDI make it very attractive. Life will become much easier for our application developers..."

VALID LOGIC: Valid Logic has historically built hardware and operating systems around its application software. This format inevitably becomes cumbersome to maintain and more complex as features are added.

Marty Hess, manager of the Graphics Systems Group, explains: "We are looking for a unified method to improve maintainability, create better lines of distinction between our systems engineers and our applications designers, and to increase the capabilities of our graphics system. We have chosen the proposed ANSII VDI standard for our graphics interface. Our absolute requirements are portability across systems, no performance degradation, and no required rewrite of existing applications. Our wish list, in order of importance, includes support for distributed graphics processing, ease of programmer and customer use, adherence to a universal industry standard, and device independence. We are confident the VDI will deliver."

VDI AND UNIX FUTURES

The VDI is a virtual system that gives the Unix system the full dimension of graphics. Direct linking of the Unix system with the VDI has not yet occurred. AT&T has taken a significant step by offering the VDI with every Unix PC. □

Thomas B. Clarkson is chairman and chief executive officer of GSS. Before cofounding GSS, he worked at Tektronix Inc. on its PLOT-10 interactive graphics software library and as a software project leader and computer analyst at the Jet Propulsion Laboratory, developing programs for the Galileo project to Jupiter. He is a member of the ANSI X3H3 Graphics Standards Committee, ACM SIGGRAPH, and the National Computer Graphics Association.

THE ZILOG SYSTEM 8000

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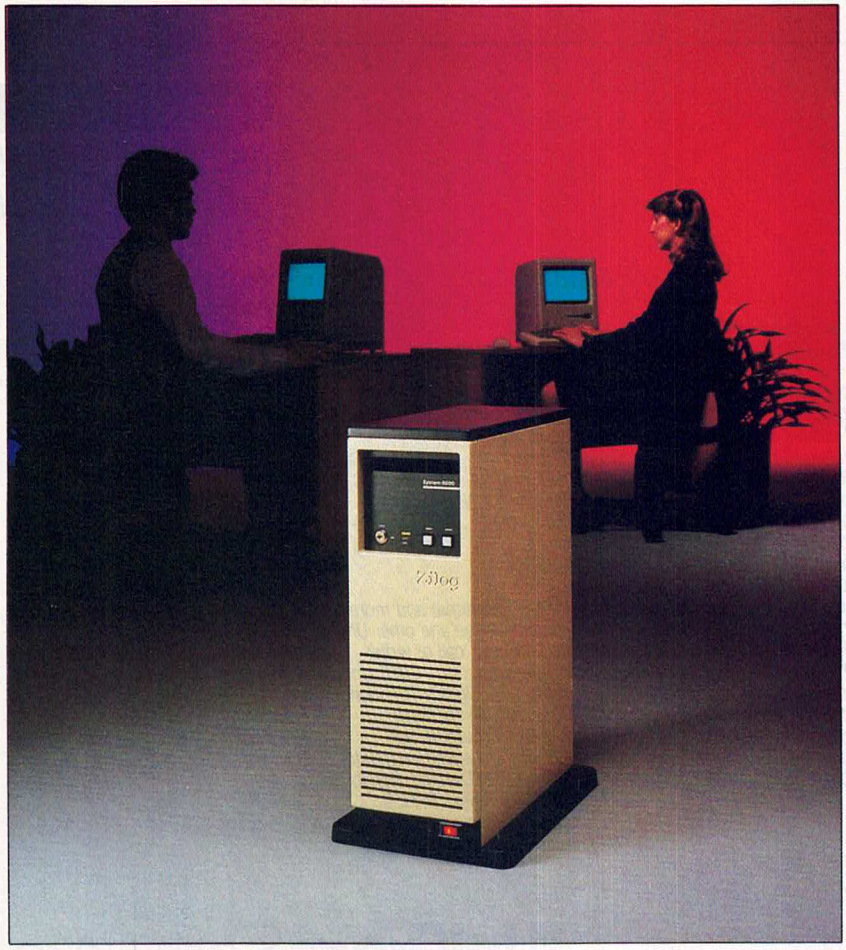

Zilog's superfast System 8000 supermicro has many pluses and minuses.

Just when I thought the Plexus challenge was all behind me, I received a letter from Gary Babcock, marketing manager at BASIS in Berkeley, Calif., telling me about the Zilog System 8000 (see Figure 1). The gauntlet was down; perhaps I hadn't looked far enough afield. I armed myself with my trusty benchmark tape and off I went. After spending a month with a Model 12 and visiting the Zilog factory, I can report that Babcock is right: the Zilog System 8000 is a fast, inexpensive supermicro.

This machine is one of the better Unix system-based supermicros, with one of the highest performance/price ratios on the market. The Model 12 that I reviewed has a suggested retail price of $20,000 (since reduced to $16,950). Furthermore, the Unix System III operating system (Zilog has just released System V) supports a large selection of end-user applications and a wide spectrum of communication protocols.

Before the recent proliferation of VLSI processors (the Micro-VAX II and WE32000, to name two), four processors dominated in the Unix system market: the Intel iAPX86, the M68000, the Z8000, and NS32000. Of the four today, the Zilog processor has become a neglected stepchild, except in the military marketplace.

Many attribute the Z8000's fourth place showing in part to a half-hearted marketing effort and to the decision by former Zilog president Manny Fernandez to keep the chip "captive" for his own systems effort, despite its appeal to many of today's larger Unix system vendors rumored to have come knocking on Zilog's door back then (Tandy, for one, according to some reports). Although I hate to restate the obvious, Zilog, the king of the 8-bit CP/M mi-

cro world, has lost out to Intel and Motorola in the 16-bit environment.

Nevertheless, Zilog's dominance in the 8-bit, CP/M world and its excellence in chip design led some of the first Unix system supermicro manufacturers to build their original machines around the Z8000. However, in the micro world, where brand name recognition is most important, Intel rules. In the Unix system world, some say that only cost/performance counts, and the Z8000 seemed to be losing the cost/performance war. While price/performance as the sole selection criteria can be debated, its goes without saying that marketing is just as important if not more so, and that Zilog has lost the marketing war against Intel and Motorola by a mile.

Mr. Bruce Mackinlay
WMZ/NOVATECH, Inc.
1485-G Enea Court, Suite 1330
Concord, CA 94520

Dear Bruce:

I'd like to compliment you on your informative and well-written articles in Unix/World. Of special interest is your most recent piece on the cost and performance of the Plexus P/35. In general, I believe we here at BASIS share your impressions of the Plexus machine: it appears to be a solid performer with a good UNIX port and at a very reasonable price.

As it happens, we also "took the Plexus challenge" last fall with a Zilog Model 32. As a result, the Plexus-Heuer chronograph found a home in Berkeley. I enclose a variety of benchmark results for Zilog and several other Unix machines.

We'd very much like to know more about your findings, particularly any based on tasks similar to those used in the benchmark reports I've enclosed.

Sincerely,

Gary Babcock
Marketing Manager
BASIS
1700 Shattuck Avenue
Berkeley, CA 94709

FIGURE 1

In the case of the System 8000 the engineers developed a good computer—but hardly anybody knows that Zilog sells supermicrocomputers. The System 8000 is price-competitive with Motorola-based systems, and it's a reasonably powerful and fast machine. A million-dollar marketing campaign might have captured a significant market share, but I think that would be a little late now. The competition has either surpassed the Z8000 in performance or is close to producing machines that are even faster and cheaper than the System 8000.

The Zilog 8000 system has one of the best performance/price ratios on the market.

Although it's an unwritten rule that chip manufacturers don't compete with the people who buy their chips (the independent computer manufacturers), Zilog has chosen to break this rule.

The new Zilog System 8000 uses Zilog chips, Zilog boards, Zilog chassis, Zilog cable assemblies—you get the picture. Board fabrication, cable fabrication, indeed the whole manufacturing process takes place on Zilog's own assembly line. Zilog's competitors contract out most of this work because they can't afford the capital investment required for a complete fabrication plant. Zilog (a wholly-owned subsidiary of Exxon Corp.) has deeper pockets, and so can afford to make a cheaper machine.

A firm called Lutzky-Baird Associates has used the System 8000 and as the center of Ultra-Office, their new office networking system (see sidebar). This system uses the AppleTalk Personal Network to link up to 64 Macintoshes, with a Zilog System 8000 as the host. Unix system mail and other Unix system

COMPANY OVERVIEW

Company Name: Zilog, Campbell, CA (Wholly Owned Subsidiary of Exxon), 408/370-8000.
Management: CEO, Dr. Edgar A. Sack; VP marketing, Richard H. Rubin.
Miscellaneous Data: Units shipped, not reported; Major support centers, Campbell, CA; Boston, MA; Chicago, IL; Atlanta, GA; Houston, TX; Other major products, Z8, Z80, Z800, and Z8000; Stock symbol, XON. In business since 1976.

HARDWARE/SOFTWARE OVERVIEW

Model: System 8000, Model 12; **Price:** $16,950; **Configuration:** 1 Mbyte main memory, 52 Mbyte Winchester hard disk, 8-port I/O controller (not intelligent processor); **Related models:** Model 22, Model 32; **First delivered:** October, 1984; **Processor:** CPU, Z8001, Cache, 32 Kbytes, Cycle time, 11.1 MHz; **Min. Memory:** 512 Kbytes; **Max. Memory:** 8 Mbytes; **Floating Point:** In software (hardware avail. on 22 & 32): **Storage Memory:** Floppy, none; Winchester, 2 52 Mbytes ST506 (168 Mbyte SMD on Model 32); **Backup:** 4M tape cartridge, (nine-track on 22 & 23); I/O **Processor:** 8-port serial, disk and tape. **Other Hardware:** Serial ports, 8-port/card, max. of 16, (40 on model 22 & 32), Serial I/O utilities: ZSC (source control), System Administration Tools; **Languages:** C Z8000 assembler. **Software:** Unix System V, **Shells:** Bourne, CSH; **Libraries:** termcap, curses, C-ISAM.

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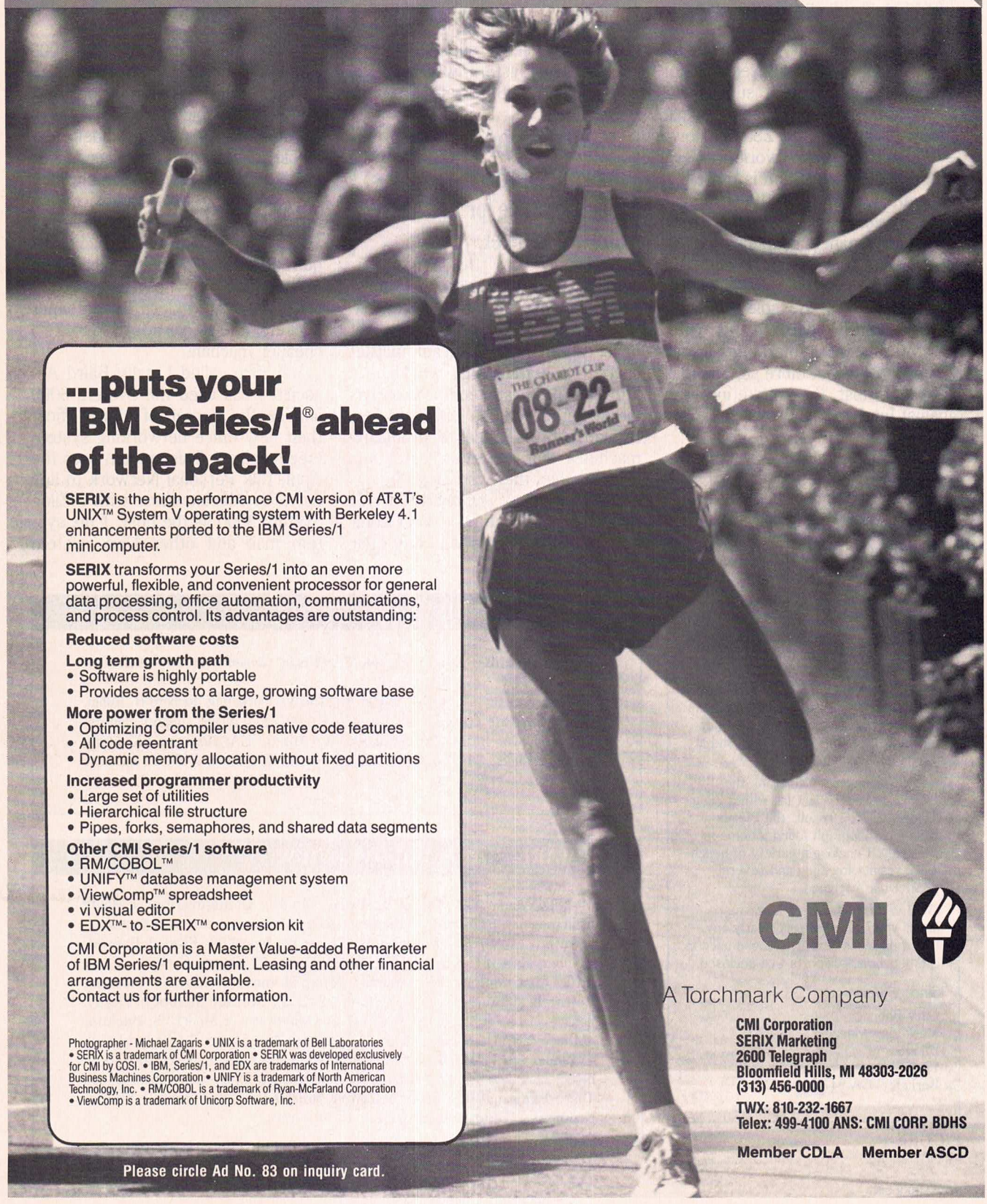

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THE ULTRA-OFFICE: ZILOG'S MACINTOSH CONNECTION

The Unix system may well end up being the glue that ties the Macintosh office together.

While Apple Computer Corp. has provided local-area networking products for stringing Macs together, the AppleTalk LAN only supports about 10 Macs in a row. This limitation for an otherwise extremely friendly Mac workstation has hampered its introduction into Fortune 500 corporations. With these large companies' penchant for IBM-compatibility as well as MIS control, Apple is losing out on many contracts.

But in Los Angeles last year, the software design firm of Lutzky-Baird Associates hit upon a solution that would allow as many as 400 Macs to talk to each other—and to Unix system-based hosts.

The approach? Lutzky-Baird decided to write a Unix system interface that resided both on the Macs and on Zilog Inc.'s System 8000 supermicrocomputers. Initially, the two-year-old startup did this to solve a problem for a single large advertising agency. Since then, however, the custom project has evolved into a commercial product, called Ultra-Office, and has since gone on (through a co-marketing agreement with Zilog) to other end-users.

In its first release, called Ultra-Talk, as many as 50 Macs—or five strings of AppleTalk LANs—could be hooked to a single System 8000 unit.

The Zilog computer's Zeus operating system, a version of Unix System III, acts as file server and system administrator, handling file transfers between Macs and an electronic mail system. In addition, the Zilog's Unix system updates a "public library," (common applications and data files) of files that all the Macs could access.

"Unix untied us from hardware vendors," said Lutzky-Baird president Charles Baird, a former aerospace software engineer. "We selected the Unix system because it's the operating system of choice for supermicro sys replacing many of the installed minicomputers in today's offices."

In a release of Ultra-Office this summer, Mac users gained the ability to "window" to the Unix system, thereby enabling them to work on any Unix system application Zilog supports. Mac users can now reserve part of the Zilog system's hard-disk space for their own use of Unix system applications as well, Baird said.

In December, an Ethernet-based network is expected to be ready that will allow up to eight Zilog units to connect into a single LAN supporting 400 Mac workstations. In addition, Lutzky-Baird will provide software to allow IBM PCs onto the Ultra-Office network.

And the new networking Ultra-Office gateways and Zilog's communications capabilities—including X.25 packet-switching standard—create a new environment for Macs.

In the future, says Larry Tesler, manager of the Macintosh Division's software group, the Unix system may well be included in this Apple scheme of things as an operating system for an Apple-labeled file-server products. "Our main interest in the Unix system is in systems software and connections to the mainframe," Tesler says.

Still, Apple stops short of outright endorsement of the Lutzky-Baird and Zilog products. "We're acknowledging that this is a strategically important product," says Barbara Knaster, an Apple spokeswoman. "But what we're doing with Lutzky-Baird is typical of the way we try to co-market without third-party suppliers."

Nontheless, the tripartite marketing relationship between Apple, Lutzky-Baird, and Zilog will allow all three to make corporate sales none of them would likely have made alone.

—Jean S. Bozman

tools are available to network users. The user can store files either as local Macintosh files or as Unix system files (using the Zilog as a "hard disk"). Ultra-Office is a step in the right direction toward Unix system-based networking, although it's still not really what I'd like to see. (My idea is a system using IBM PCs as very intelligent terminals under a Unix system where the actual end-user never is sure when he is using the PC or the Unix system box.)

HARDWARE

The Zilog System 8000 uses the Z8001 processor. It has 32K cache memory and an intelligent disk controller (also based upon the Z8001). It has two types of serial controllers, one with an intelligent processor and one without. Both serial controllers support 8 serial ports, with a fully configured System 8000 supporting up to 40 serial ports.

I understand that some of Zilog's machines are supporting 40 terminals, but based upon the benchmarks I suggest limiting it to 16 terminals and then only using the intelligent I/O processor. The intelligent serial processor supports a very wide spectrum of protocols, including SNA, X.25, 2780/3780 (bi-sync) and AppleTalk. Recently Zilog added a Berkeley 4.2/Ultrix-compatible Ethernet card. While I was at the factory, I was shown a VAX communicating with a Model 32. I understand that the Ethernet card is made by Excelan.

Zilog offers a 9-track drive and/or a streaming cartridge tape for backup. The latter has a 25.7-Mbyte capacity. The system uses a 32-bit ZBI bus (Zilog standard), but since the processor only handles 16 bits at a time, having a 32-bit bus is of questionable value. (Maybe this is in preparation for the future Z80000 processor?)

The system comes in three configurations: the Model 12, Model

BENCHMARK MEASUREMENTS

AIM TECHNOLOGY SUITE II:

ZILOG SYSTEM 8000 MODEL 12

ARITHMETIC INSTRUCTION TIMES (microseconds per op)

	short	*long*	*float*	*double*
+ add	541ns	918ns	450	450
* multiply	7	30	453	454
/ divide	11	72	1001	1001

MEMORY LOOP ACCESS TIMES (nanoseconds per byte)

	read	*write*	*copy*
CHAR type	3	2	3
SHORT type	589ns	827ns	1
LONG type	391ns	570ns	885ns

INPUT/OUTPUT RATES (bytes/sec)

	read	*write*	*copy*
DISK	47K	28K	23K
PIPE			218K
TTY 1		864	
TTY 1+2		2K	
RAM 1-byte			378K
RAM 4-byte			1129K

ARRAY SUBSCRIPT REFERENCES (microseconds)

short[]	long[]
4	5

FUNCTION REFERENCES (microseconds/ref)

0-parameters	1-parameter	2-parameters
funct()	funct(i)	funct(i,i)
3	7	10

PROCESS FORKS

(35K bytes)
22 per second

SYSTEM KERNEL CALLS
(calls-per-second and microseconds per call)

`getpid()` calls:	5 Kcalls/sec or	222 microseconds/call
`sbrk(0)` calls:	18 Kcalls/sec or	55 microseconds/call
`create/close` calls:	256 pairs/sec or	3906 microseconds/pair
`umask(0)` calls:	4 Kcalls/sec or	236 microseconds/call

22, and Model 32. All three come with 512K bytes of memory standard, expandable to 8 Mbytes. The top-of-the-line Model 32 supports up to 40 terminals and up to four very fast SMD 8-inch 168-Mbyte disk drives. The middle-range Model 22 can also handle up to 40 terminals, but uses the much slower ST506 5 ¼-inch disk technology, with up to four 52-Mbyte drives. The lowest-priced Model 12 can support only 16 terminals and two 52-Mbyte drives.

When I opened up the machine I found a lot of multi-layer cards, with some but not a lot of patching. I noticed the unusual fact that all their boards have a 96-pin plug on the back left-hand side of the board for I/O devices rather than the traditional cables. This makes it much easier to remove and inspect a card. In essence, I found the cabling to be innovative, and I'd suggest that other manufacturers use a similar technique (but not the ZBI bus).

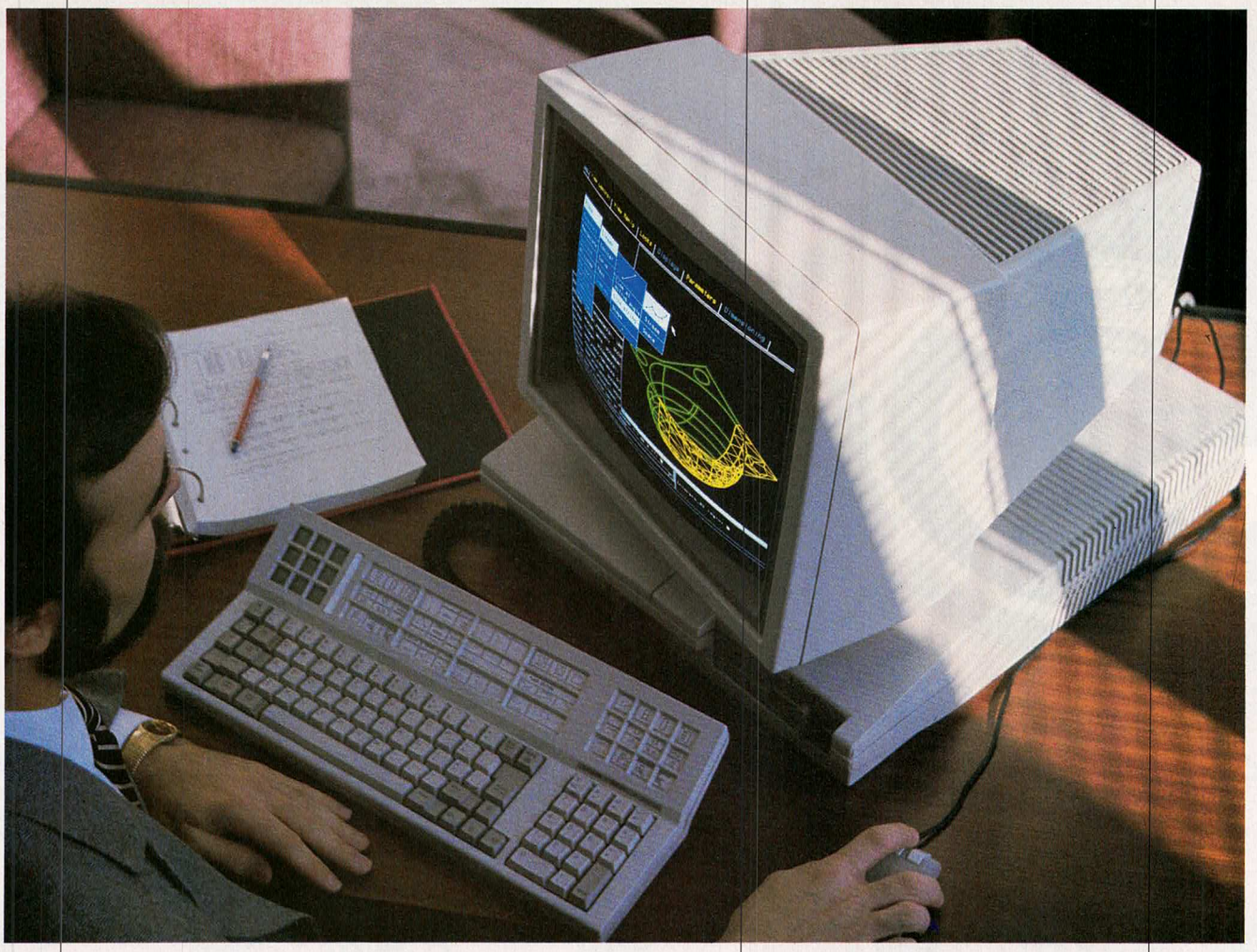
The AIM Benchmarks showed the System 8000 Model 12 to be quite fast. Zilog's integer arithmetic was faster than Plexus, but Plexus has faster floating point arithmetic

The AIM Benchmarks showed the System 8000 Model 12 to be quite fast.

(both systems do floating point in software). Plexus wins out in memory access time, a surprise because it has a smaller cache. Memory speed is an important measurement because it figures heavily into an application's overhead. The speed of memory I/O shows through in function call references where the P/35 is twice as fast as the Zilog. Strangely, the slowest Zilog disk is faster then the slowest Plexus disk, but the fastest Plexus disk is much faster then the fastest Zilog disk. This is interesting because disk I/O is one of Plexus's weak spots.

The real difference between these systems (besides memory I/O) lies in the measurements of the speed of the Unix system kernel. Zilog is a clear winner here. Pipe I/O is almost twice as fast on the Model 12. Zilog's Unix system kernel calls are faster than Plexus across the board. (The results for `sbrk(0)` seem to be an anomaly.)

The benchmarks for the Model 32 are almost identical. Disk speed was faster, but only by a disappointing 20%. Ironically, the superior read speed on the Plexus can probably be attributed to its intelligent disk controller—a Z8000! (Plexus also uses the Z8000 in its intelligent serial I/O processor.)



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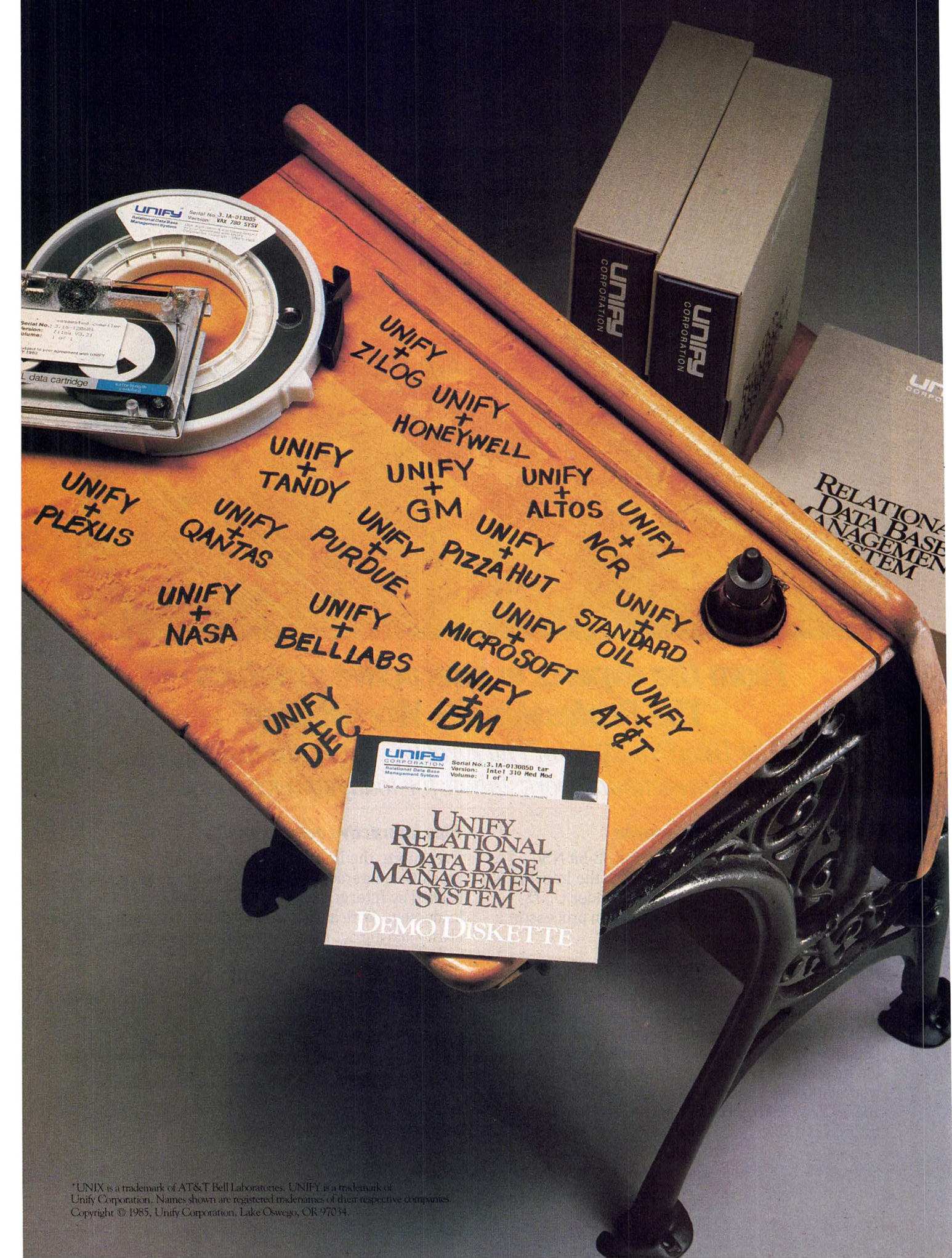

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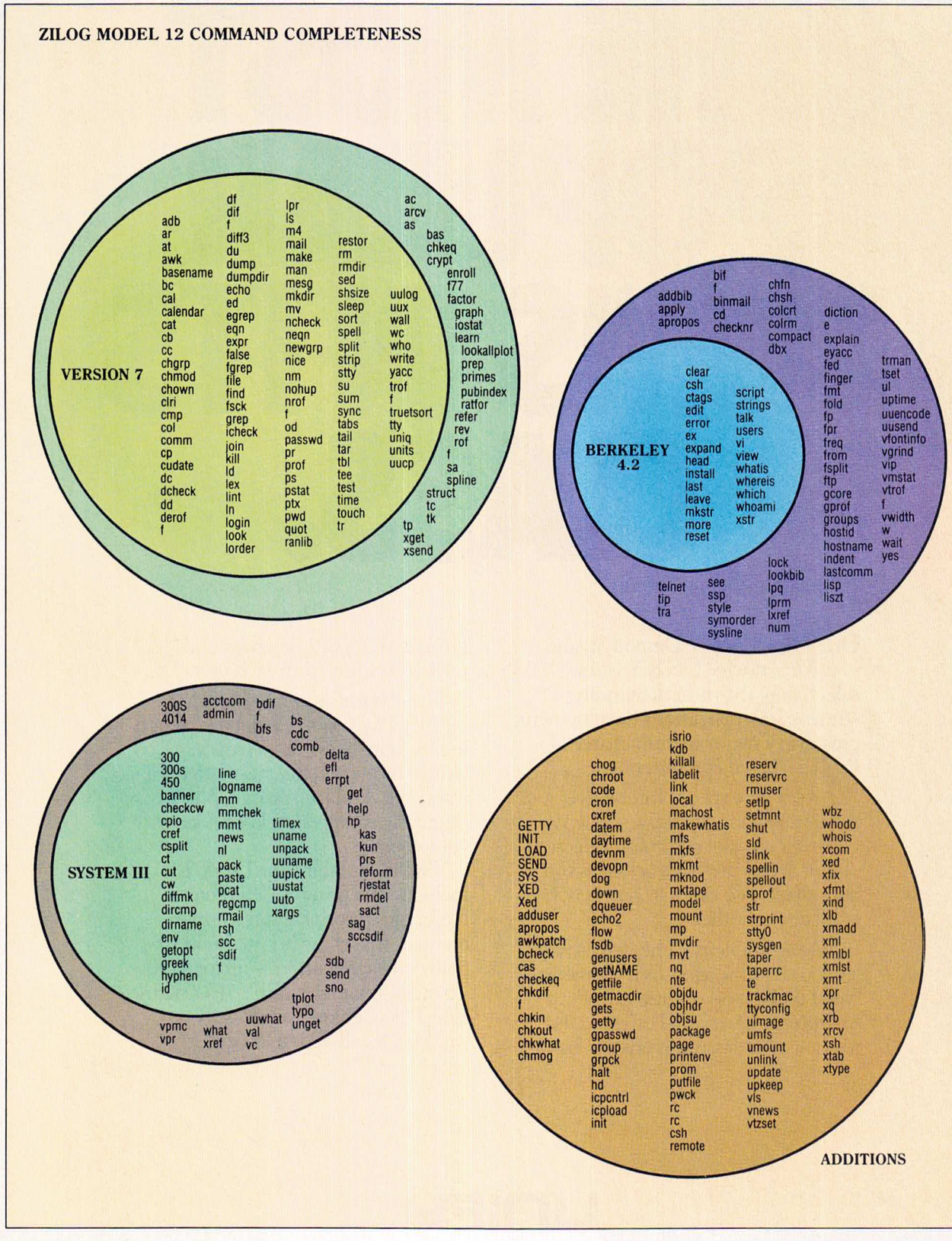

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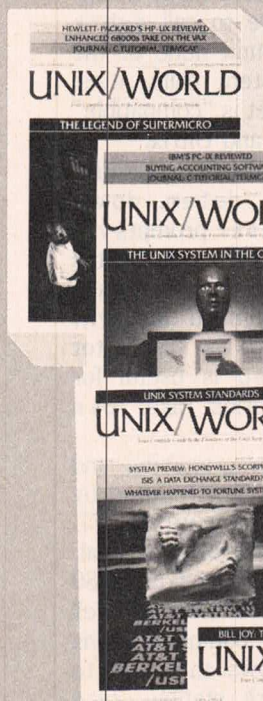

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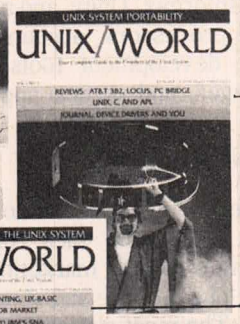

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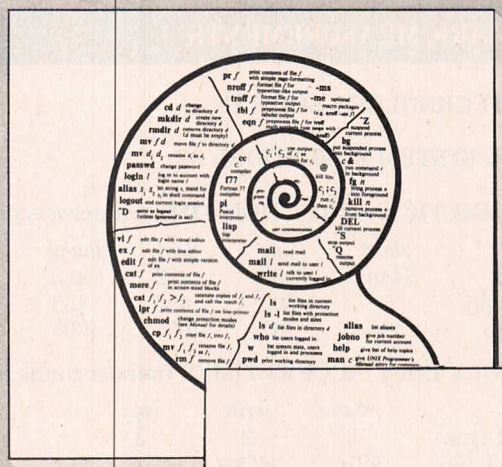

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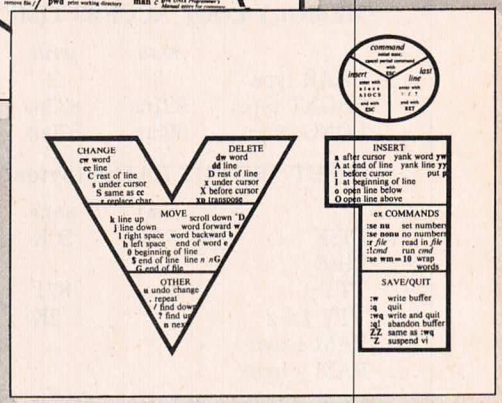

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BIP35

BENCHMARK MEASUREMENTS

AIM TECHNOLOGY SUITE II:

ZILOG SYSTEM 8000 MODEL 32

ARITHMETIC INSTRUCTION TIMES (microseconds per op)

	short	*long*	*float*	*double*
+ add	544ns	918ns	452	452
* multiply	7	30	456	456
/ divide	11	73	1001	1004

MEMORY LOOP ACCESS TIMES (nanoseconds per byte)

	read	*write*	*copy*
CHAR type	3	2	3
SHORT type	591ns	833ns	1
LONG type	395ns	570ns	890ns

INPUT/OUTPUT RATES (bytes/sec)

	read	*write*	*copy*
DISK	52K	50K	26K
PIPE			202K
TTY 1		871	
TTY 1+2		2K	
RAM 1-byte			377K
RAM 4-byte			1124K

ARRAY SUBSCRIPT REFERENCES (microseconds)

short[]	long[]
4	5

FUNCTION REFERENCES (microseconds/ref)

0-parameters	1-parameter	2-parameters
funct()	funct(i)	funct(i,i)
4	7	10

PROCESS FORKS

(35K bytes)
22 per second

SYSTEM KERNEL CALLS
(calls-per-second and microseconds per call)

`getpid()` calls:	4 Kcalls/sec or	224 microseconds/call
`sbrk(0)` calls:	18 Kcalls/sec or	55 microseconds/call
`create/close` calls:	228 pairs/sec or	4386 microseconds/pair
`umask(0)` calls:	4 Kcalls/sec or	233 microseconds/call

SOFTWARE

On the System 8000 I reviewed, a full Unix System system is standard. Zilog's added enhancements include a flexible record-locking mechanism, a screen editor, and C-ISAM file access. Missing were `sccs` and `f77`. In place of `sccs`, Zilog offers a `zsc`, a Zilog Source Control system. I did not try it, so I can't report whether it is any better or worse than `sccs`. Also included were `csh` and `vi` (thank goodness!).

The file locking mechanism is not /usr/group compatible. There is a "make segment" kernel call to allow you to allocate data beyond the traditional 64K-byte limit on the Z8001. Once you have made a segment you will have to call `sgbrk` to expand it. I found none of the Berkeley 4.2 system calls, even though the Ethernet is "compatible" with Berkeley 4.2 and Ultrix.

System administration utilities include `adduser`, `datem`, `down`, and `upkeep`. `adduser` prompts you for details about a user and creates user accounts, `datem` is a "user-friendly" `date` command (hurray!), `down` shuts down the computer nicely, and `upkeep` is useful for maintaining directories (like `/bin` and `/usr/bin`).

Among the programming and software migration tools offered by Zilog are RM/COBOL, FORTRAN 77, SMC Basic, and Microsoft Pascal. Zilog also offers X.25 and 2780/3780 (bi-sync) communications, as well as PC works, a communications package which allows an IBM PC to function as a work station. Zilog offers a Software Subscription Service, which includes two levels of post-warranty software support to customers.

Zilog has been actively soliciting third-party software for the System 8000 through its Referred Software Vendor Program (RSVP). Software currently available includes Multiplan, Informix, Unify, and a variety of word processors, accounting packages, development tools, graphics packages, and vertical applications.

CONCLUSION

I have a couple of bones to pick with Zilog. First, the slick, expensive-looking packet of marketing materials is long on hype and short on hard facts. The most glaring omission is a price list. When I asked, I was told that Zilog doesn't publish a price list at all. It is available to OEMs and VARs on request.

While the information I do have suggests that the System 8000 is reasonably priced, I can't help wondering why Zilog would not publish

this information, since everyone else does. Perhaps the answer is that Zilog's prices are only competitive in certain configurations. I don't know, but I find this omission highly unusual.

These mysteries aside, I found it just plain difficult to get the cold technical information I needed from Zilog personnel.

While I'm complaining, I'd like this system a whole lot better if it were a true 32-bit machine. Now, I'll freely admit that I have a bias against 16-bit machines. I have been traumatized by long nights spent trying to cram a program into the 64K-byte limitation.

That brings up a major flaw in the System 8000/Z8000 architecture: segmentation. You can segment programs on the Z8000, but handling segments adds extra overhead to the application. In addition, concerns about segmentation interfere with programming, even in a high-level language such as C. If your application is going to use more than 64K-bytes, you have to use special non-Unix system-compatible system calls, which reduces the portability of your application. Of course, Intel has the same problem and is still a major force in the market, so the picture for Zilog is not completely black.

Needless to say, there are tradeoffs to every design decision a system engineer makes. In particular, the "to segment or not to segment?" question is the subject of intense (and verbose) debate among system engineers. Unfortunately, I don't have the space to elaborate on that discussion here, though you might want to take a look an article "Understanding the New Microprocessor Architectures: What They Mean to System Performance and You" to help you understand some of the issues involved. The article appeared in UNIX/WORLD's August 1985 edition (Volume 2, Issue 7). To make a long discussion short, let it suffice to say I'm ag'in it.

Overall, Zilog has done some things really right. The System 8000 is a reasonably fast supermicro with generally good performance for the price.

However, despite its strengths, I'm not really all that impressed with the Zilog machine. Some features affecting performance are oddly out of kilter with the rest of the system architecture (slow disk drives teamed with a fast chip, for instance). Moreover, I doubt the System 8000 can stand up for long

BENCHMARK COMPARISON

AIM TECHNOLOGY SUITE II:

ZILOG MODEL 12 VS. THE PLEXUS P/35

(Numbers in parentheses represent the difference between the Zilog Model 12 and the Plexus P/35 in cases where the Zilog is faster then the Plexus. Numbers NOT in parentheses are the differences whhere the Plexus P/35 is faster than the Zilog System 8000, based on the Aim benchmarks.)

ARITHMETIC INSTRUCTION TIMES

	short	*long*	*float*	*double*	
+ add	(3.69)	1.01	1.31	1.96	
* multiply	(4.00)	(1.26)	(1.23)	1.07	
/ divide	(4.45)	1.38	2.50	3.37	Avg. (0.16)

MEMORY LOOP ACCESS TIMES

	read	*write*	*copy*	
CHAR type	3.46	1.00	3.00	
SHORT type	1.34	1.00	1.63	
LONG type	1.25	1.29	1.81	Avg. 1.75

INPUT/OUTPUT RATES

	read	*write*	*copy*	
DISK (model 12)	(1.38)	1.00	(1.21)	
DISK (model 32)	3.53	1.04	1.26	
PIPE			(1.77)	
TTY 1		(1.40)		
TTY 1+2		(2.00)		
RAM 1-byte		2.17		
RAM 4-byte		1.82		Avg. 0.25

ARRAY SUBSCRIPT REFERENCES

short[]	long[]	
1.00	1.25	Avg. 1.12

FUNCTION REFERENCES

0-parameters funct()	1-parameter funct(i)	2-parameters funct(i,i)	
2.33	1.85	1.80	Avg. 1.99

PROCESS FORKS

(1.22)

SYSTEM KERNEL CALLS

`getpid()` calls:	(1.06)
`sbr`	Avg. 1.38

+ Number from Zilog Benchmark is not meaningful.

Note: the Model 12 disk is compared to the slowest P/35 disk while the Model 32 is compared against the fastest P/35 disk.

against the newest Altos, Plexus, and National Semi-based machines. In sum, I for one believe the limitations of the Z8000 architecture aren't worth the System 8000's performance benefits. □

Bruce Mackinlay, a frequent contributor to UNIX/WORLD, is a senior partner in Novatech Systems Inc., a software development and consulting firm based in Concord, Calif.

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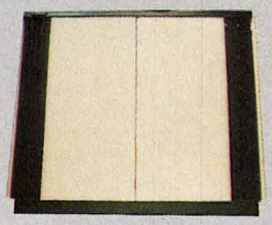

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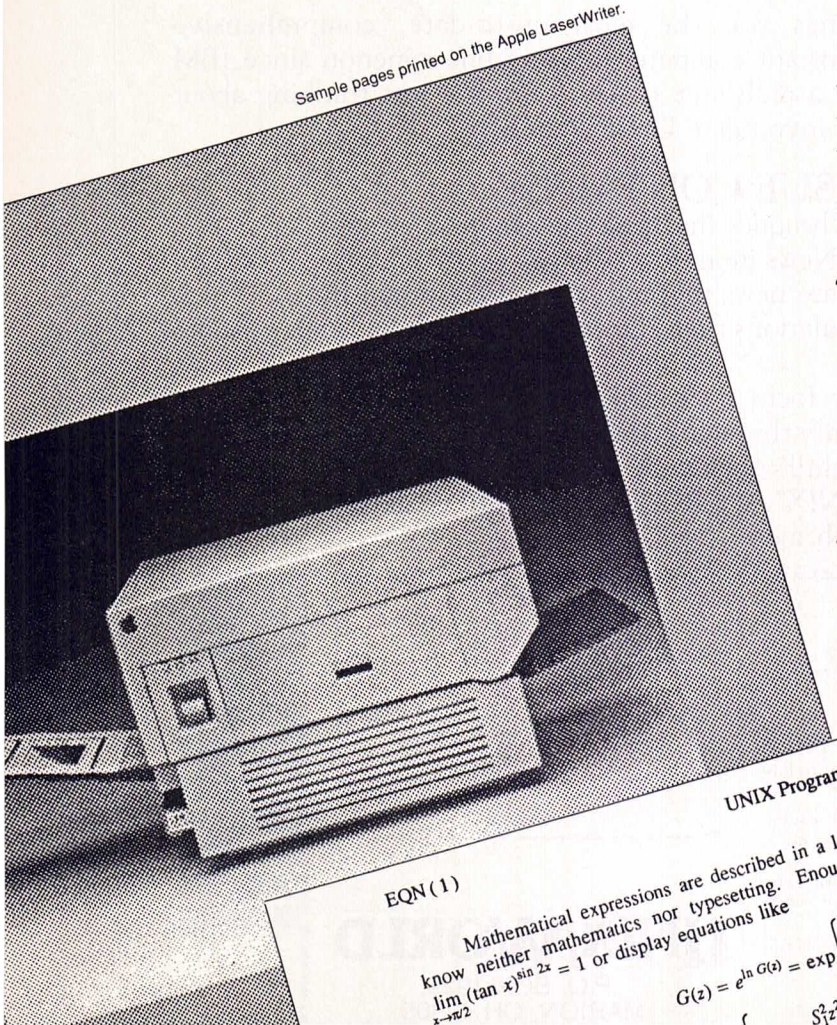

SYSTEMS ADMINISTRATION: CURES FOR BUSINESS ILLS

PART 7, CONTROLLING TERMINAL LINES AND SCHEDULING TASKS USING CRON

BY DR. REBECCA THOMAS

Users generally access the Unix system via a terminal. Each terminal (or terminal line) has a particular `getty` process monitoring the line for a log-in request. `getty` prints the `login:` prompt and goes to sleep, patiently waiting for a user to type something. When a user begins typing, `getty` wakes up and starts the chain of events that eventually logs him in.

You may disable terminal lines that support system access. But why would you want to do such a thing? Well, when a terminal line is disabled it may be used for another purpose—such as sending output to a serial printer, communicating with another Unix system via a modem that's attached to a serial terminal line, etc. Also, you should disable lines that are "floating"—that is, have nothing connected to them. How do you disable a terminal line? You do so by requesting that the system not run a `getty` process for that terminal line.

The procedure for enabling and disabling the `getty` process is similar for both Bell Version 7 and Berkeley, but is substantially different from both Bell Systems III and V. We will describe the procedure for Bell Version 7 and Berkeley first.

THE BELL VERSION 7 AND BERKELEY PROCEDURE

Immediately after executing the preconditioning shell script, `/etc/rc`, when going multiuser, the `init` process reads the file `/etc/ttys` to determine which terminal ports (or lines) are to have a `getty` process created for them. `/etc/ttys` is a human-readable text file containing the names of the terminals, one terminal per line. Figure 1 illustrates a sample file for supporting five ter-

minals—a system console and four additional terminals.

The first character of each entry is either a 0 (zero) or 1 (one). If the line begins with a zero, `init` ignores that entry line so no `getty` process is spawned and the corresponding terminal port is disabled for user log-in. An entry of one causes `init` to start a `getty` process that monitors that terminal line for a log-in request. Thus, in our example, terminal lines `/dev/console`, `/dev/tty0`, and `/dev/tty1` will support user access to the system, whereas `/dev/tty2` and `/dev/tty3` will not.

The second character of each entry line becomes an argument for the `getty` process. This argument tells `getty` the line speed or sequence of line speeds to use while monitoring the terminal line. Each argument value corresponds to a different entry in a correspondence table built into the `getty` program. Figure 2 shows a typical correspondence table.

In 4.2BSD the second digit in the `/etc/ttys` file points to an entry in another file `/etc/gettytab`. The `gettytab` file, which is similar in layout to `termcap`, specifies speeds and modes to be used before and after log in, the login banner, and other information. This file is used by 4.2BSD `getty` like System V `getty` uses `gettydefs` (discussed below).

```
$ cat /etc/ttys
12console
12tty0
13tty1
03tty2
05tty3
$ □
```

FIGURE 1: A SAMPLE `/etc/ttys` FILE

The `getty` process also displays any Unix system sign-on banner and the `login:` greeting prompt. This prompt is recognizable only if the speed of the terminal line speed (controlled by `getty`) matches the terminal baud rate (which can be set by the user).

You may try to match the baud rates in one of two ways. *One*, you could reset your terminal baud rate until you get a readable prompt. Older terminals require that you adjust switch settings that control the baud rate. Often these switches are difficult to get to, especially if located inside the terminal case. Then you have to turn off and then turn on the terminal after changing the settings so the terminal will recognize the new settings (during its power on initialization). Some newer terminals allow you to adjust the baud rate from the keyboard without powering down.

Two, if the correspondence table entry for your terminal line allows more than one line speed, you may instruct `getty` to cycle through them. When the line speed matches your terminal baud rate setting you'll get a recognizable greeting prompt. Simply depress your terminal's BREAK key, and `getty` will cycle through the baud rates. After each press of the BREAK key wait several seconds until `getty` changes the line speed. Pressing the RETURN key can have the same effect—the hardware detects a "framing error" if the baud rate is wrong when RETURN (or BREAK) is pressed. Do this until you see a recognizable `login:` prompt.

You would edit the `/etc/ttys` file if you wanted to enable or disable user log-in or to change the line speed(s) used by `getty`. Note that if a terminal line is in use, even if you change `/etc/ttys` to disable the line, it won't be "turned off" until the `init` process is sent a hangup signal (`kill -1 1`).

Argument	Line Speed(s)	Usage
0	1200,300,150,110	For a dial-up line used with a variety of terminals.
–	110	For a model 33/35 Teletype.
1	150	For a model 37 Teletype.
2	9600	For most hard-wired CRT display terminals.
3	1200,300	For dial-ups with Bell 212 Datasets.
4	300	For hard-wired 300-baud terminal, such as the DECwriter (LS36).
5	300,1200	For dial-ups with Bell 103 Datasets.

FIGURE 2: A CORRESPONDENCE TABLE FOR `getty` ARGUMENTS

THE BELL SYSTEM III AND V PROCEDURE

Substantial changes have been made to `init` in these newer Bell Unix releases. One major change is that the `init` process is directed by the contents of a new file, `/etc/inittab`. ("Inittab" is short for initialization table.) `init` is a special process created by the kernel during system initialization (or start-up)—hence its name. The `inittab` file may have several one-line entries, each consisting of four colon-separated fields. Figure 3A shows how the fields of Bell System III version are named.

The `init` process wakes up when a user logs off the system and it checks `/etc/inittab` for instructions. We assume that your system has `/etc/inittab` correctly set up, so we'll be concerned only with the contents of the *flags* and *command* fields for enabling and disabling the log-in sequence.

The *command* field contains the command line used by `init` for invoking `getty` to monitor the terminal line. The *flags* field is edited to enable or disable the `getty` process specified in the *command* field. If the *flags* field contains only the character `c`, the terminal line is enabled for user log-in; in this case the *command* is continuously reinvoked whenever a user logs off. If the char-

a. General format of an `inittab` entry:
state:*id*:*flags*:*command*

b. A sample `inittab` file:

```
$ cat /etc/inittab
1:co:c:/bin/sh</dev/console >/dev/console
2:co:c:/etc/getty console 5
2:01:c:/etc/getty tty01 3
2:02:c:/etc/getty tty02 5
2:03:tko:/etc/getty tty03 5
2:04:tko:/etc/getty tty04 5
$ □
```

FIGURE 3: BELL SYSTEM III `inittab` ENTRIES

a. General format of an `inittab` entry:
id:*rstate*:*action*:*process*

b. The command field of the `inittab` entry:
sh -c "exec command line"

c. Part of an `inittab` file:

```
co:2:respawn:/etc/getty console t_9600
tty0:2:respawn:/etc/getty tty0 t_9600
tty1:2:respawn:/etc/getty tty1 t_9600
tty2:2:off:/etc/getty tty2 t_9600
tty3:2:off:/etc/getty tty3 t_9600
```

FIGURE 4: BELL SYSTEM V `inittab` ENTRIES

acters `tko` are present instead, user log-in for the associated terminal is disabled. First a software termination signal (number 15) and then a "sure" kill signal (number 9) is sent to the process specified by the *command* field. (You could use the mnemonic "technical knock out" to remember "tko.")

As an example, Figure 3B depicts a typical System III `/etc/inittab` file. The first line begins with the numeral 1 (one) in the *state* field, which specifies single-user mode. The other lines begin with the numeral 2 and are used by `init` to designate multiuser operation.

Looking at the multiuser entries, you can see five terminal lines with *id* fields: `co`, `01`, `02`, `03`, and `04`. These numbers correspond to terminal devices `/dev/console` (the system console), `/dev/tty01`, `/dev/tty02`, `/dev/tty03`, and `/dev/tty04`. The `console` and terminals `01` and `02` are enabled for system access since the *flags* field contains a `c`, whereas terminals `03` and `04` are disabled as their *flags* field contains `tko`.

The last field contains the `getty` command line invoked by `init` to begin the user log-in sequence. For instance, `/etc/getty console 5`, where `console` is the terminal line name (`/dev/` is understood) and the argument `5` specifies the correspondence table entry used for controlling the line speed.

The entries for the System V version of `/etc/inittab` are somewhat different from those for System III. Figure 4A names the fields for this version. The *id* field contains one to four characters that identify the entry uniquely. The *rstate* field defines the *run-level* for which this entry is processed. An entry of `s` in this field specifies the single-user state, whereas the multiuser state may have one of seven levels, numbered zero through six. (Some implementations are set up to use level six as a single-user state.)

For this article we assume the *id* and *run-level* fields have been set up correctly as we will only be concerned with changing the contents of the *action* and *process* fields for enabling and disabling the log-in sequence.

As with the System III version, the `getty` invocation command line will appear in the *process* field; but it is passed to the Bourne Shell as the *command line* depicted in Figure 4B. That is, the Bourne shell "forks" creating an identical copy of itself and this copy "execs" the specified *command line*. This generalized approach means that you may specify commands other than `getty`: For instance, you might invoke a dedicated graphics demo to run on a terminal. Also, the command lines can be more complex than for the System III version; they may include I/O redirection, pipelines, and even comments.

With the System V version, you enable user log-in by placing the word `respawn` in the *action* field for `inittab` entries with a numerical run level. Log-in is disabled if this field contains the word `off`. Figure 4C shows examples of enabled and disabled `inittab` entries. In this example, entries corresponding to terminal lines labeled `co` (system console), `tty0`, and `tty1` are enabled whereas `tty2` and `tty3` are disabled for log-in.

With previous Unix system versions the `getty` correspondence table, which controls the search for the correct line speed, was "hardwired" in the `getty` program code. If you needed to change this table for some reason, `getty` had to be modified and recompiled (which required source code for `getty`). In the System V version, the internal correspondence table has been replaced by an external, human-readable ASCII file, `/etc/gettydefs` (stands for "getty definitions"). Thus you may easily change or augment the line speed search behavior by editing this text file.

a. Fields of the `gettydefs` file:

label	Provides the link between a `gettydefs` entry and an `inittab` entry. This field is supplied as an argument to `getty` in the `inittab` file.
initial flags	Specifies how to set up the terminal line initially (when a log-in request is first made).
final flags	Specifies the terminal line conditions before control is passed to the next process in the log-in sequence (`login`).
login message	The greeting prompt for system sign-on.
next label	Tells `getty` the next entry to use if the line speed appears incorrect.

b. A sample `gettydefs` file:

```
t_9600 # B9600 # B9600 SANE # \r\nSystem V login: # t_1200

t_1200 # B1200 # B1200 SANE # \r\nSystem V login: # t_300

t_300 # B300 # B300 SANE # \r\nSystem V login: # t_9600
```

FIGURE 5: THE SYSTEM V `gettydefs` FILE.

Each entry in the `gettydefs` file has five fields, each separated from the next by the `#` character. A blank line separates each entry line. The baud rates and line conditions are specified by special identifier words defined in the TERMIO manual entry (section 7 of the Bell System V *Administrator's Reference Manual*). These identifiers are easy to spot—they use upper case letters (and may contain numbers, too).

Figure 5A describes the fields of the `gettysdefs` file and Figure 5B shows some entries from a typical file. In this figure the *label* field suggests the terminal device (begins with `t_`) followed by a number corresponding to the baud rate. The *initial flag* only includes the line speed (for instance, B9600 for 9600 baud). The *final flag* repeats the same speed designation and has another string, "SANE", which has a special meaning not described in the termio(7) manual entry. It represents a likely set of "normal" line parameters, such as seven data bits, one stop bit, even parity, echo enabled, etc. From the shell enter `stty sane` then `stty -a` to display these settings.

The *login message* field begins with `\r` and `\n` (which represent a carriage return and line feed, respectively) to insure that the `login:` prompt begins on a line by itself. This field could contain anything desired, such as an escape sequence for clearing the screen (for a particular terminal hardwired to the terminal port).

In our example the entries of the *next label* field form a closed circle with the sequence 9600 → 1200 → 300 → 9600. This way, no matter where you enter the circle, sooner or later you should get the correct line speed for your terminal (by pressing the BREAK or RETURN key repeatedly).

EXECUTING PROGRAMS PERIODICALLY WITH CRON

The `cron` process executes commands at dates and times specified in the `/usr/lib/crontab` (or "cron table") file. The `cron` process is initiated when the system goes into multiuser mode—that is, the `/etc/cron` command, which starts the `cron` process, is specified in the `/etc/rc` multiuser preconditioning file. Since `cron` never terminates, it only needs to be started up once.

The contents of the `/usr/lib/crontab` file are read into memory after `cron` starts up; `cron` examines this copy once a minute and executes any commands that are scheduled to run. If the disk copy of `/usr/lib/crontab` is changed while `cron` is executing, the new copy of `/usr/lib/crontab` will be read into memory. The `cron` process also updates a history log file, `/usr/lib/cronlog`, every time it performs an action.

The entries in `/usr/lib/crontab` consist of lines of six fields each. The fields are separated by spaces or tabs. The first five fields specify how often to execute the command line that is named in the last field. The first five fields specify the minute (0–59), the hour (0–23), the day of the month (1–31), month of the year (1–12), and day of the week (0–6, with 0 = Sunday), respectively. The last field contains the shell command line. The command line can contain I/O redirection, pipes, and even multiple commands if separated by semicolons.

Each of the first five fields can contain a single number in the range shown above; two numbers, *m–n*, indicating an inclusive range, such as `1-5` in the *day of the week* field to stand for all days in the work week, Monday through Friday; a list of numbers separated by commas, such as `0,15,30,45` in the minutes field to stand for on the hour, quarter past, half past, and quarter to the hour; an asterisk (`*`), which means all valid values.

Figure 6 shows several sample `crontab` entries, which are interpreted below.

`0 * * * * /bin/date >/dev/console` The current date and time are displayed on the system console once every hour on the hour.

`30 2 * * * /bin/calendar -` The `calendar` command is executed for all system users every night at 2:30 A.M.

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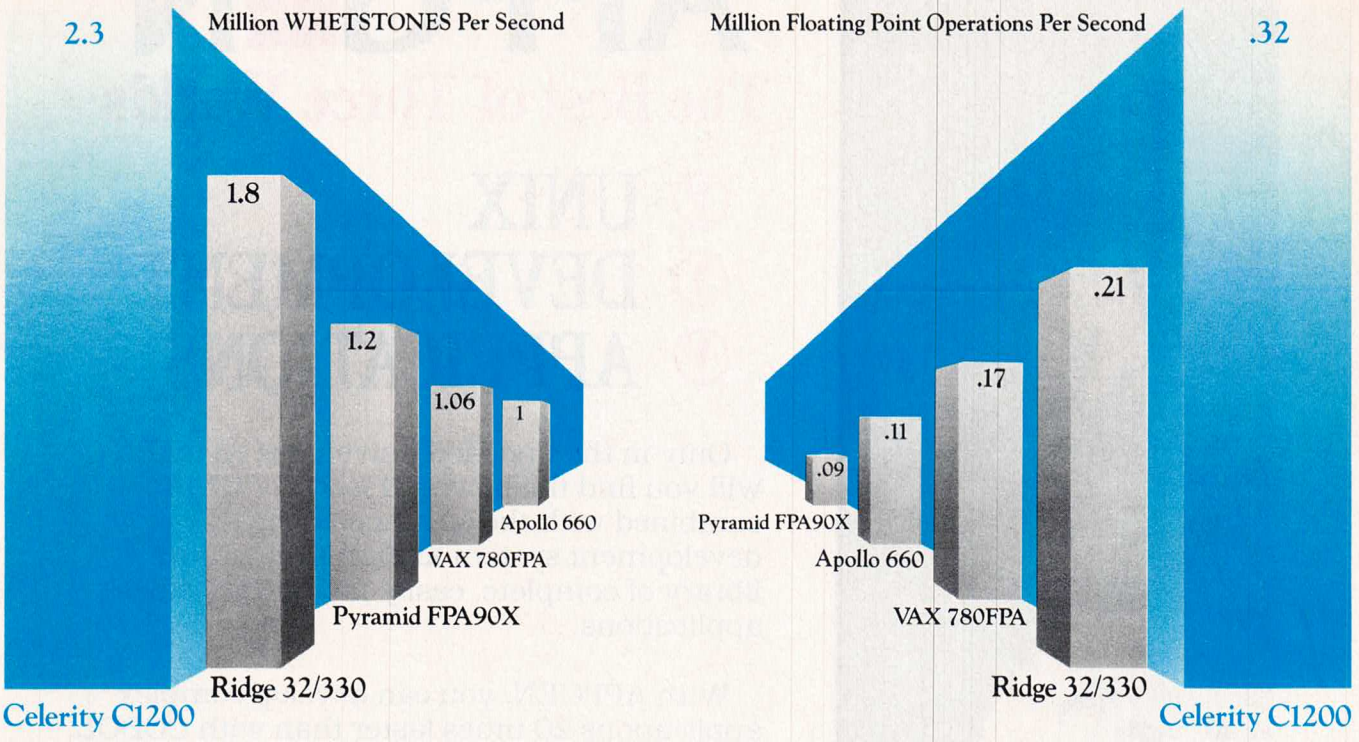

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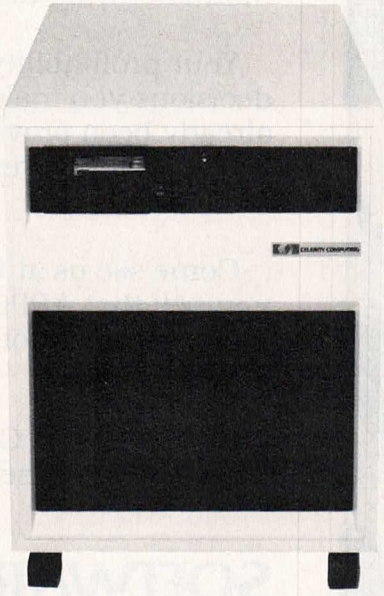

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```
$ cat /usr/lib/crontab
0 * * * * /bin/date >/dev/console
30 2 * * * /bin/calendar -
30 3 * * * cp /etc/passwd /etc/passwd.bak
30 4 * * * find /tmp /usr/tmp -type f -atime +2 -exec rm {} \;
35 4 * * * find /tmp /usr/tmp -type d -mtime +5 -exec rmdir {} \;
0 0 15 * * echo ''Time to clean fan filters'' | /bin/mail root
0,15,30,45 * * * * /usr/lib/atrun
$ □
```

FIGURE 6: A SAMPLE `crontab` FILE

`30 3 * * * cp /etc/passwd /etc/passwd.bak` The password file is duplicated every night at 3:30 A.M.

`30 4 * * * find /tmp /usr/tmp -type f -atime +2 -exec rm {} \;` All ordinary files in the temporary directories that haven't been accessed within the last two days are removed every night at 4:30 A.M.

`35 4 * * * find /tmp /usr/tmp -type d -mtime +5 -exec rmdir {} \;` All empty subdirectories of the temporary directories that haven't been changed within the last five days are erased every night at 4:35 A.M.

`0 0 15 * * echo "Time to clean fan filters" | /bin/mail root` The message "Time to clean fan filters" will appear in the superuser's mailfile after midnight of the fifteenth day of each calendar month.

`0,15,30,45 * * * * /usr/lib/atrun` Execute `/usr/lib/atrun` on the hour, quarter past, half past, and quarter till for every hour of the day. Recall that `atrun` is the daemon that executes the commands specified at a particular time in the future by the `at` command. □

Dr. Rebecca Thomas, UNIX/WORLD's Technical Editor, is an author of A User Guide to the Unix System, *the second edition of which is now available. She is currently writing a book on Unix system administration.*

This is the last installment of our system administration series that's based on the second edition of *A User Guide to the Unix System.* However, because of overwhelming interest in this series, we aren't ending it here. Next year we'll be starting a new series that covers more advanced system administration topics, but still in a manner that beginning administrators can understand.

Many of our future installments will be based on material from my forthcoming book on system administration, which I'm coauthoring with Rik Farrow. This book will cover administering popular microcomputers with XENIX and Bell System V Unix systems, such as the AT&T 6300 and 7300, the IBM XT AT, popular PC compatibles, Tandy, Altos, and a myriad of other systems.

Furthermore, we are soliciting installments from outside authors. If you would like to contribute please send a written proposal to Dr. Rebecca Thomas, % UNIX/WORLD magazine or electronically to `ucbvax!sun!idi!uworld!sirius!beccat`.

Some topics we'll be covering early on in the series will be file system backup strategies, system security, setting up and using UUCP. The UUCP program let's two or more Unix systems communicate via their terminal lines. File transfer, remote command execution, electronic mail, and access to Usenet, a popular electronic bulletin board that connects thousands of Unix installations worldwide, are supported by UUCP. And in future issues we'll show you how to setup an electronic mail link between two Unix machines and how to access the Usenet bulletin board network.

Happy New Year
Dr. Rebecca Thomas

Acknowledgement

I'd like to thank Rik Farrow and Armando Stettner for reviewing this month's installment.

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WIZARD'S GRABBAG

PARAGRAPH REFORM, A SCCS-LIKE UTILITY, AND `ls -l` and `file`

BY DR. REBECCA THOMAS

In this month's installment of Wizard's Grabbag we have two contributions from our readers to share with you. However, first we'd like to share a utility you might find useful when using `vi`.

Those who cut their teeth on WordStar may occasionally find `vi` lacking a feature that their favorite WordStar version had. We found the lack of the paragraph reformatting feature (the WordStar control-B command) frustrating. So I wrote a "quick and dirty" filter program (in C) to simulate this feature and sent the listing to an accomplished C programmer, Ray Swartz, for polishing. He suggested a word-oriented approach that gives clean modular code. We'd like to share the result with you this month.

Figure 1A presents this program. It collects words from the standard input and sends them to the standard output until a predetermined line length is reached. Then a NEWLINE is output to end the current line. The next input word appears on a new line in the output stream. This program is "smart" enough to maintain the sentence structure used by `vi`; that is, two spaces follow each sentence terminator (a period, question mark, or exclamation point).

Why reform paragraphs? Well, a bunch of short or overly long sentences on the CRT screen are difficult to read. Sure you can use `vi`'s "wrap margin" feature to format text during text entry, but this editor won't adjust the margins after you've edited the paragraph. So why not send the paragraph through a filter that folds long lines and adjusts short ones, and have the output replace the input text? This task is easy to do with `vi`—simply use the `!}` command. If the filter is named

a. The `reform` program listing:

```
$ pr -n -t reform.c

 1  #include  "stdio.h"
 2
 3  #define YES 1
 4  #define NO 0
 5  #define LINELENGTH 70
 6
 7  main()
 8  {
 9      int endchar;    /* Does this word end a sentence? */
10      int getword(); /* get next word on stdin */
11      int length;     /* length of word read by getword */
12      int count;      /* number of characters on line so far*/
13      int strlen();
14      int printf();
15      char word[81]; /* word read from stdin */
16
17      while ((endchar = getword(word)) != EOF) {
18          count += length = strlen(word);
19          if (count > LINELENGTH) { /* split the line here */
20              putchar('\n');
21              count = length; /* beginning count for next line */
22              printf("%s ", word);
23              if (endchar == YES)
24                  putchar(' ');   /* end of sentence space */
25          }
26          else if (endchar == YES) {
27              printf("%s  ", word);   /* print an extra space */
28                  count++;  /* to account for the extra space */
29          }
30          else
31              printf("%s ", word);
32          count++; /* to account for the space separating words */
33      }
34      if (strlen(word) > 0)
35        printf( "%s" ,word);/* print the last word if applicable */
36      putchar('\n');
37      exit(0);
38  }
39
40  int getword(word)
41  char *word;   /* storage for word read */
42  {
43      char c;
44      int endflag = NO;   /* Does this word end a sentence? */
45      int beginflag = YES; /* is this the beginning of new word? */
46
```

Continued

FIGURE 1: THE `reform` PROGRAM

```
 47      while ((c = getchar()) != EOF) {
 48          switch(c) {
 49              case '.':
 50              case '!':     /* end of sentence characters */
 51              case '?':
 52                  endflag = YES;
 53                  *word++ = c;
 54                  break;
 55              case ' ':
 56              case '\t':      /* word delimiters - white space */
 57              case '\n':
 58                  if (beginflag == YES)
 59                      continue; /* skip leading whitespace */
 60                  *word = '\0'; /* terminate word */
 61                  return(endflag);    /* non-EOF return */
 62              default:        /* just another character */
 63                  endflag = NO;
 64                  *word++ = c;
 65          }
 66          beginflag = NO;     /* no longer at beginning of word */
 67      }
 68      *word = '\0';   /* terminate the last word */
 69      return(EOF);
 70  }
$ □
```

b. Defining the `map` macros:

```
:map #1 !}reform^V^M<RETURN>
:map #2 !}reform^V^M}j<RETURN>
:map
f1 ^[OS !}reform^M
f2 ^[OT !}reform^M}j
: □
```

FIGURE 1: THE `reform` PROGRAM continued

```
$ pr -n -t c
 1      echo;echo;echo
 2      for i in $*
 3      do
 4           echo "compiling $i\c"
 5           if cc -c $i = 0
 6           then
 7                echo "  no problem"
 8                date >>Diff-dir/$i
 9                diff Backup/$i $i >>Diff-dir/$i
10                cp $i Backup
11           else
12                echo "******^G******* PROBLEM ****************"
13                exit 1
14           fi
15      done
16      echo;echo "LINKING NOW"
17      cc reform.o -o reform
18      echo "^G"
$ □
```

FIGURE 2: THE c SHELL SCRIPT

`reform`, place the cursor at the beginning of the paragraph, type "!}reform" followed by RETURN, and lo and behold the paragraph is reformed *à la* the WordStar control-B command.

Keystrokes can be reduced even further on a terminal with function keys by mapping the reformatting command to a function key. Actually, two different command forms seem useful—one that retains the cursor in its original position and one that moves the cursor to the beginning of the next paragraph. The latter is helpful for moving through the document reformatting paragraph after paragraph. Oh, the program could be even smarter; for instance, if it ignored embedded `nroff` directives and macros it could reform the entire document in one step! However, we'll leave that enhancement as an exercise for an inspired reader.

Figure 1B shows what to type to map the two reformatting commands to function keys f1 and f2. (The functions keys must have their definitions noted in the `termcap` or `terminfo` entry for your terminal.) Note that the control-V is necessary for entering the control-M without prematurely ending the definition of the `map` command. We hope you like this utility. Now let's hear from our readers . . .

A "POOR MAN'S" MAKE/SCCS

Dear Dr. Thomas:

When writing more complex programs in the C language, I find it helpful to break the program up into several reasonably sized modules (100 to 500 lines of code). This approach has advantages and disadvantages. Some of the advantages include easier and quicker editing as

```
$ pr -n -t ls2
  1     trap "rm -f /tmp/psh$$ls2[ab]; exit" 0 1 2 3 13 15
  2     recurs=
  3     dir=
  4     for i
  5     do
  6          case $i in
  7               -r) recurs="yes" ;;
  8                *) dir=$i ;;
  9          esac
 10     done
 11     echo ${dir:=`pwd`} " "`date`
 12     cd $dir
 13     ls -al | sed 1d >/tmp/psh$$ls2a
 14     ls -a | xargs -l file  | sed s"/://" >/tmp/psh$$ls2b
 15     join -j1 9 -o 1.1 1.3 1.4 1.5 1.9 2.2 2.3 2.4 2.5 2.6 \
 16          /tmp/psh$$ls2a /tmp/psh$$ls2b |\
 17     awk '{printf "%s %8s %8s %7d %14s <%s %s %s %s %s %s>\n",\
 18          $1,$2,$3,$4,$5,$6,$7,$8,$9,$10,$11}' |\
 19          sed s"/ *>/>/"
 20     if test X$recurs = Xyes; then
 21          echo;echo
 22          for i in *
 23          do
 24               if test -d $dir/$i; then
 25                    ls2 -r $dir/$i
 26               fi
 27          done
 28     fi
$ □
```

FIGURE 3: THE `ls2` SHELL SCRIPT

well as faster compilation, since after a change you only need to recompile the appropriate module(s) (say 200 lines) as compared to the entire program (some 1500 lines, for instance). Also, hard-copy printouts only need be made for the small module rather than for the entire program.

On the down side, this approach requires more typing on the invocation command line. For instance, instead of "cc bigfile.c" you'd type "cc mod1.c mod2.c mod3.o mod4.o", or whatever. The accompanying (Bourne) shell script (see Figure 2) solves this problem—and while we're at it—adds several more features useful for C programming.

The shell script is simply named `c`. All program modules should reside in the same directory, along with a copy of this shell script. [*Doctor's notes*: After making the script executable (enter `chmod u+x c`), you may invoke it by entering `./c` then the names of the source files. Alternatively, install the script in a directory that's included in your command search path (defined by the `PATH` variable).] Note that you should tailor line 17 for the C program modules in your working directory.

What does this shell script do? It speeds up program development by alleviating the repetitive entry required for the `cc` command line; it allows you to compile one or more modules, and then automatically links all modules and libraries easily; it provides an optional backup facility, an optional history of what was

changed and when, as well as alerting you with the terminal bell when all is finished or an error was detected. No . . . it doesn't make toast.

Here's a blow-by-blow description of how this shell script operates. Line 2 allows you to specify one C program name, several C module names, or use a wild card to compile all modules in your current directory. The `for` loop will step through each argument on the command line, processing them one at a time. Line 4 tells you what module is being compiled.

Line 5 tries to compile the program or module into a relocatable object file. When successful `cc` returns a zero, otherwise a one. If successful, line 7 prints "no problem" along with the module name. Lines 8 and 9 record the time and what changes you made since the module was last compiled. This feature is optional and you may choose to leave it out. The `for` loop will continue the same way processing the next argument, if any.

After all arguments have been processed control passes to line 16, which displays "LINKING NOW." Line 17 invokes `cc` again, this time to link all relocatable object modules to create the final executable program. Line 18 rings the bell when done.

If compilation (line 5) was not successful, you will see error mes-

sages generated by the compiler while line 12 rings a bell and says that you have a "PROBLEM."

If you choose to use the backup facility on line 10 you must have a subdirectory named `Backup` (or whatever you prefer). If you choose to use the "line change" history feature provided by lines 8 and 9 you'll need a subdirectory named `Diff-dir` containing source files with the same name as in your working directory.

Jack Pierce
President,
Superior Software Corporation
Augusta, Ga.

"KILLING" TWO BIRDS WITH ONE SCRIPT

Dear Dr. Thomas:

Enclosed is a (Bourne) shell script named `ls2` that combines the output of the Unix `file` utility with the output from the `ls -l` command to produce a single informative listing. Since I'm a new Unix system user, I find this script useful when exploring the various directories in the file system.

[*Doctor's notes*: See Figure 3 for a listing of `ls2`. The Unix `file` command performs a series of tests on the files named as arguments to classify the type of file. This output is appended to that produced by the `ls -l` command (minus the link count and time/date stamp) to give a composite listing. I took the liberty of replacing some of the author's code with `sed` and `awk` functions, making the overall script shorter and improving appearance of the output. If speed is an issue, interested readers could replace the `awk` command with appropriate `sed` commands; however, then the code for maintaining justified columns would be much more complicated.]

The script accepts two optional command line arguments, which may be specified in any order. Name a directory if you wish to list it instead of the current directory (the default). Specify the `-r` option to recursively list all directories under the starting directory.

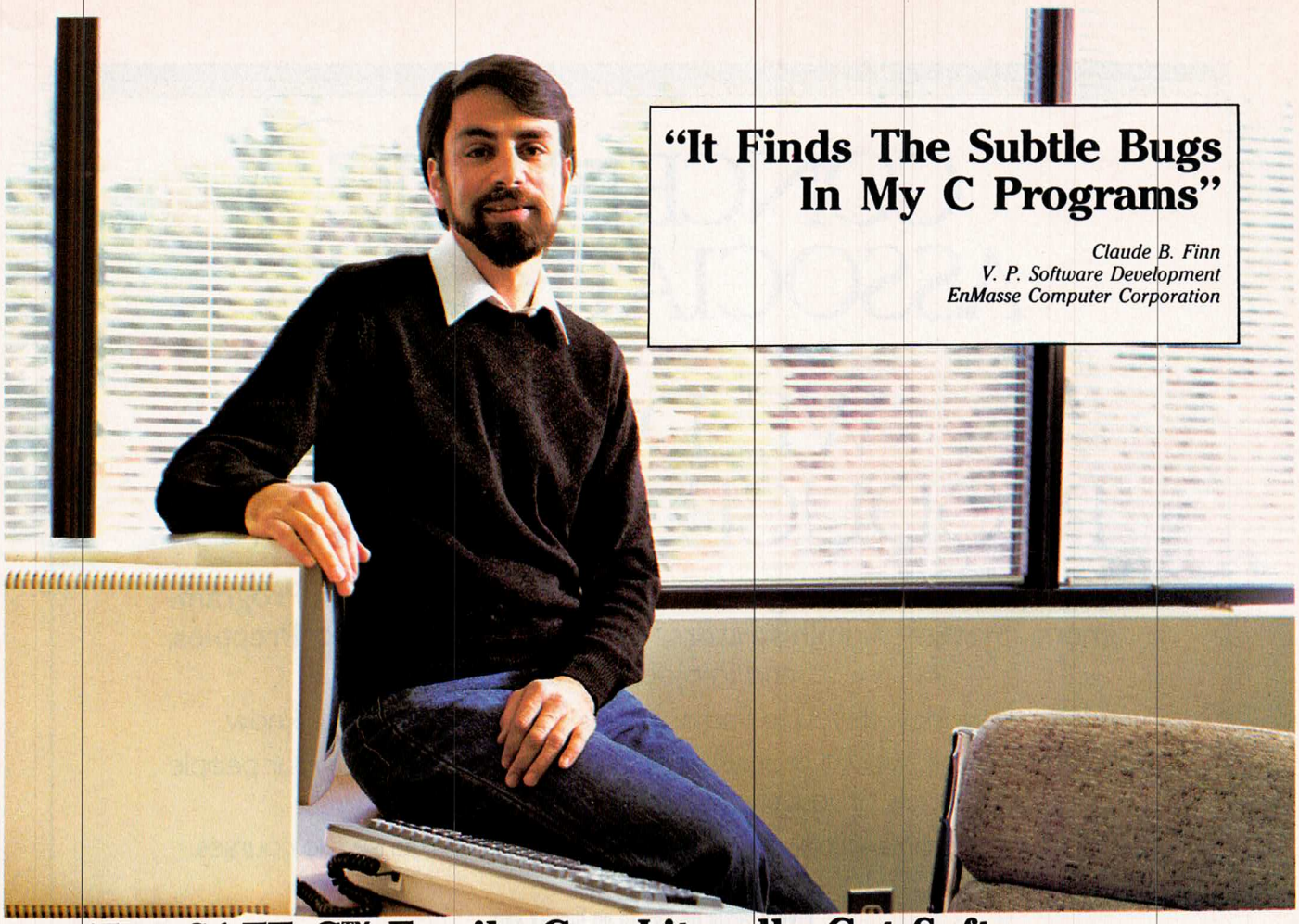
Paul Hite
Falls Church, Va.

"Wizard's Grabbag" is a regular feature of UNIX/WORLD. Mail your shell scripts, C programs, or other code, tips, techniques, or discussions that ease the burden of system administrators and programmers to "Wizard's Grabbag," UNIX/WORLD, 444 Castro St., Suite 1220, Mountain View, CA 94041. Or submit electronically using the route (from `ucbvax`): `ucbvax!sun!idi!uworld!sirius!beccat`.

Authors of published material receive $50 for their contributions. As a new feature, we'll pay $25 for questions of general interest that we publish. The best answer we receive will be published and its author will receive $50.

Guidelines: Please write your code so that it is as portable as possible across the currently popular versions of the Unix system (System V.x, 4.x BSD, Xenix, etc.) Some hints to achieve this goal include: Write Bourne shell scripts if possible, although C shell scripts are still welcome since most of our readers have access to this popular command interpreter. Use universally available utilities in shell scripts, such as `who am i` (all systems) in lieu of `whoami` (Berkeley only).

Use the standard I/O library when writing C code. Check your source code for non-portable constructions with `lint`. Hardware dependencies, such as terminal control sequences, should be eliminated, if possible. (Use `termcap` or `terminfo`.) Isolate non-portable code to one region or a separate module. Keep your examples compact, say under 100 lines of code, if possible. For instance, use `sed` in lieu of `ed` scripts, pipelines instead of intermediate temporary files, etc. □



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UW-1085

THE UNIX SYSTEM STARTER KIT THE sort FACILITY

BY BILL TUTHILL

Nobody outside the computer field knows what sort really means. It just isn't the sort of word used by the sort of people who haven't yet sorted out what computers are good for. These people alphabetize their records, or they put their Visa slips in order. But they don't sort them.

Just think about your laundry. You sort it. That's what computer people mean by sorting: organization.

CP/M and an early version of MS-DOS don't (PC-DOS 2.01 does have a primitive one) include a sort facility—you have to buy a database program, or something like it, instead. But all versions of the Unix system come with the sort command. It isn't called "alphabetize" because that's too hard to spell, and because sort does more than just alphabetize; it also puts numbers in order, and can also merge two ordered lists into a single list.

Unfortunately, the documentation for sort epitomizes what is bad about Unix system manuals. Despite the usefulness and complexity of the command, it has no tutorial introduction and no reference manual—only an incomprehensible manual page. Unlike most Unix system manual pages this one contains examples, but they aren't very well explained. So this month's column supplies a tutorial introduction to the sort program.

BEGINNING sort

In its simplest form sort alphabetizes a list, starting at the beginning of the line. If you have a list of names, last name first, it's easy (see Figure 1A). If the first name is first, you want to skip the first word on the line—so use the +1 option, as in Figure 1B.

Normally, sort organizes lines in a file according to machine collating sequence. On most computers, this would be ASCII order, but on IBM mainframes, it would be EBCDIC order (the IBM PC, though, uses ASCII). On most Unix systems, the file /usr/pub/ascii contains an ordered chart of the ASCII character set.

In ASCII ordering, upper case letters sort before lower case letters; if you want them folded together, use the -f option, and sort will consider upper case to be the same as lower case. For example, if you have the last names MacVay and Mack, sort will place MacVay first, unless you specify -f, because capital V comes before lowercase k.

In ASCII, punctuation marks are scattered between digits, upper case, and lower case; if you want sort to consider only alphanumeric characters, use the -d option to indicate dictionary ordering. This is especially useful with foreign languages, which often contain weird accent marks.

```
% cat names
McReynolds, Tom
Hamilton, Mary
McKee, Judy
% sort names
Hamilton, Mary
McKee, Judy
McReynolds, Tom
```

FIGURE 1A: SAMPLE LIST OF NAMES

```
% cat names
Tom McReynolds
Judy McKee
Mary Hamilton
% sort +1 names
Mary Hamilton
Judy McKee
Tom McReynolds
```

FIGURE 1B: SAMPLE LIST SORTED BY LAST NAME

NUMERIC VALUES

The sort program can also organize lists of numbers by numeric value. Suppose that the /usr file system has filled up, and you want to find out which directories are hogging the most disk space. If /usr contains protected directories, you need to be logged in as root to read them. See Figure 2.

The -rn argument indicates a reverse numeric sort (to put the biggest numbers at the top). These statistics show that Mr. McReynolds is using most of the system's available disk space; so this would be a good chance to practice your persuasion techniques on him. Note that, without the -n flag, sort would have placed the three lines in exactly the opposite order.

If you have two files that are already sorted, you can bring them together with the -m (merge) option. When doing this, you may also want to eliminate duplicates with the -u (unique) option, as shown in Figure 3. This may help save postage costs. You could also do this without the -m option, but it would take longer as sort would have to work to sort material which has already been sorted.

```
# du /usr | sort -rn
4134234 /usr/mcreynolds
3642312 /usr/mcreynolds/junk
3295    /usr/tut
...
```

FIGURE 2: SAMPLE OF A SORTED DIRECTORY DISK SPACE REPORT

```
% sort -mu mailing1 mailing2
```

FIGURE 3: SORT COMMAND TO ELIMINATE DUPLICATE NAMES

Continued on page 95

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Ordinarily `sort` breaks a line down into words, or fields. In the second example, for instance, +1 meant to skip the first word and sort on the second word. Fields are normally separated by white space (a blank or tab); However, you can tell `sort` to use a different field separator. The `/etc/passwd` file, for example, contains fields separated by the colon. Thus, when sorting the password file, use the `-t:` option.

To sort all users on your system by numerical user ID, try the command shown in Figure 4. The first field of the password file contains the user name, the second contains the encrypted password, and the third contains the numerical user ID. So you want to skip the first two fields, and use numerical sorting. Two users should never have the same numerical ID.

The computer industry still lives with the heritage of punched cards. Most VDT terminals have 80 columns, many printers are limited to 80 columns, and many database systems produce output with 80 columns. So it's not unreasonable to assume that someday you may have to sort a database with ZIP codes starting in column 60. Remember that you must give `sort` the number of columns to skip, not the starting column (see Figure 5).

The decimal place means to skip 59 spaces into field zero, which starts at the beginning of the line. Even if there are more fields on the line, it doesn't matter—`sort` will skip into following fields.

This covers most of the options, but there are a few others. For two of the best complete explanations of `sort` I've seen, see pages 352-359 of Mark Sobell's book, *A Practical Guide to the Unix System*, or pages 472-482 of *A User Guide to the Unix System* second edition by Dr. Rebecca Thomas and Jean Yates. □

```
% sort -t: +2n /etc/passwd
```

FIGURE 4: COMMAND TO SORT ALL SYSTEM USERS BY NUMERICAL ID

```
% sort +0.59 database
```

FIGURE 5: COMMAND TO SKIP CERTAIN COLUMNS WHEN SORTING

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.

NEW PRODUCTS

APOLLO UNVEILS TAPE DRIVE

Apollo Computer Inc. has introduced the MSD6250, a new dual density high-speed tape drive that increases the density of data stored on a reel of a tape by a factor of four, and speeds backup operations. The new tape drive provides a fast, dependable network resource which can be accessed by all users within a Domain network.

The MSD6250 tape drive is priced at $26,000, and is available 60 days after receipt of order. The monthly maintenance fee is $175, and the cost for field installation is $280.

For more information, contact Apollo Computer Inc., 330 Billerica Rd., MA 01824; 617/256-6600.

Please circle Reader Service Number 160.

CORVUS WORKSTATION

Corvus Systems Inc., manufacturer of the Omninet local area network (LAN), has introduced a high-performance, multitasking graphics workstation for OEM/VAR markets. It offers the power and features of leading graphics workstations at a substantially lower price.

Cheetah, the new full-function workstation, features the powerful 16/32-bit MC68010 microprocessor, Unix System V, up to 4 Mbytes of dynamic RAM, a transparent virtual memory, and a high-resolution, bit-mapped graphics monitor.

The Cheetah workstation offers the following features: a powerful microprocessor, graphics aspect ratio of 1:1, Unix System V, Intelligent disk controller, Omninet local area network, the Corvus Connection, system ports, and floating-point co-processor.

List price for the basic Cheetah workstation, including hard disk, is $9,995 (OEM and VAR discounts are available). Evaluation units are available now, with production quantities expected in early fall.

For more information, contact Corvus Systems Inc., 2100 Corvus Dr., San Jose, CA 95124; 408/559-7000.

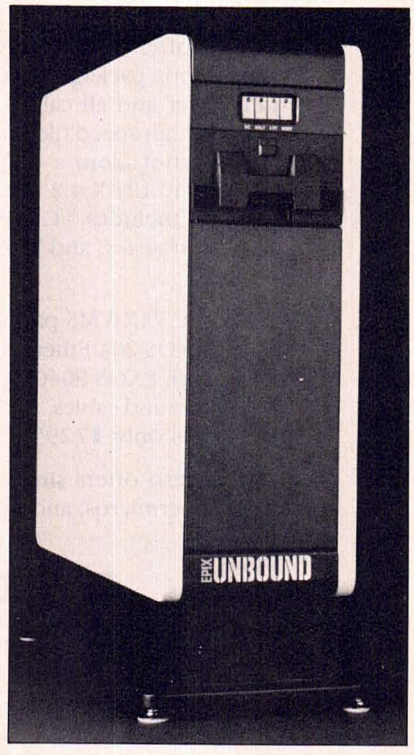
Please circle Reader Service Number 161.

UNBOUND 16-USER SUPERMICRO

Unbound Inc. has introduced a new modular supermicrocomputer incorporating Ultrix-11, a powerful DEC J11 microprocessor, and up to 369-Mbyte on-line disk capacity.

The new EPIX system, based on Unbound's Variable Storage Architecture, offers value-added resellers and Unix system end-users the advantages of Digital Equipment Corporation's Ultrix-11 (an enhanced Unix system).

The 16-user system accepts up to four full-height and one half-height five and one-fourth inch peripherals in a free-standing tower cabinet measuring only 24 inches high, 21 inches deep, and 7.5 inches wide.



Unbound Inc. introduces a new modular supermicro computer.

EPIX systems with a 74-Mbyte fixed disk, 5-Mbyte removable cartridge disk, 1-Mbyte main memory, eight channel multiplexer, and 16-user Ultrix license sell for $16,400. VAR and volume discounts are available.

For more information, contact Unbound Inc., 15239 Springdale St., Huntington Beach, CA 92649; 714/895-6205.

Please circle Reader Service Number 162.

PERKIN-ELMER'S FPS-5000

Perkin-Elmer Corp. has introduced the Floating Point Systems (FPS) 5000 Series of scientific array processors for users of its Series 3200 superminicomputers.

The FPS-5000 Series is designed to expedite large-scale arithmetic computations when attached to a superminicomputer.

FPS-5000 Series handles computationally intensive tasks at extraordinarily high speeds, ranging from eight million floating point operations per second (8 MflOPS) to 62 MFLOPS.

For more information, contact Perkin-Elmer Corp., 497 Hance Ave., Tintonfull, NJ 07724; 201/530-5900.

Please circle Reader Service Number 163.

ESPRIT'S IN VDT

Esprit Systems Inc. has introduced a new video display computer terminal that provides full emulation of the ADDS Viewpoint at a price of $395. Dubbed the ESP 6110+, the new Esprit terminal is designed with performance and comfort features to meet the needs of the Viewpoint replacement market.

The ESP 6110+ is an enhanced version of Esprit's ESP 6110. The new ESP 6110+ features a larger screen than the ADDS Viewpoint, better resolution, and four function

keys to provide users with full Viewpoint emulation.

The 6110+ operates at baud rates of 50 to 19,200, with an optional bi-directional auxiliary port interface for connection to a local hard copy or data input device. This includes either RS422 for data integrity at high baud rates, or current loop interface.

For more information, contact Esprit Systems Inc., 100 Marcus St., Melville, NY 11747; 1-800/645-4508.

Please circle Reader Service Number 164.

SOFTWARE CATALOG

Unisource Software Corp. has introduced the Unix Software Solutions Catalog, an 18-page guide to a complete line of microcomputer Unix system software products. Offerings range from the company's "flagship" product, the Venix/86 operating system, to the powerful Unify Relational Database to Unisource's newest product LaserLink.

The *Unix Software Solutions Catalog* contains all the standard business applications from spreadsheets to word processors, program development tools, and then some. Also included are some non-standard offerings such as the source code for the Venix/86 device drivers. The catalog additionally provides specific information on what packages work with which machines and guides the user in developing the particular hardware/software configuration to meet his needs. The catalog is free and available immediately.

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

Please circle Reader Service Number 165.

MUMPS AVAILABLE ON MOTOROLA

Motorola has announced that it is offering the Micronetics Standard MUMPS (MSM) programming language with its Series 6000, Unix system-based multiuser computers.

MUMPS will operate under the 6000's virtual memory operating system derived from Unix System V under license from AT&T.

The MUMPS licensing fee starts at $1995 and the product is available immediately.

MUMPS is also available on the Motorola Series 2000. The Series 2000 and the Series 6000 product families consist of 32-bit computers based on the Motorola 68010 microprocessor. Both product families support a full range of software including word processing, data processing, database management, and other office support functions.

For more information, contact Four-Phase Systems, 10700 N. DeAnza Blvd., Cupertino, CA 95014; 408/255-0900.

Please circle Reader Service Number 166.

ALLIANT INTRODUCES FX/8

Alliant Computer Systems Corp., Acton, Mass. has also introduced a field-expandable, entry-level supercomputer that offers performance never before available in its price range ($270,000 to $1,000,000).

The new FX/8 computer is the first to apply parallel processing (Alliant concurrency) automatically to software programs used in science and engineering, including existing

software programs that runs on Digital Equipment VAX systems.

The FX/8 supports two forms of parallel processing. Alliant concurrency simultaneously applies up to eight computational elements (CEs) to the execution of a single program. Multiprocessing applies up to 12 interactive processors (IPs) to the execution of independent user interactive jobs, the operating system, and all I/O.

An Alliant FX/8, configured with eight computational elements, delivers peak performance of 94 MFLOPS and 35.6 MIPs. Running the Linpack benchmark from Argonne National Laboratories in full 64-bit precision, a fully configured FX/8 delivers more than 12 times the performance of the top-of-the-line Digital Equipment VAX 8600.

For more information, contact Alliant Computer Systems Corp., 42 Nagog Park, Acton, MA 01720; 617/263-9110.

Please circle Reader Service Number 167.

PPI EXPANDS OBJECTIVE-C

Productivity Products International (PPI) has expanded and is now marketing a broader version of their popular Objective-C, a compiler that accepts the full C Language, plus PPI-developed message/object extensions. The reusable Objective-C dramatically reduces the bulk of paper and code throughout the development of various user programs.

Objective-C is available for such Unix systems as Sun Microsystems, HP 9000-200 and 500, Digital VAX 730, 750, 780, 785, and 8600, Digital's VME family, Data General ADS/VS family, IBM PC, and a variety of other popular systems.

Available for $400 for use with the IBM PC, and up to $7200 with Digital's VAX 730, users receive a complete package, including a 280-page reference manual; executable code on floppy disks or magnetic tapes; two libraries of 40 reusable Software-ICs from which to build a compiler or new products; plus a seat in a two-day concepts course and one-year maintenance.

For more information, contact PPI Inc., 27 Glen Rd., Sandy Hook, CT 06482; 203/426-1875.

Please circle Reader Service Number 168.

7300 UPGRADES FROM CMS

Upgrade kits, expansion boards, and add-on products that enhance performance and capability of the recently introduced AT&T 7300 PC and the new Compaq 286 Deskpro and Portable computers are now available from CMS, Inc.

Upgrade kits include a 20-Mbyte hard disk, RAM cards that allow memory expansion to 1.5 Mbyte, and serial/parallel I/O boards that allow hook-up to additional peripherals. Products available in kits are also available separately, including a combo board that combines RAM memory and I/O port expansion.

Tape backup systems offering 25-, 45-, and 60-Mbyte storage capacity with streaming (mirror image), start/stop (file by file), and random access (file update) read/write modes are also available from CMS.

CMS upgrade kits including 20-Mbyte hard disk, 384K byte additional RAM, and I/O card with serial and parallel ports carries a dealer price in volume of $1195. The RAM card is user upgradable to 1.5 Mbyte with 256K-byte chips. Separately, the hard disk is $995, the RAM card

(384K byte) is $295, the I/O card (half-card) is $95 and the combo RAM-I/O card (with 128K byte, expandable to 3 Mbyte) is $295. Tape backup systems carry dealer volume prices of $695 for 25-Mbyte, $950 for 40-Mbyte and $995 for 60-Mbyte. All are available immediately.

For more information, contact CMS, 401-B W. Dyer Rd. Santa Ana, CA 92707; 714/549-9111, 953-0407.

Please circle Reader Service Number 169.

MINX MANUFACTURING SYSTEM

Minx Software Inc. has introduced the Minx Information System, a comprehensive, fully integrated line of standard manufacturing and financial management products. The system is designed to assist management in the supervision of marketing, engineering, materials and production control, and finance.

The Minx Information System consists of 13 modules, including accounts payable, accounts receivable, general ledger, inventory management, material requirements planning, purchasing and shop floor control. A sales order administration module is planned for September.

Included with the system is the Minx spreadsheet, an electronic spreadsheet that allows you to analyze information within the system.

Hardware requirements for the system are a minimum of 30 Mbytes for disk storage and at least 1-Mbyte of main memory. The system is available in a minimum configuration of 10 users for $35,000. Additional users, in increments of 10, cost $1000 per user.

System support includes five days of training; full documentation, which includes a self-paced implementation guide; and future enhancements. A software subscription service is available for a $4200 yearly fee.

For more information, contact Minx Software Inc., 4966 El Camino Real, Los Altos, CA 94022; 415/969-6528.

Please circle Reader Service Number 170.

ALLIANT VECTOR PROCESSING

Alliant Computer Systems Corp. has introduced the FX/1, a disk-high, multiprocessing superminicomputer that is said to be the first in its price class to provide integrated vector processing.

The FX/1 incorporates vector processing. As a result, the FX/1 typically delivers two times the performance of the Digital Equipment VAX 8600. The FX/1 runs existing software programs used in engineering and science, including those that run on VAX systems.

Priced at $132,000 for a complete system, the FX/1 addresses many market needs. It can be used as a multiuser departmental system, a computational server on a network of engineering workstations, or as a personal supercomputer. A system configured for original equipment manufacturers (OEMs) is available for $99,500 and is fully discountable to 41 percent.

For more information, contact Alliant Computer Systems Corp., 42 Nagog Park, Acton, MA 01720; 617/263-9110.

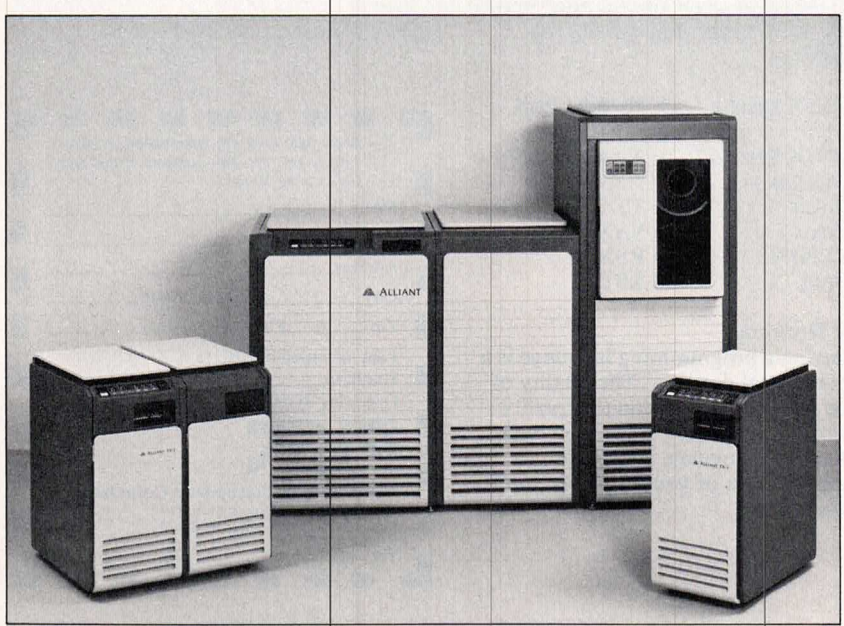
Please circle Reader Service Number 171.

PLEXUS UPS MEMORY

Plexus Computers Inc. said high density memory boards based on 256K RAM chips that boost memory capacity of the P/35 and P/60 computers by 400 percent are now available.

1-, 2-, and 4-Mbyte boards are also available. In a related move, Plexus also announced it is offering an Enhanced Mass Storage Processor (EMSP) in conjunction with a larger 600-Mbyte Fujitsu hard disk drive for the P/60.

With the new memory boards, capacity can be increased from 2 to 8 Mbytes on the Plexus P/35 and



The Alliant FX/Series: FX/8, an entry level supercomputer and FX/1, a superminicomputer.

from 4 to 16 Mbytes on the P/60. The new EMSP disk controller provides improved random disk access and allows the P/60 to utilize the larger storage facilities of the Fujitsu drive as well as existing drives.

The new EMSP can control up to 4 SMD drives at transfer rates of 1.9 Mbytes per second. EMSP handles the more sophisticated and higher capacity drives at a faster transfer rate.

For more information, contact Plexus Computers Inc., 3833 N. First St., San Jose, CA 95134; 408/943-2248.

Please circle Reader Service Number 172.

MOTHERBOARD FOR PC

Unisource Software Corp. has signed an agreement with Wave Mate Inc. to sell Wave Mate Inc.'s new XT motherboard—the Bullet-286—throughout North America.

The Bullet-286 enables an IBM PC/XT, Portable PC or Tandy 1200 to run up to 6 1/2 times faster—faster even than an AT. It can be installed in less than ten minutes using only a screwdriver, completely replaces the XT's own motherboard, and preserves PC hardware and software compatibility.

The Bullet-286 is available immediately at a cost of $2495.

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

Please circle Reader Service Number 173.

IMAGEN'S NON-IMPACT PRINTERS

Imagen Corp. has introduced the ImageStation Series of text and graphic laser printers for the workstation market.

The ImageStation Series consists of three models: The Executive, priced at $5950; the Designer, priced at $6400; and the Innovator, priced at $7200. All three models

use the popular Canon CX printing mechanism and print eight pages per minute on up to 14-inch cut sheet paper.

The Executive is intended for text and business graphics, the Designer for increased graphics support, and the Innovator for the most demanding graphics, including the printing needs of very sophisticated computer-aided design (CAD) and computer-aided engineering (CAE) applications.

Each printer includes Courier 8-, 10-, 12-, and 14-point typefaces, with 10- and 12-point bold, in all orientations—portrait, landscape and inverted. Optional fonts may be host-resident or printer-resident, which eliminates down-loading time.

All ImageStation products have a resolution of 90,000 dots per square inch (300 by 300) and use dry toner and plain paper. They support many host computers running the Unix operating system, including those manufactured by Digital Equipment Corp., Sun Microsystems Inc. and Apollo Computer Inc.

All three ImageStations are available immediately.

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

Please circle Reader Service Number 174.

OFFICELAN 6300 LINKS UP TO 1,000 PROCESSORS

Motorola Information Systems has introduced OfficeLAN 6300, a combination hardware/software system that allows as many as 1000 Motorola System 6300 Office Information Systems to be connected in a high-speed, baseband local-area network.

The initial product offering, OfficeLAN 6300, transmits data via coaxial cable at speeds up to 10 Mbits per second. Each 6300 processor attached to the LAN must have installed an intelligent LAN controller board or a combination RS232/LAN board. Both boards provide the physical link and data link to the network; the combination board also provides additional serial interface ports.

The LAN controller board will be available for $1195 per processor, and the LAN software will be licensed at $1300 per processor. All are available immediately, including the combination RS232/LAN board.

For more information, contact Four Phase Systems, 10700 N. DeAnza Blvd., Cupertino, CA 95014; 408/864-4783.

Please circle Reader Service Number 175.

MARKET DIRECTORY

Unisource Software Corp. has published the *Unix Market Directory,* an up-to-date and cross-indexed listing of Unix system software, hardware, and services.

The 80-page guide was developed by Urban Software Corp. and contains 24 categories of software product listings from Accounting to Graphics to Word Processing; vertical market products for 19 industries such as Advertising, Law, and Real Estate; and service listings in five areas including Software Distribution, Timesharing, and Training. The *Unix Market Directory* retails for $18.00.

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

Please circle Reader Service Number 176.

PALOMINO DEBUGGER

Palomino Computer Systems, Inc. has introduced SADB, a stand-alone debugger, to speed and simplify the debugging and maintenance of operating systems and drivers.

SADB runs co-resident with the host operating systems to provide advanced operating system debugging capabilities.

SADB features include full symbolic name support (including many C language data structures), disassembler, single line assembler, eight forms of breakpoints, command level programming with flow control, command aliases, Unix file system access, structured data print-outs, and much more. SADB requires 256K bytes of main memory that is unused by the host operating system.

SADB is currently available for M68000 microprocessors running AT&T System V, M68000 version. The license fee to run SADB on one to five machines is $15,000. This initial license fee includes porting SADB to the target system plus six months maintenance. Ports to new machines for SADB licensees run from $5000 to $10,000, depending upon the complexity of the port. The license fee for more than five machines is $3000 per machine.

For more information, contact Palomino Computer Systems Inc., 5777 South Rural Rd., Suite 4, Tempe, AZ 85283; 602/897-UNIX.

Please circle Reader Service Number 177.

SUNBURST SOFTWARE AVAILABLE TO PERKIN-ELMER USERS

Sunburst Software, a complete set of financial applications designed by Sunburst Software, Ltd., is now available to users of Perkin-Elmer Series 3200 superminicomputers.

Modular in design, Sunburst Software features an extensive selection of financial applications including accounts payable, accounts receivable, general ledger, inventory control, job costing, and point of sale. A professional management module comprised of a word processor, spreadsheet, and database manager affords an easy-to-use tool for planning, modeling, and analyzing data. These menu-driven modules are available individually or in a combination.

For more information, contact Perkin-Elmer, 497 Hance Ave., Tintonfull, NJ 07724; 201/530-5900.

Please circle Reader Service Number 178.

80286-BASED WORKSTATION, FILE SERVER

MAD Intelligent Systems has introduced two new products for OEMs and VARs: its D1000 Workstation Series and F2000 File Server Series.

Both systems are based on the 80286 microprocessor. These products will run XENIX 3.0 and IBM DOS 3.10 at NCC, and use IBM's Profes-

sional Graphics and Digital Research's GEM packages to display their impressive high-resolution color graphics capabilities. Both systems also support MS-DOS 3.1, MS-Net, Venix, and Concurrent DOS operating systems.

For more information, contact MAD Intelligent Systems Inc., 2950 Zanker Rd., San Jose, CA 95134; 408/943-1711.

Please circle Reader Service Number 179.

CRYSTALWRITER FOR 7300

Syntactics Corp. has introduced a version of the CrystalWriter Word Processor for AT&T's new Unix PC 7300.

The new version of CrystalWriter supports the system's three-button mouse, multiple windowing feature, and 35 function keys. The program offers completely new documentation and on-line help files tailored for the Unix PC.

CrystalWriter also supports the PC 7300's electronic mail system: Files created with CrystalWriter can be used directly for data transmission without reformatting.

The new version of CrystalWriter is available immediately for $595 from Syntactics. Quantity discounts are offered.

For more information, contact Syntactics Corp., 3333 Bowers Ave., Suite 145, Santa Clara, CA 95054; 408/727-6400.

Please circle Reader Service Number 180.

THE CONNECTOR

Unisource Software Corp. has introduced The Connector program for the AT&T PC 6300. The Connector allows personal computer users for the first time to run both DOS programs such as Lotus 1-2-3 and dBase II and the group productivity features of the Unix System such as multiuser, multitasking, and networking.

In addition to the PC 6300, The

Connector runs on the IBM PC/XT, AT and compatibles. The Connector is distributed on a single diskette and retails for $350.

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

Please circle Reader Service Number 181.

TEKTRONIX AI SYSTEMS

Tektronix's Information Display Group has introduced the new 4405 and 4406 Artificial Intelligence (AI) Systems.

Engineered to be a cost-effective AI development tool and delivery system for complex applications, the new 4406, priced at $23,950 (U.S. only), is powered by the new Motorola 68020, and assisted by a 68881 floating point co-processor.

The 4406 includes a 19 inch, 60-MHz display with a resolution of 128 x 1024, 2 Mbytes of dynamic RAM (expandable to 4 Mbytes), a 32-Mbyte virtual memory address space, and a 90-Mbyte hard disk (with 5¼ inch floppy).

The new 4405 designed for a personal programming tool or application delivery system costs $14,905 (in the U.S.).

Please circle Reader Service Number 182.

TRANSTEXT LINKS MOTOROLA, IBM DISOSS

Motorola Information Systems has introduced TransText, a series of software programs that allows its 4000/5000 minicomputers to communicate with an IBM Office Systems Network via DISOSS, the IBM Distributed Office Support System.

Transtext will provide Motorola users with document management capability within the DISOSS network, including the integration of data files with text and distribution of documents.

Motorola users can transfer documents in one of three programs. TransText Native Form provides Series 4000 or 5000 users with the capability to assemble and transfer ForeWord word processing documents in their native modes via DISOSS to other Series 4000/5000 systems tied into the network.

TransText Revisable Form allows documents to be exchanged between users, edited, then returned to the originator in a form that is compatible with IBM's Revisable Form Text Document Architecture.

The Transtext Interface, Native Form and Final Form are available immediately at licensed prices of $6,000, $800 and $1,000 respectively. TransText Revisable Form will be available in November at a licensed price of $1,500.

For more information, contact Four Phase Systems, 10700 N. DeAnza Blvd., Cupertino, CA 95014; 408/864-4873.

Please circle Reader Service Number 184.

MDT COMPUTER & TAX SERVICES

MDT Computer & Tax Services has ported the entire Myte Myke software line to the Molecular System 16/200 and the TRS-80 Tandy Model 16/600, both machines running under the Xenix operating system. Additional Xenix/Unix system machines are also being planned.

The Myte Myke Software contains the following intergrated modules: Business System, Order Entry-Billing, Inventory Control, Sales Analysis, Accounts Receivable, Accounts Payable, General Ledger, and Purchansing. They are designed for both business and manufacturing applications.

For more information, contact MDT Computer & Tax Service, 905 Harlem Rd., Suite 9 West Seneca, N.Y. 14224; 716/822-1185.

Please circle Reader Service Number 185.

BRIDGE'S TCP/IP LAN PROTOCOLS

Bridge Communications has introduced a family of Ethernet local-area network (LAN) communication servers and internetwork gateways implementing the TCP/IP protocols standardized by the Department of Defense and widely adopted by the CAE/CAD/CAM community.

The family's three new members are the GS/3-IP-based Ethernets; the CS/1SNA-TCP/IP, the first gateway permitting interconnection of two remote TCP/IP, the first server providing TCP/IP-based hosts and Bridge server-interfaced products with access to IBM SNA hosts over Ethernet; and the CS/100-TCP/IP, a low-cost terminal server linking up to 14 RS-232 devices to a TCP/IP-based Ethernet.

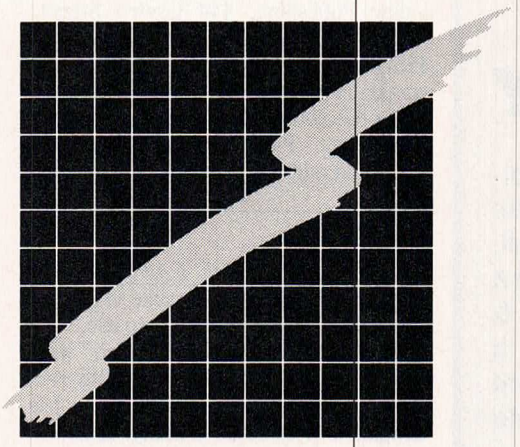
The CS/100-TCP/IP is priced at $5400 (14-port configuration) plus a $250 annual software fee; the CS/1-SNA-TCP/IP is priced at $13,000 plus a $1000 software fee; and the GS/3-IP is priced at $10,500 plus $250 for software. All are available immediately.

For more information, contact Bridge Communications Inc., 1345 Shorebird Way, Mountain View, CA 94043; 415/969-4400.

Please circle Reader Service Number 186.

UNIX/WORLD'S "New Products"" section is provided as a service to our readers, and our selection criteria are based solely on the needs of our readership. If you would like to have your product news considered for publication, please address your correspondence to UNIX/WORLD Magazine, New Products Editor, Castro St., Suite 1220, Mountain View, CA 94041. Because of the large number of press releases we receive, UNIX/WORLD cannot verify the accuracy of claims made by a product's manufacturer. We advise that you thoroughly test any product before buying.

MEET A WONDERFUL BUNCH OF SQUARES.



YATES

121 to be exact.

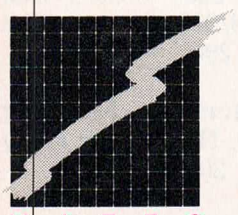
And when they position themselves correctly, we think they form a stunningly handsome logo.

The fact that it just happens to be our logo has little to do with it. Well o.k., maybe more than a little.

What we think is really important though, are the services and products that this logo represents—the computer industry's most comprehensive marketing research, product evaluation and information resource available.

In the coming months you'll be seeing more of this logo and learning a lot more about what and who it represents.

For the meantime though, we just wanted to be sure you were properly introduced.



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Readers who have computer merchandise or services to sell, buy, or trade and 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. 415/940-1500. 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.

VI & NROFF MADE EASY!—Color-coded beginner's guides make vi & nroff -ms simple to learn and easy to use. "Let Vi Do It" and "The Nroff Sampler," written by M. Howard Hall, a nationally recognized Unix spokesperson who has simplified vi & nrof f training. Available by mail-order only. $52.00 per set. (Calif. residents must add $3.25 sales tax.) Send check or money order to OFFICE COMPUTER INTERFACE, 805 S. Fremont Ave., Alhambra, CA 91803. (818) 289-4433.

WE WANT A UNIX COMPATIBLE—screen painter package. Please contact Victor Drilea, Data Prompt, Inc., 3004 Oak Dr. Kensington, MD 20895; 301/942-7505. □

System Interface And Protocols: October 30–November 1, San Diego, Calif. Contact Herb Stern, Center for Advanced Professional Education, 714/261-0240.

The Unix System For The DP Professional: November 4–8, Washington D.C. Contact Webco, 301/498-0722.

Unix For Users Including Shell Programming: November 4–6, Los Angeles, Calif. Contact AIQR Registrar, 408/978-2911 or 800/621-0854 Ext. 290.

Shell Programming: November 4–5, Edison, N.J. Contact Cindy Capria, AUXCO, 201/572-5075.

Programming In LISP And PROLOG: November 5–8, Palo Alto, Calif. Contact ICS, 213/417-8888, inside Calif. 800/352-8251, outside Calif. 800/421-8166.

Computer Graphics: November 5–8, Boston, Mass. Contact ICS, 213/417-8888, inside Calif. 800/352-8251, outside Calif. 800/421-8166.

Unix Tools: November 6–8, Edison, N.J. Contact Cindy Capria, AUXCO, 201/572-5075.

Hands-On Unix For Programmers: November 6–8, Bellevue, Wash. Contact David Cheyette SSC, 206/367-UNIX.

C Programming: November 7–8, Los Angeles, Calif. Contact AIQR Registrar, 408/978-2911 or 800/621-0854 Ext. 290.

C Unix Interface: November 11–15, Edison, N.J. Contact Cindy Capria, AUXCO, 201/572-5075.

C Data Concepts For Managers: November 11–12, Tarrytown, N.Y. Contact Sessions & Gimpel Training Assoc., 617/429-6350.

Unix vi Editing: November 12, Washington D.C. Contact Webco, 301/498-0722.

Advanced Editing: November 13–14, Washington D.C. Contact Webco, 301/498-0722.

C Data Concepts For Programmers: November 13–15, Tarrytown, N.Y. Contact Sessions & Gimpel Training Assoc., 617/429-6350.

Introduction To nroff: November 15, Washington D.C. Contact Webco, 301/498-0722.

The Concepts Of Object-Oriented Programming: November 18–19, Annapolis, Md. Contact PPI, 203/426-1875.

Legal Issues In Acquiring And Using Computers: November 18–19, New York City. Contact Data Processing Institute Registrar, 212/580-5200.

C Programming Workshop: November 18–22, Merrimack, N.H. Contact Suzanne B. Battista, Plum Hall Inc., 609/927-3770.

System Administration: November 18–21, Edison N.J. Contact AUXCO, 201/572-5075.

To further the education of Unix systems users and professionals, Unix/World each month provides a calendar of events as a service to our readers. Please send information about your seminar, trade show, or course to Calendar Editor, Unix/World Magazine, 444 Castro St., Suite 1220, Mountain View, CA 94041. All items should include a title, a brief description of the course, seminar, or trade show, the date of the event, the city and state where it will be held, the name of the sponsoring company or organization, and an address and phone number for further information. Please submit all items at least four months in advance. □

Continued from page 110

A MATTER OF GOALS

So it seems that the answers to our questions regarding computer training programs revolve largely around an individual's personal goals. Is he or she most interested in job security? Or are they really looking for a springboard to aspects of computers and computer science that go far beyond the typical training available from many commercial training schools?

In the former case, word processing and "commercial" programming courses may hold some value, as we've seen above—though questions of job obsolescence still linger in the background. In the latter case, however, we must strongly question whether many of these courses will provide much significant middle- to long-term benefit for the student.

In cases where the student's aspirations go far beyond the materials of the training courses, it might well be the case that their money would be better spent pursuing other avenues (when practical) to learn about computing. Some college courses, even on an extension basis, may be of real value to many such persons.

Outside of their more directed technical content, such courses also frequently offer the student considerable access to computers for their own experimentation. In addition (nowadays at least), colleges tend to teach structured languages as a first choice rather than concentrating on the older, unstructured languages more commonly used in business computing but used less and less frequently in other applications.

Another possibility, where feasible, is to combine the somewhat "mundane" training of the commercial courses with outside learning of various sorts. This could include extension classes, a moderately-priced home computer (though choice of particular unit might be critical to real learning), participation in local "computer clubs," and similar activities.

Some commercial training courses may play a useful role in establishing a person's computer-oriented career—but if depended upon for all training, this career might turn out to be limited and might gradually even become obsolete. To the extent that such courses are augmented through other learning, a person has a much better chance of establishing a career base with a solid prospect of being both rewarding and secure. □

--Lauren--
UUCP: {ihnp4, decvax,
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!vortex!lauren

Lauren Weinstein is a computer/telecommunications consultant living in Los Angeles. He has been involved in an array of projects that range from the mundane to the bizarre.

TRAINING FOR OBLIVION?

BY LAUREN WEINSTEIN

We've all heard them . . .

"Can a phone call change your life? This one quite possibly might . . . ."

Such lines are the common bait in a variety of "train for a new career" promotions—usually in the form of slick TV ads suggesting new careers in almost every possible field, from plumbing to bartending. In some cases, the ads are timed to tie in with a particular program (for example, some ads for a form of "paramedic" training are running with reruns of the old "Emergency" program—itself a show about Fire Department paramedics).

Probably the most numerous of these career training commercials are the ones offering an "exciting new career" in the field of computers. Some offer lucrative positions in hardware maintenance (oh boy!), but most are oriented toward programming or word processing.

Because of the pervasiveness of these advertisements, it's getting increasingly common for people already working in the computer field to be asked by friends if these training programs are really of any use. People who are bored by their current jobs, or who are unemployed and searching desperately for a job that won't become technologically obsolescent too quickly, are easy prey for the claims made by many of these commercials.

The question is, do these training programs offer a viable entry into the world of computing? Can someone who wants to learn how to do all sorts of amazing and creative things with computers get a start through such training? How should we answer if someone asks us, as persons already in the computer field, if these courses are of use? There is considerable cause to wonder.

WORD PROCESSING

A lot depends on what a person *really* expects from this training. For somebody who would be happy being a word processor, which often seems to entail fairly simplistic entering and manipulating of previously prepared text for eight hours a day, a word processing course might be of considerable value. This could be particularly true if this person's current job prospects/training are fairly dismal. There's certainly going to be more job security in word processing than in steel manufacturing—that much seems pretty clear.

Of course, even some word processing jobs may be threatened by advanced optical text scanning systems, the potential (still down the line a ways) for voice-to-text systems, and other possible developments. But for the middle-term at least, word processing would seem to represent a comparatively stable, though boring by some standards, career alternative.

COBOL NEVER DIES?

But what of the person with somewhat loftier goals—someone who wants to become involved in systems programming, graphics, or innovative applications of various sorts? Will the training programs offering a programming career provide the needed stepping-stone?

One can't help but have serious doubts. While there are exceptions, many of these training programs concentrate on areas that many of us would consider to be limited and boring at best. Often the languages taught in these courses are selected from the narrow menu of BASIC, FORTRAN, and COBOL, with perhaps some specialized report generating languages on the side.

The sorts of programming taught are often limited to the same old accounting, inventory, report generating, and similar necessary (but let's face it—mundane) applications that have been written in these languages for many years. Now, I'm not saying that such programs are unimportant. After all, COBOL programs generate most people's paychecks! But this is hardly promising material for someone who envisions an "exciting career" as promised by the ads.

OBSOLETE?

True enough, a bright person may be able to train in unstructured languages/accounting applications and move forward into other areas—into the more interesting areas that he or she really wanted to pursue. But how often is this possible? It seems likely that most of these persons will never be able to move much beyond the boundaries of the training material taught, not necessarily due to any deficiencies on their part, but rather due to the structure of their jobs and the sorts of work on which they have to spend most of their time.

Even worse, many of these jobs, which in some cases people might seek more in search of "stability" than anything else, would also seem to be fairly vulnerable to becoming obsolete in their own right. While the claims made for "automatic programming systems" of various sorts are usually vastly exaggerated, there is little doubt that programming related to accounting, inventories, report generation, and similar areas, may be susceptible to a considerable degree of automation.

To the extent that such automation takes place, people who were searching for job security may still find themselves in the technological "doghouse" as advances make the sorts of programming for which they trained increasingly obsolete.

Continued on page 109

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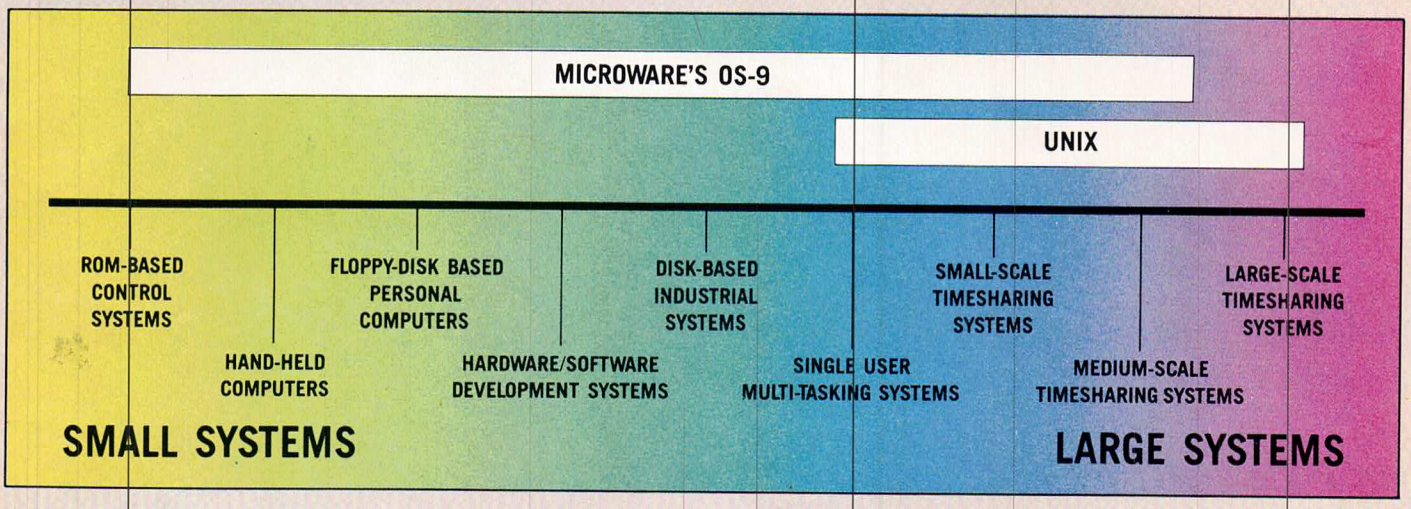

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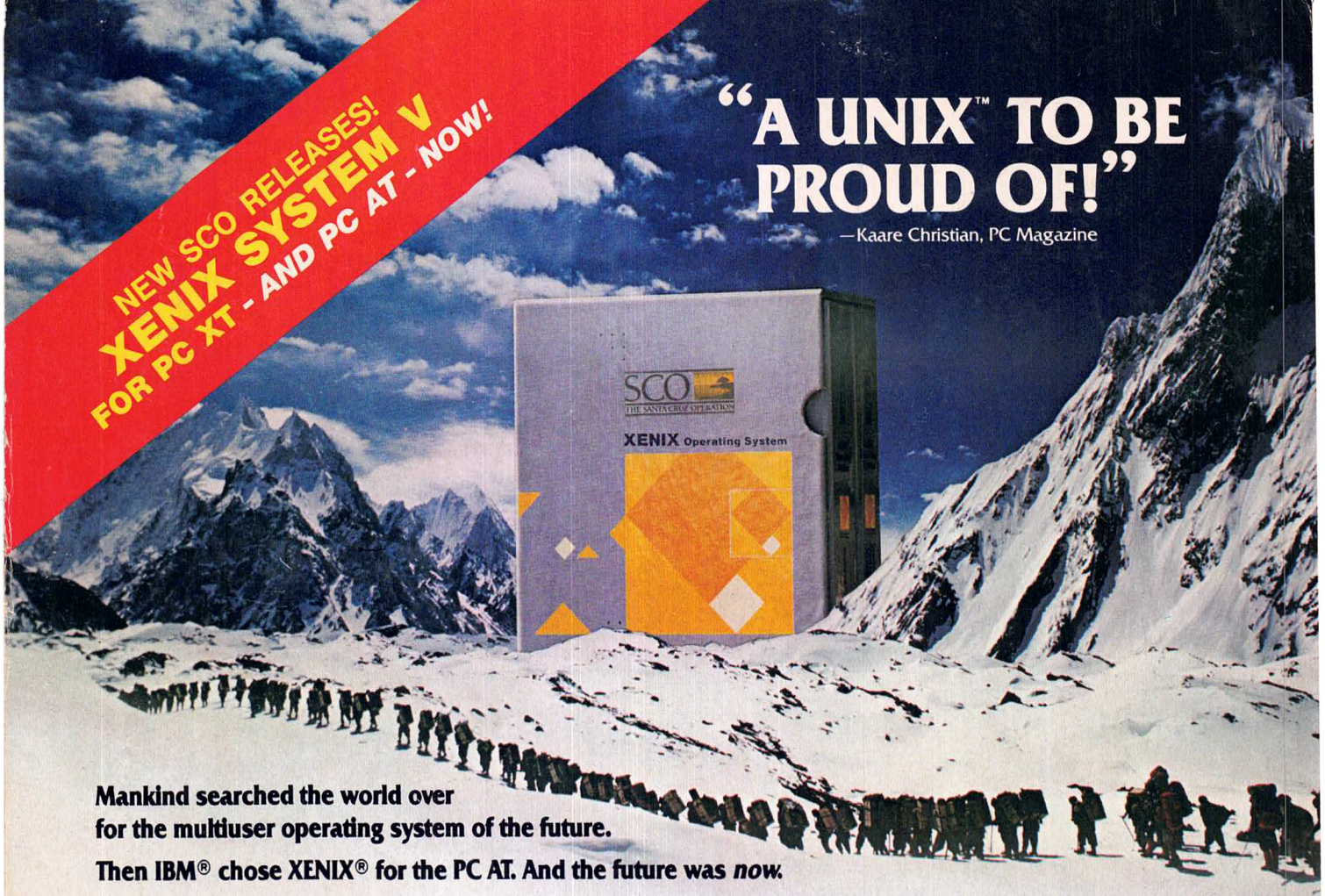

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