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UNIX/WORLD

THE MAGAZINE FOR MULTIUSER, MULTITASKING SYSTEMS

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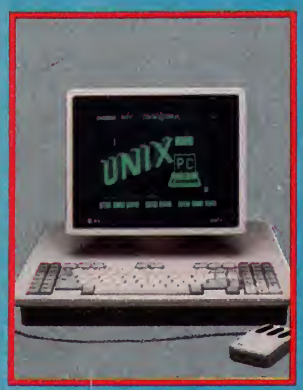

UNIX SYSTEM WORK-ALIKES

REVIEW:
AT&T's Unix PC: Unix For The Masses?

Systems Administration V: File System Backup

Getting Started: Rules of the Game

Buyers' Guide to Work-Alikes

Inside Edge: Encore, Flexible Update

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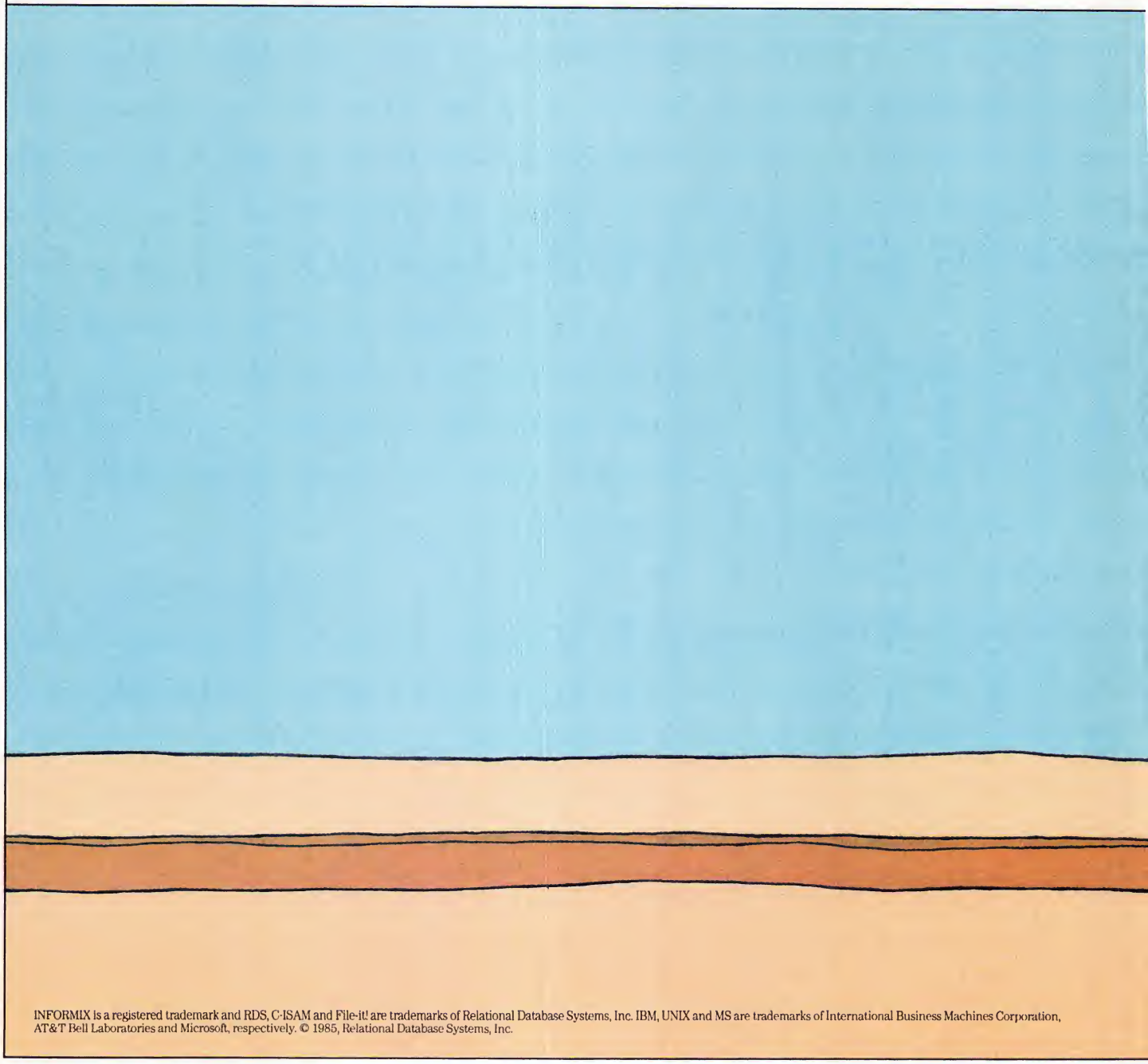

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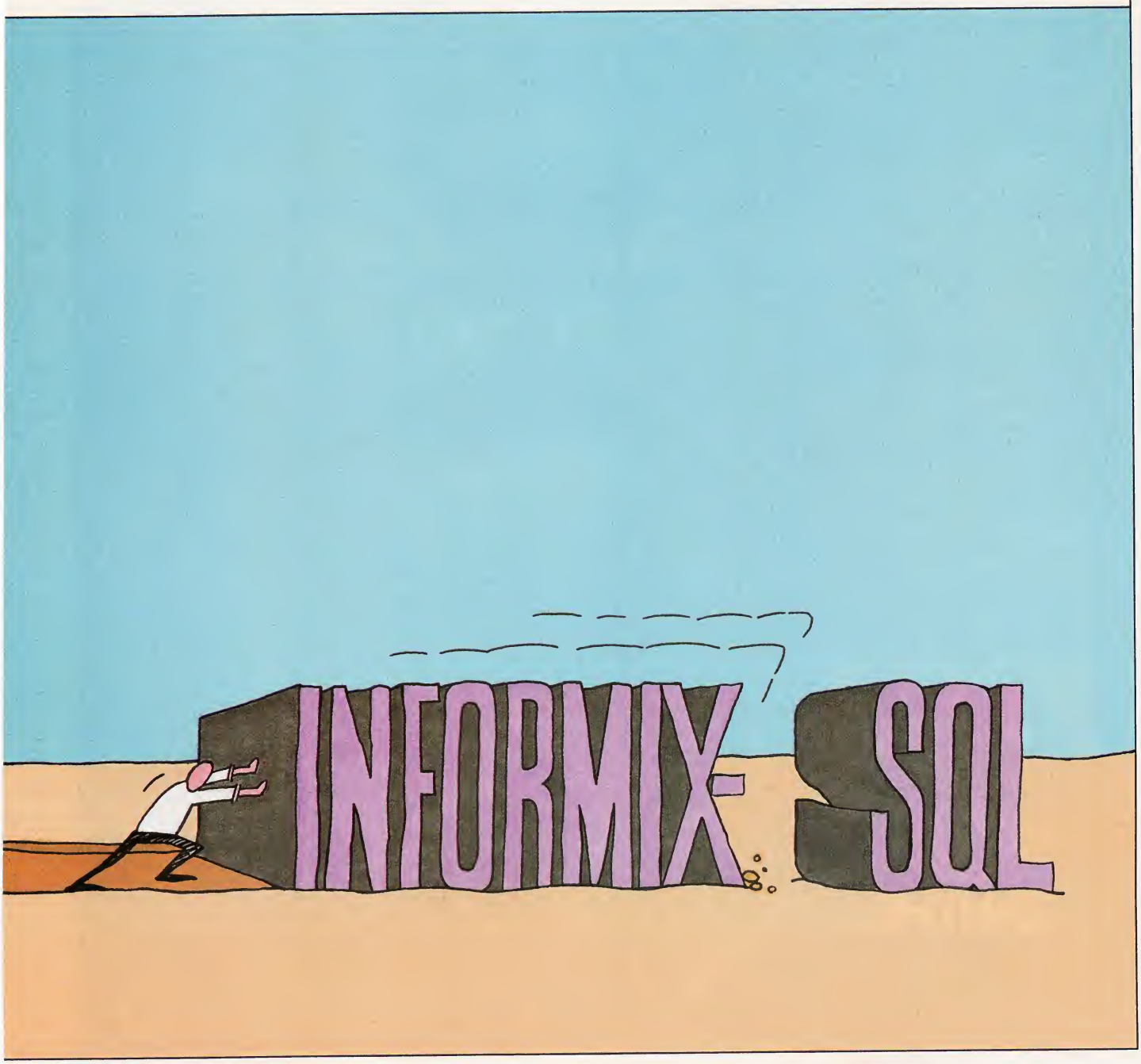

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VOLUME II, NUMBER 8

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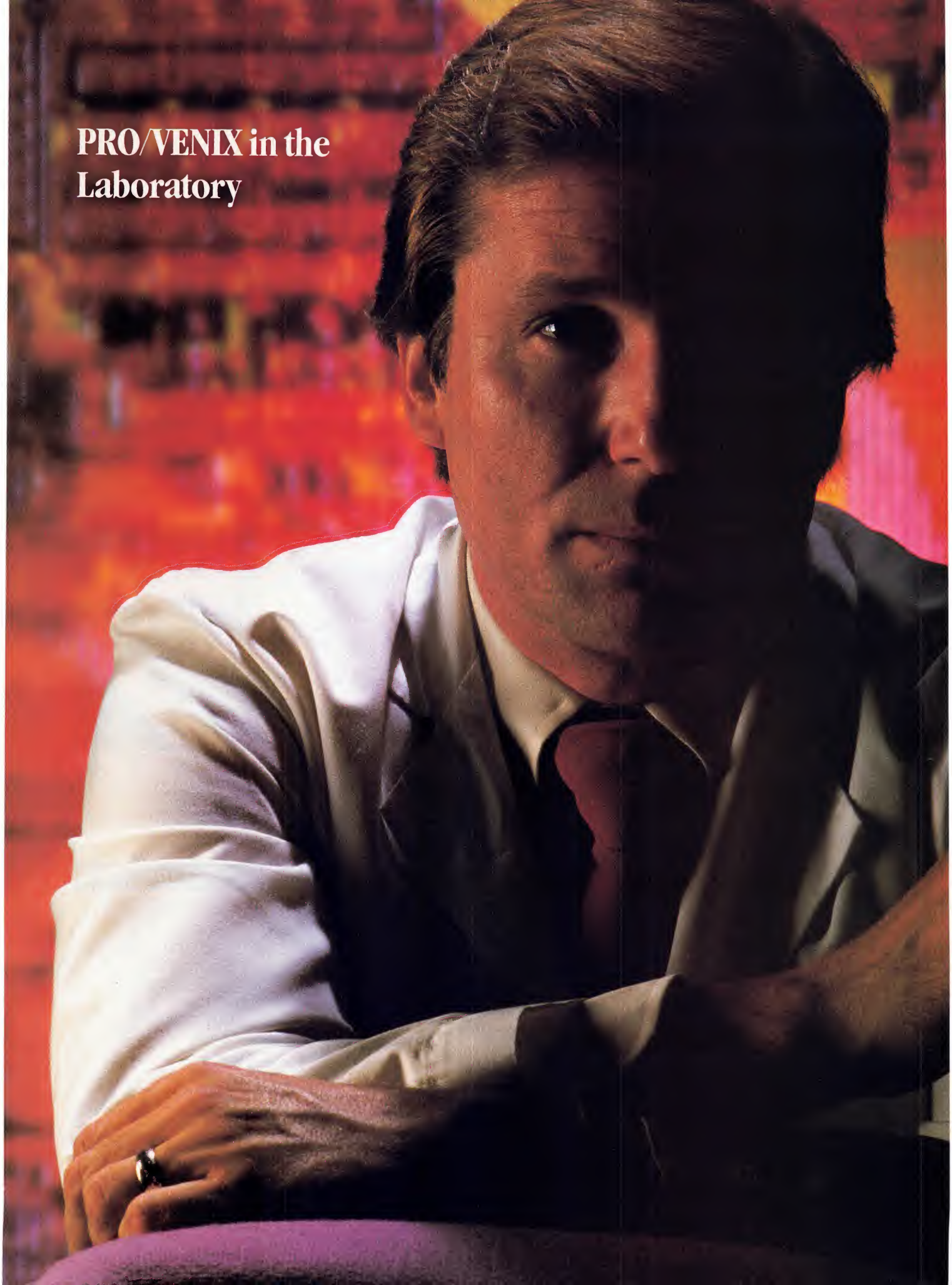

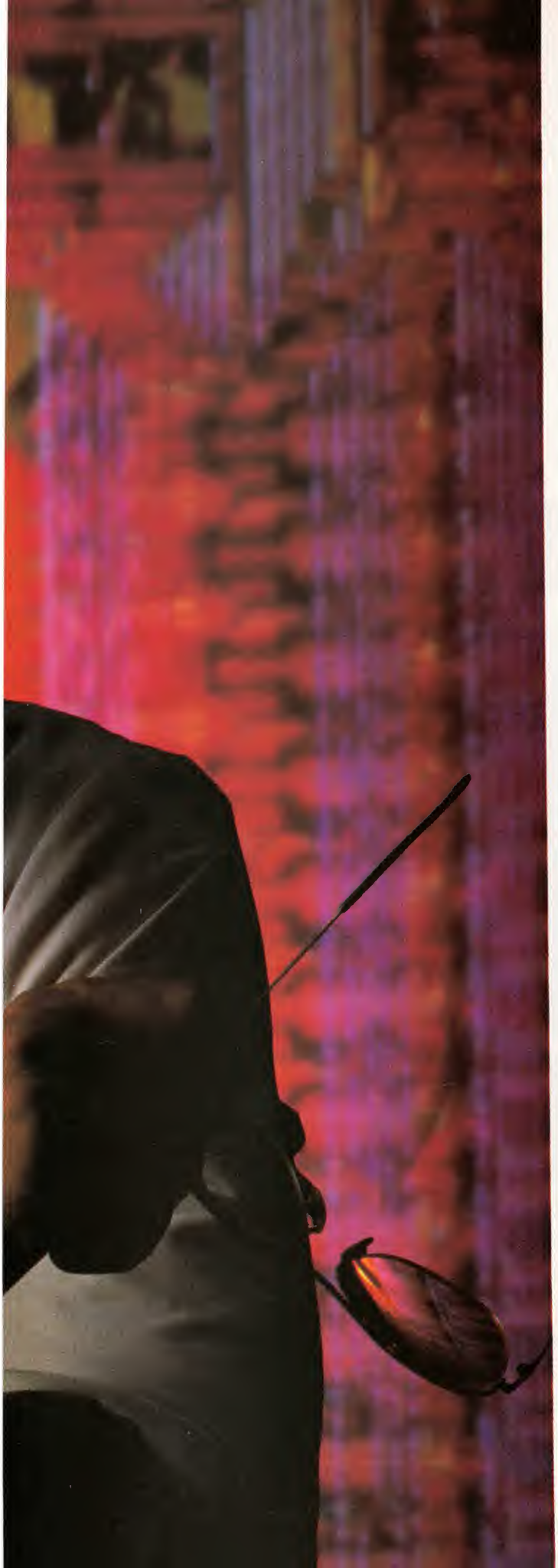

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TRENDS

EDITOR'S CONSOLE

This month UNIX/WORLD turns its attention to a subject sure to make many a die-hard Unix system techweenie cringe: Unix system work-alike and look-alike operating systems. Still, despite the scoffs of the forever faithful, the Unix system as coded by AT&T's Bell Labs does have its faults—faults that make it a sometimes unwise choice for certain applications.

In the course of developing this issue, our authors talked to numerous users, vendors, and analysts, all of whom came up with the same list of grievances against the Unix system that made going with a Unix work-alike or look-alike operating system the smart choice for particular applications and users.

Typically, the interviewees listed the lack of real-time capabilities, a poor user interface, speed, high hardware overhead requirements, or expensive licensing and royalty fees to AT&T as reasons for their decisions. Still, because they chose to go with a Unix system-like (one vendor, reluctant to have his product dubbed a "work-alike" said his system was "Unix-inspired") operating system, many actually achieved the best of both worlds.

Recent news from AT&T itself tends to support the growing importance of Unix system work-alike vendors, an importance that far exceeds their current market share. In a recently disclosed surprise agreement, AT&T said it is licensing Alycon Corp.'s Regulus Unix System V-compatible operating system, used primarily for real-time applications. Although AT&T is officially mum, an Alcyon executive has been quoted as stating that Regulus will form the basis of an upcoming AT&T computer system, presumably intended for real-time applications such as factory automation and/or process control.

Work-alikes range from products like Alcyon's Regulus (for real-time applications) to Mark Williams Co.'s Coherent (a low-cost work-alike meant mainly for IBM PC and PC clone users) to Z-System (which adds Unix system-like capabilities to 8-bit, Z80-based CP/M machines). If you want to know more about where work-alikes fit in, I suggest you read Vanessa Schnatmeier's "The Power of Work-Alikes," this month's cover story. Then for more details and some help in possibly choosing a work-alike, follow-up with David Keith's "Choosing A Unix System Work-Alike."

Finally, I'd suggest you don't miss one other article this month—Harry Avant's review of AT&T's Unix PC. It may not be perfect, but at last AT&T has given the PC world something to talk about. □

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FOR THE RECORD

Top of the News . . . Just as we were preparing to close this issue, AT&T-IS unleashed another volley of computer products aimed at shoring up the telephone giant's less-then-sterling first year performance in the computer business. The new gear includes a more capable addition to the 3B2 supermicro family called the 3B2/400, a VAX-class minicomputer called the 3B15 that presumably succeeds the 3B5 in price and performance, and communications capabilities that tie AT&T computers into IBM SNA networks. . . .

Overall, the new products should be good news for AT&T sales reps and customers. The 3B2/400 is a long-overdue fix for the the 3B2/300, a better-than-average supermicro with some performance problems. The 3B15, if it lives up to its billing, is a badly needed challenger to DEC VAX-class machines. Badly needed because in the market niche AT&T-IS espouses as its target—office automation—that class of machines (usually running proprietary applications software on top of a proprietary operating system) currently are favored for departmental, or work-group, computing systems in *Fortune 1000* companies. This trend has become even more pronounced as the PC fad continues to trail off. Most important of all, however, is the IBM SNA links. Strong ties into IBM networks are the first step in convincing MIS and DP managers to take a look at AT&T gear, especially for departmental information systems. . . .

Body Count . . . As we were going to press, we received word that the wave of layoffs hitting Silicon Valley's merchant semiconductor houses was about to claim yet another victim, **Intel Corp.** Reports were numerous and varied in detail, but all said the latest additions to the unemployed lines in Silicon Valley would total somewhere between 700 and 1,000, with more jobs at risk in distant reaches of Intel. At least 500 and perhaps more reportedly are slated for the axe at Intel facilities in the Hillsboro, Oregon, area. . . . At last look, the Silicon Valley body count reached toward 3000, with no end in sight. . . .

Major U.S. Job Nears . . . The long-rumored, monster Unix system bid for the U.S. Air Force is about to be made public, according to a recent report in *Datalink*. The weekly British software tabloid said the proposal calls for some 16,000, 8- to 64-user Unix system-based processors, estimated to cost some $8 billion in U.S. taxpayer dollars during the life of the contract. Regardless of who wins the contract—and you can rest assured the bidders will be legion—$8 billion worth of Unix system hardware and software may just be the boost the Unix system market needs. . . .

Rumor of the Month . . . It seems that **Exxon Corp.**, the oil giant whose diversification efforts into computers, electronics, and other high-tech areas have floundered, is now looking to unload another troubled venture. Knowledgeable sources say Exxon has put its **Zilog Inc.** subsidiary, a Campbell, Calif., maker of Unix system-based supermicros and merchant semiconductors, up for sale at the same time it chose to dispose of its loss-plagued **Exxon Office Systems** (EOS) subsidiary (which, by the way, was a Zilog customer). However, although the two Exxon Enterprise siblings were decreed the same fate, Zilog's sentence was more lenient; whereas EOS had six months to be sold or die, Zilog reportedly has been given a full year. Now wait, there's more. One knowledgeable source said that Melbourne, Fla.-based **Harris Corp.**, who picked up EOS's orphaned installed base through its **Lanier Business Products Inc.** office automation subsidiary, also thought about picking up Zilog to boot. No explanation as to why Harris didn't bite, however. . . .

IBM Workstation(s) Due . . . IBM reportedly has at least two Unix system-based CAD/CAM/CAE workstations brewing, according to a story making the rounds at the recent Usenix/Summer '85 technical conference in Portland. That story predicted a September introduction of a workstation based on what is known as IBM "Austin 801 RISC" processor. Meanwhile, talk of a National Semi NS32000-based machine abounded as well, but in not so definitive a tone as the 801 machine. . . .

EnMasse System Nears . . . Although a technical snafu earlier this year scotched plans for a summer introduction of its expandable, Unix system-based multiprocessor, EnMasse Computer Corp. is reportedly back on track. One system is currently said to be at a beta test site in the Boston area and the firm is said to be planning a fall introduction. . . .

Workstation Wars . . . While on the subject of Unix system-based technical workstations and rumors buzzing through the halls of Usenix, expect to see a possible price war between archrivals **Apollo Computer** of Chelmsford, Mass., and **Sun Microsystems,** Mountain View, Calif. Both are expected to cut prices shortly, if they have not already done so by the time this piece appears. It may also be of interest to note that Sun at least is gearing up for the inevitable market incursion of customized IBM PC AT-based workstations—properly equipped for scientific and engineering duties with a native Unix system and specialized floating-point and/or other co-processors—into its mainstay markets. Two potential competitors have already appeared—one each from **Tektronix's** CAE **Systems Division** and **Daisy Systems Inc.**, both based down the road a bit from Sun in Silicon Valley. This trend has not been lost on Sun. Some insiders claim the firm is prepared to bring prices down to as low as $5,000 for some low-end models sold to the education markets by this time next year if needed. One thing for sure, the currently eroding price structure for Unix system CAD/CAM/CAE workstation market is sure to continue (and perhaps accelerate). . . .

Contracts . . . Altos Computer Systems Inc. San Jose, Calif., said it has signed four agreements for marketing Altos hardware with vertical market applications packages to medical practices and clinics, auto repair, accounting, and pharmaceutical businesses. The OEM's are **Provider Automated Services Inc.** (PAS) of Jacksonville, Fla; **Automotive Repair Maintenance Services Inc.** (ARMS), S. San Francisco, Calif.; **Accountants Microsystems Inc.** (AMI), Bellevue, Wash., and **Bergen Brunswig Drug Company,** Los Angeles. . . .

Quadratron Systems Inc. (Encino, Calif.) said it has signed eleven contracts to supply its office automation software to major U.S. domestic and international government agencies. The company valued the renewable agreements at approximately $12 million . . . **Interleaf Inc.**, Cambridge, Mass. said it has signed agreements with three European companies to distribute its Workstation Publishing Software (WPS) and laser printers. The agreements are with: **Nokia**, based in Finland; IGL (**Institut de Genie Logiciel-Software Engineering Institute**) of France; and BIM (**Belgian Institute of Management**). . . .

Pathway Design Inc., Wellesley, Mass., has signed a contract with **CMI Corp.** Pathway Design will supply CMI with the company's uniPATH software for porting to the IBM Series/1 under CMI's proprietary Unix system-based operating system, Serix. The three-year contract, valued at $650,000, provides exclusive use of Pathway Design's SNA/3270 communications product on the IBM Series/1. . . . **Intel Corp.** Phoenix, Ariz.-based, entered into a three-year volume purchase agreement with **Provider Automated Services Inc.** (PAS), a subsidiary of **Blue Cross/Blue Shield** of Fla. to jointly develop systems for the health care industry based on Intel 286/310 supermicros running Xenix 3.0. . . .

Applix Inc., Westboro, Mass. and **Ericsson Information Systems**, a subsidiary of **L.M. Ericsson**, have signed a contract under which Ericsson will market Alis, Applix's Unix system-based office software system. Under the agreement, Ericsson can market both the single-user and shared multi-user Alis systems in network and stand-alone environments. . . .

News From AT&T . . . AT&T said it has made new arrangements that will provide selected business customers with a service for their total communications and office automation systems—including non-AT&T equipment. Under the umbrella of "**Integrated Service Management**" (ISM), the company will offer computer and communications customers a range of new customized service options, some available immediately, and others by year-end. These include: Technical consulting services, project implementation services, and management and operations services. Under ISM, AT&T will offer customers a single point of contact for merging disparate technologies, accommodating multiple vendor systems, designing customers' networks, and administering and managing total service support operations. In the process, AT&T will maintain, on a selective case-by-case basis, certain customer-owned, non-AT&T equipment, as it does now for a limited number of companies. . . .

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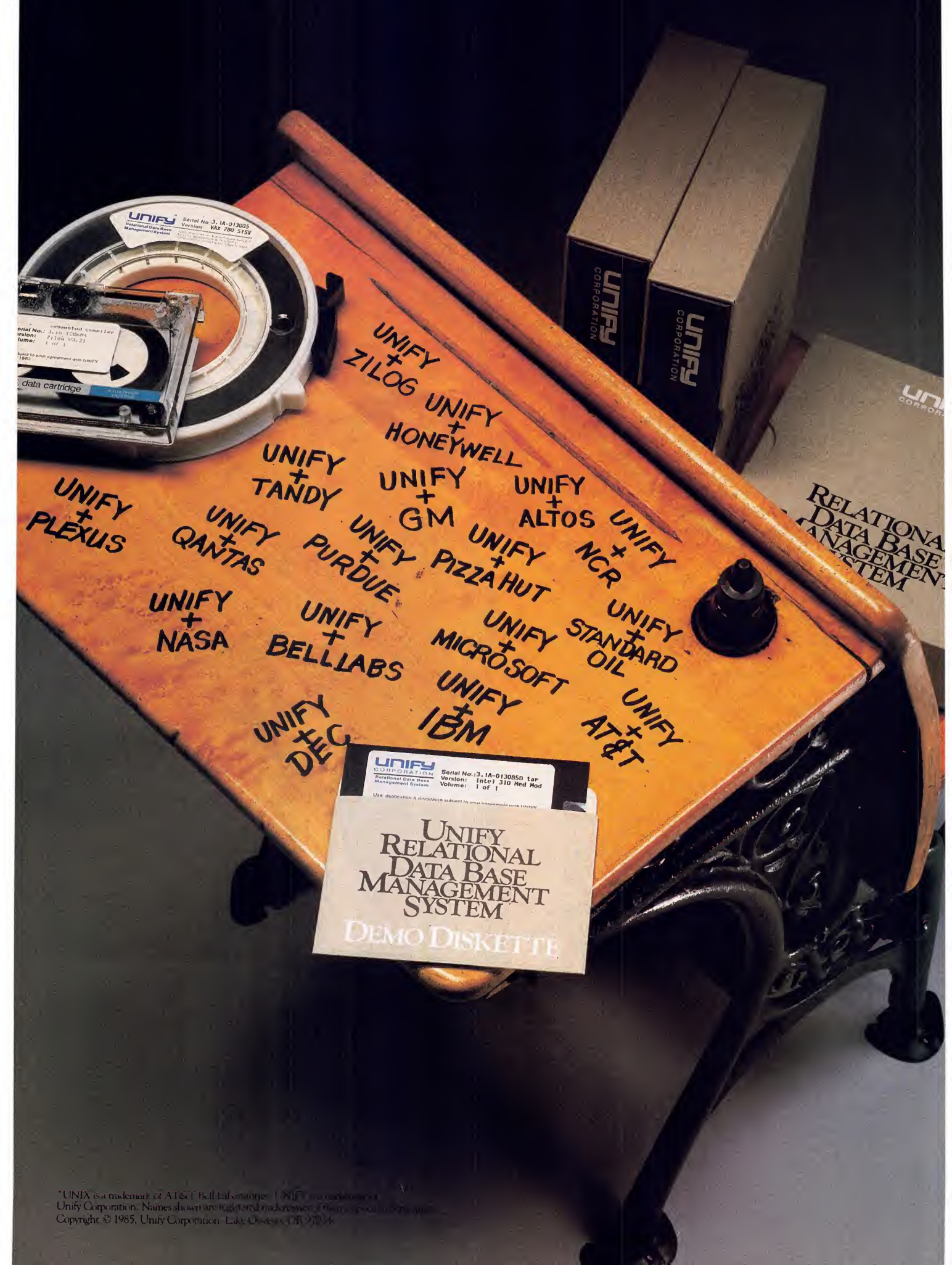

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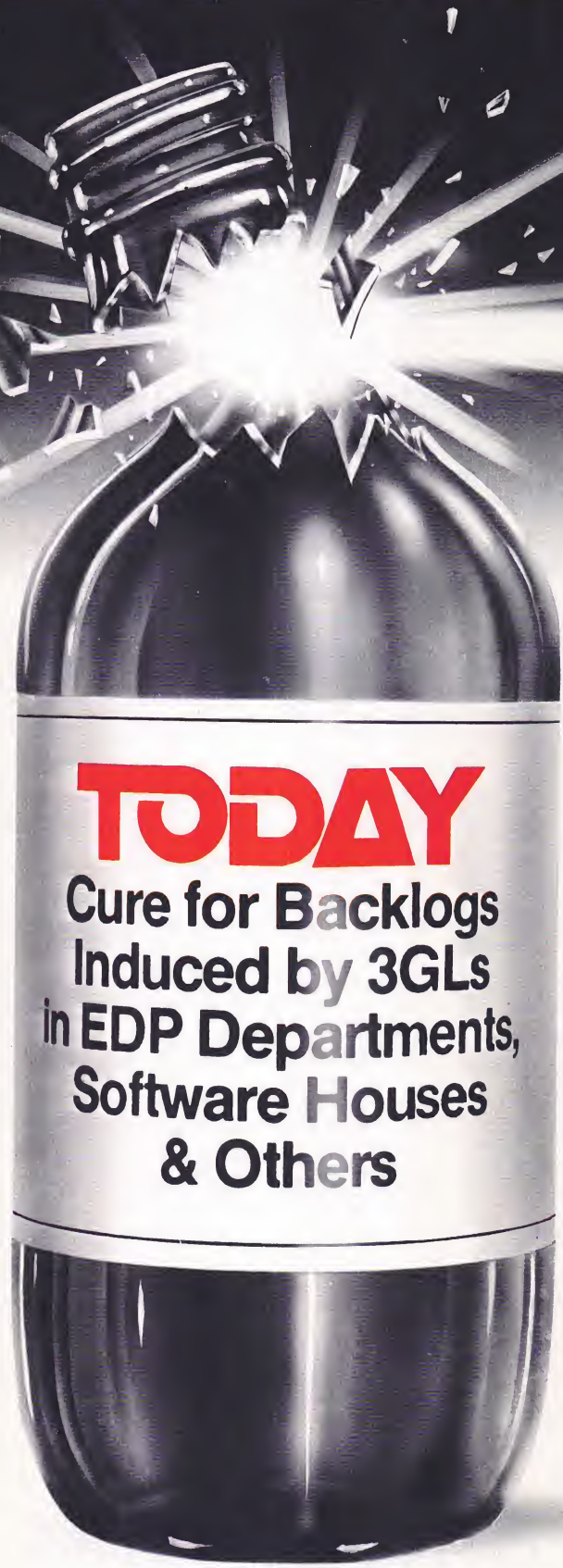

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"FEELING STRONGER . . ."

Dear Editor:

My hat's off to you for your aggressive stand in the June "Editor's Console."

I've suggested to our Vice President of Sales that he kick off his next staff meeting by reading it aloud while playing the "Theme from *Rocky*"—it reads even better that way.

Best regards,

Jeffrey E. Sulma
Vice President, Marketing
Handle Technologies

Editor's Reply: Better yet, why not wear some boxing gloves as well? —Philip J. Gill.

A NEW TERM: HEMOSECONDS

Dear Editor:

I thoroughly enjoyed your May 1985 issue. Bruce MacKinlay's definition of "MIPS" was thought-provoking, as was the article by Dr. Brian Boyle and John Dunham. Both articles prompt me to offer a term.

The term is the "hemosecond." This measurement requires the installation of a sharp needle protruding upwards from the Enter key. The measurement starts when the operator presses the Enter key and concludes at the point when the operator has bled to death waiting for a response. Hemoseconds may describe response times for IBM System 34s, many networks PCs, the Apple Macintosh, and other floppy disk systems, poorly designed applications, and even, overloaded Unix systems. High personnel turnover may be attributed to large numbers of hemoseconds.

Best Wishes,

Jerry H. Woods

UNDERSTANDING EXECUTIVES

Dear Editor:

The article "Supermicro Beats Little Blues: A Cost Analysis" by Alan Winston in the June 1985 issue made some excellent points concerning the advantages of a multiuser microcomputer compared to the networked PCs. Having worked with microcomputers of all kinds over the last nine years, I can support everything Mr. Winston stated about those advantages.

However, my experience leads me to my only conflict with Mr. Winston's article. He states in his last paragraph: "All in all, the Unix system saves money and is more productive. That's the kind of reasoning that executives understand."

My experience, limited to applications in manufacturing, schools, small business, and distribution, has shown the only kind of reasoning most "executives" understand is that they want their computer to have "IBM" on it someplace. If it doesn't fit that qualification, it must not be a real computer.

Do I agree with this reasoning? Absolutely not. I've seen heavy business applications running on Altos supermicros under Xenix and I know what kind of powerful software and fast response times are available. And I've seen "executives" attend hands-on demonstrations with this type of hardware, be totally impressed, agree that Big Blue doesn't have anything that will touch it, and turn right around and buy a System/34 or System/36 at tens of thousands of dollars more. Then they hire a programming staff to write the programs to do what was available off the shelf for the Altos. It is unfortunate, but sometimes it goes back to the old saying, "Nobody ever got fired for buying an IBM." We're in the logic business, but sometimes business people aren't logical.

Sincerely,

Steve Wiltsie
President
microConcepts Consulting

STATUS REPORT: ENCORE AND FLEXIBLE

BY OMRI SERLIN

Encore, which managed to go public at $5/share in April, officially introduced its graphics workstation and Ally software at the Hanover Fair.

The HostStation 100 from the Resolution Systems subsidiary is a peculiar product whose intended application is unclear. It is a $3500 intelligent workstation with a 19", 1056 × 864-pixel monochrome display that can be divided into 2 or 3 "hard" windows, each running a "port" to one or more hosts. Each of these windows can be further subdivided by host-running software. A more advanced Model 500 was expected in the second quarter of 1985.

Also unveiled at Hanover: the Ally portable applications generator. Like numerous other such packages now available, Ally allows the non-expert user to create small business applications in a non-procedural language. Ally is written in C and creates a "virtual machine" environment (*a la* Pick), so that once Ally has been ported to a given machine, any Ally application developed elsewhere can run without recompilation.

License price for Ally ranges from $200 for a run-time only on a PC to $100,000 for a development system. DEC has already licensed the product.

Encore's key product, the Multimax MMP architecture from Hydra, is now expected to be unveiled sometime this summer; the aim is to exhibit a working product at the NCC in July in Chicago, something we'll know by the time this article appears. The product is believed to be seriously behind schedule, most likely because of software difficulties, although the company unofficially characterizes the unfinished tasks as merely "tuning" and "grunt work."

These delays led late last year to the removal of the two key co-founders from their posts: president Dave Schanin and vice president of software development, Steve Chapin. Although an Encore spokesman told this author both are still with the company, other reports suggest they are on an "extended leave of absence" that masks a de-facto separation from any involvement with the company.

Software development is now said to be divided between Jonathan Addleston and Isaac Nassi. Addleston previously took over from Chapin; Nassi, previously with Resolution Systems, was apparently brought in to help solve the software difficulties.

Hydra currently uses 10 MHz 32032 MPUs (two per board) in the Multimax, so each of up to 10 processor boards is rated 1.5 MIPS, for a total system power of 15 MIPS (assuming linearity). Sometime in 1986, however, Hydra expects to have an 8 MIPS basic board, containing four MPUs of 2 MIPS each. Beyond that, there is talk of a RISC chip being developed by Fairchild (Schlumberger, which owns Fairchild, is a key Encore investor). That MPU is expected to yield around 4 MIPS, and 4-8 may be possibly packed on a board, leading to a best-case scenario of 32 MIPS per board. (Schlumberger, currently a major DEC buyer, may also surface as a major "sink" for the Resolution workstations).

Contrary to press reports, the supply of National's 32032 is *not* a problem, because Hydra's current needs are small. (TI recently became a second source, but is not delivering yet.)

Encore's marketing thrust continues to be in the scientific and engineering communities, no doubt reflecting the background of Encore's founders. Sperry, whose "$7.4 million order" for Encore's Multimaxes now appears to be far from solid, will (if and when the order is consummated), concentrate on business applications. Encore expects to rapidly expand its 35-person end-user marketing force (including 11 salespersons), and to achieve a mix of 80-90 percent end-user sales within four years (obviously an attempt to emulate Prime, once headed by Encore's president Ken Fisher).

Encore expects to have a substantial loss in the fiscal year ending October, 1985, but hopes to show substantial revenues, and be profitable, in fiscal year 1986.

Despite the strong reputation of the Encore founding team (Ken Fisher, Henry Burkhardt, Gordon Bell), the company has had significant difficulties attracting investors. Its first formal private financing fell far short of the goal and had to be augmented with bank credit. The

NEWS SUMMARY

Encore officially unveiled its $3500, hi-res workstation, and the Ally portable applications generator, at the Hanover Fair, while its Multimax MMP system from Hydra is due at the July NCC. Meanwhile, Flexible Computer Corp.'s recent debenture offering was oversubscribed. The company has shipped several of its NS32032-based multicomputer systems since December 1984.

public offering fetched $5/share, just 10% over the price paid by the private investors. Usually, the public pays three to ten times more; but usually a company going public has a product, and a growth record in shipments, revenues, and profits, which Encore does not.

In part, investors shied away because of the uncomfortable similarities between Encore and ill-fated Trilogy. Like Encore, Trilogy traded heavily on the reputation of its founder, Gene Amdahl (and, by association, his son Carlton). Again like Encore, Trilogy tried to blaze new trails in an uncharted technical territory (although many regard Trilogy's wafer scale integration effort as far more difficult and risky than Encore's multiprocessor architecture). And finally, like Encore, Trilogy went public well before it had a product. Trilogy eventually abandoned all of its development work and laid off most of the employees.

Even discarding this emotional issue, skepticism about Encore is well placed. While the MMP concept employed by Hydra and others is very promising, it is a difficult architecture to perfect, especially with Unix system-based software. (The delays at Hydra illustrate the point.)

Furthermore, the key appeal of this architecture lies in transaction processing and commercial applications, where the database is the key software. Hydra doesn't even offer a DBMS, and Encore's marketing thrust for the Multimax appears to be focused on scientific number crunching and real-time engineering applications; the founder's past experience seems to influence this slant more than careful analysis of market needs.

Encore's diverse activities (Resolution workstations, Ally applications generator) are precariously tied together under the Encore Continuum buzzword, which appears to be little more than Ethernet. There is nothing wrong with doing business in different market segments (especially when they generate early revenues—$2.5 million from Ally so far); but Encore's management's characterization of these diverse activities as synergistic parts of some mystical whole is more hype than fact.

The Ultra project, intended to result in some massively parallel machine based on multiple Multimaxes, is an academic "pie in the sky" unlikely to ever lead to any commercial benefits.

Will Encore be able to bring it off? Those who bought five million shares recently evidently believe it can. In the final analysis, it all boils down to faith.

FLEXIBLE GETS $8.5 MILLION, SHIPS SYSTEMS

Flexible Computer in late April raised $8.5 million dollars via a convertible subordinated debenture offering, managed by Baer & Co. This offering, substantially over the initial goal of $7.5 million, brings total investment in the firm to $12 million, the company says.

Flexible was founded in October 1983, with a $300,000 capitalization. The company had no revenues through 1984. Still, the company is very optimistic: the debenture's conversion price drops sharply if the company fails to achieve sales of $20 million, $30 million, and $45 million in 1985, 1986, and 1987, respectively.

Flexible is developing an MMP architecture not aimed at any particular application or market. Rather, Flexible views its Flex/32 as a "configurable building block," to be adopted to end user applications by the end user themselves, or by VARs. The Flex/32 designers apparently visualize the typical end-user as an academic research department.

This curious approach seems to be working. On December 31, 1984, Flexible shipped a 7-CPU system to Trinity Systems, a Dallas-based, systems integrator in energy management and industrial controls. (Trinity will pay $331,000 for this system only if it succeeds in reselling it.) In February, a 2-CPU system was delivered to 3S, an Irvine, Calif.-based developer of satellite tracking systems for the federal government. This, too, was a contingency system. In March, a 6-CPU system went to Purdue University's Center for Parallel and Vector Computation (PARVEC). This system is valued at $500,000, but actual revenues from this sale (due second quarter, 1985) will be discounted substantially. Delivery of a 17-CPU system to NASA-Langley is expected in May.

The Flex/32 architecture is basically a loosely-coupled arrangement of up to 20 processors, each with a private memory and a copy of the operating system. The processors may be dissimilar, and each may run different software altogether. However, all have access to a common control system, used to implement synchronization mechanisms (about 8,000 semaphores and locks). Locks can be requested asynchronously.

An optional, common memory system of up to 4.5 Mbytes (implemented in static RAMs) is also accessible to all processors. Currently its use is limited to data exchange and sharing. However, common memory can be nominally used to develop a tightly-coupled system, although Flexible does not provide software for this configuration. You can carry out accesses to the syncronization hardware on an independent com-

mon bus; they do not interfere with accesses on the common memory bus.

Each single-board processor is currently based on an 8 MHz National 32016 MPU; Flexible has tested 10 MHz 32032s from second-source TI successfully, and they are now being phased into production. Flexible also plans to develop a CPU board based on the Motorola 68020, to be supplied by second-source TI. Each processor carries 1 Mbyte memory on board, as well as a 4K byte cache and a 32-entry TLB (address translation cache).

Each cabinet supports 10 independent VME busses with two slots each; these slots can house any combination of processor or 1-4 Mbytes memory boards. More than one cabinet may be included in the system; but that is achieved by point-to-point links between a pair of processor, one in each cabinet; the 10-slot, dual bus common control and common memory systems directly serve only one cabinet each. Also PC boards are in Eurocard (445.5 × 400mm) form factor (approximately 17″ × 16″).

An interesting self-test system has its own redundant bus threaded through every card position in the system; each card is expected to have an 8-bit MPU to support the self-test system, which is responsible for initialization, auto shut-down and restart, fault diagnosis, or, optionally, performance monitoring. (The system diagnostic functions are disabled while performance monitoring is in effect.)

Flexible developed a special variant of the C language to facilitate writing parallel processing programs. However, this supports only basic primitives for interprocess communications, data sharing, and synchronization. It is the user's responsibility to partition the problem among the processors, and enforce the relevant synchronization mechanisms for controlling use of shared data and for managing concurrent execution. Concurrent C also supports "event variables" for real time activities.

Flexible offers two operating systems: A Unix System V, and a real-time system dubbed MMOS (multicomputing, multitasking OS). MMDS is designed expressly to support programming in Concurrent C. This system also supports Ada.

In addition to standard Unix System V facilities, the Flexible port supports virtual memory, shared code, and interprocess messaging, semaphores, and file locking. Shared memory may be attached to the user's virtual memory.

A "virtual I/O" system allows the user to configure I/O devices on just one or a few of the private VME busses, yet have them accessible by processes running on any of the CPUs. Creation and execution of remote processes is also supported. Still, the user sees a completely standard System V; that is, you require no source or object modifications to port user code that complies with the System V specifications.

Neither MMOS nor the Unix system allows load balancing; the user must bind each process to a specific processor. However, a third operating system is under development, which will support automatic load balancing. This system will still provide Unix system compatibility, but will feature a brand-new kernel, probably written in Concurrent C.

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.*

The POWER of Work-Alikes

Is there a future for nonstandard versions of the Unix system? The mysterious world of Unix system work-alikes and look-alikes are herewith explored.

BY VANESSA SCHNATMEIER

The idea of the Unix system having doubles, commonly known as work-alikes or look-alikes, makes some people laugh aloud. If it's not AT&T System III or V or at least 4.2BSD, they remind you with a raised eyebrow, it isn't worthy of the name Unix. Then they pointedly turn away and resume reading their Bell Laboratories *Technical Journal.*

The fact is, though, the vast majority of Unix systems today aren't pure System V, or even III. Many systems don't even bear the AT&T seal of approval and are not based on Bell code. Yet even these illegitimate offspring play a distinct role in bringing the Unix system to fields that a vanilla Unix system couldn't reach—real-time applications, for example. The only sad thing is that these poor relations may never taste the wealth their parent operating system should eventually rake in.

Although some are many years old, work-alikes really came into their own only in the IBM PC-compatible market, where for several years vendors have bent over backward to develop software and hardware that resemble the real *verismo* as much as possible without actually stealing code or board layouts. (I'll define work-alikes more thoroughly later.) But in order to understand where work-alikes fit in the grand scheme of things, we have to look at the current status of the Unix system's various flavors.

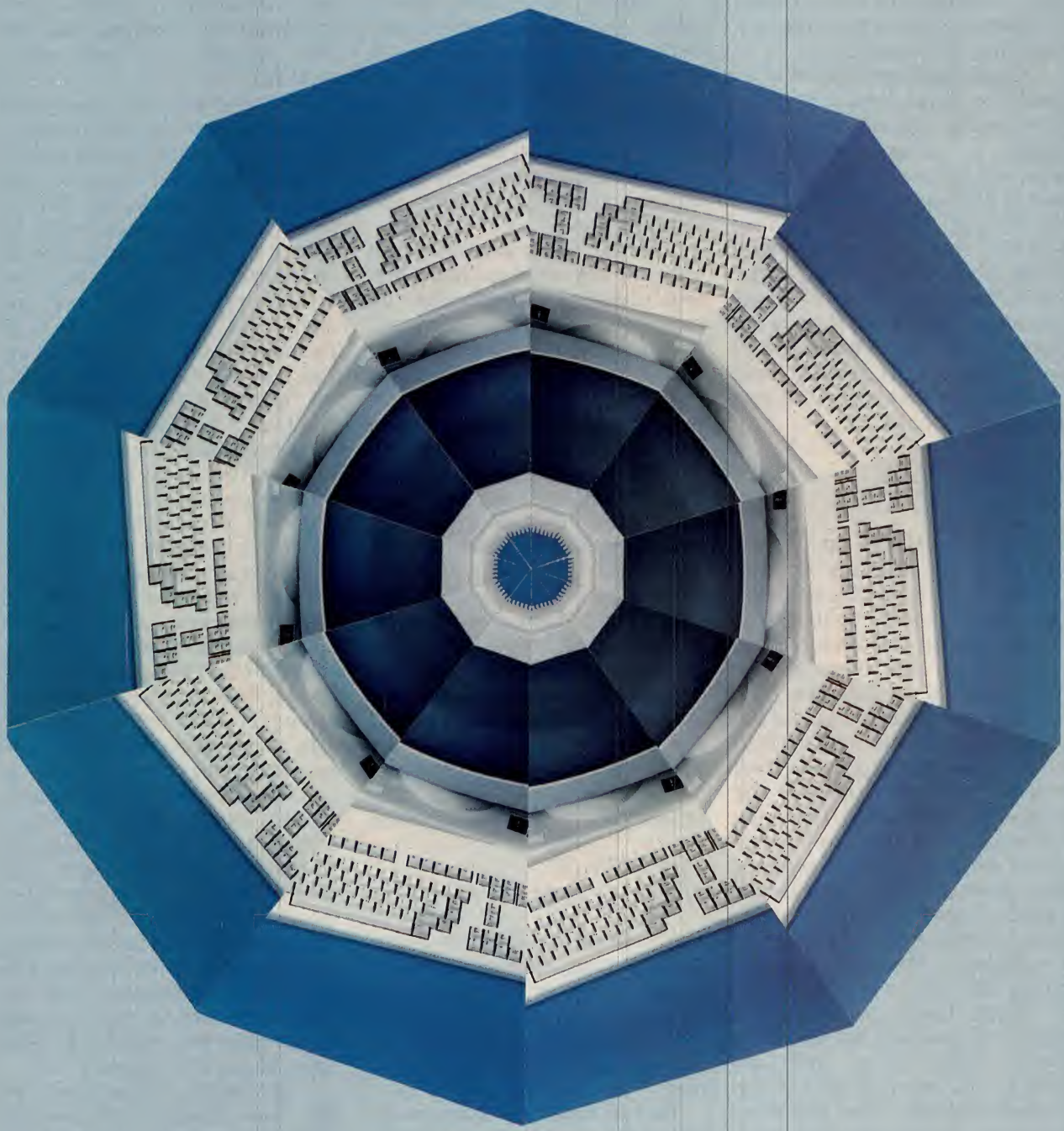
While that situation is changing somewhat—though some say the Unix system is turning into a standard in search of a market—the work-alikes still have a tough row to hoe.

First, we have 99 percent pure, unadulterated Unix, the AT&T System V product (or System III or Version 7). Next, we have the standard software ports—Microsoft Xenix, the UniSoft UniPlus, the Interactive PC/IX. Also, let's not forget the hosted operating systems, such as Amdahl's UTS and The Wollongong Group's Eunice, that run as guests on the native operating system. Following that are the proprietary ports by hardware firms—Plexus, Digital Equipment Corp. (DEC), Data General, and Hewlett-Packard, among others. Finally, we have the unlicensed versions of the Unix system, usually called work-alikes or look-alikes, produced by companies unencumbered by royalty payments to AT&T.

WHO GETS THE MONEY

The biggest hunk of money goes, of course, to Xenix. Machines running Xenix comprised more than 60 percent of the units shipped in 1983: Tandy with 30 percent of the market, Altos and Fortune with 15 percent each, and DEC, with about 7½ percent, according to Novon Research Group figures. All of those ran Xenix, which couldn't have done much harm to Microsoft's coffers. Xenix's share went down overall in 1984, but the actual numbers went up.

UniSoft, king of the ports, has a UniPlus port on about 40 percent of all the Unix system machines made. Note this means *all* the models



made; unfortunately, none of those machines belongs to the aforementioned hardware vendors.

Says Brian Boyle, director of research for Novon Research Group, "Seventy-five percent of the Unix market is microprocessor-based, using standard systems house ports, such as Microsoft Xenix, PC/IX, and UniPlus, or third-party operating systems." Another 15 percent goes to the proprietary hardware ports. AT&T's System V has only a 7½ percent share (though that share is expanding), and the unlicensed versions of the Unix market must content themselves with a 2½ percent slice of the pie.

THE WHAT ARE OF WORK-ALIKES

The unlicensed Unices vary in their conformity to standards of Unix system compatibility. By definition they are supposedly written from scratch, without reference to Unix system source code. In one branch, which we might call look-alikes, you probably won't be able to tell the difference between, say, Idris and System III if you're not digging into their innards. The other branch, the work-alikes, have many Unix system features and functions but may not be mirrorlike in their compatibility. Boyle classifies the former as a kind of transsexual Unix system, while he characterizes the latter as transvestites—"You find out pretty quickly what you've got."

These Unices may not have much of the market, but they fill a distinct niche. First, they are cheaper. You may only have to pay hundreds of dollars rather than thousands for a Unix system that seats ten users. Oasis 86, for example, costs only $695, and Coherent on the PC/XT costs only $500. You'd pay more than that for a good relational database management system.

Second, they fulfill specific needs. The area in which many work-alike Unix systems shine is in real-time applications, since the Unix system is notoriously weak and slow in fault-tolerant, immediate functions. Regulus from Alcyon, among others, caters largely to embedded product applications and real-time work.

Among the companies not signed up with AT&T are Mark Williams (Coherent), Whitesmiths (Idris), Morrow Designs (Micronix), Oasis (Oasis), Gimix (OS-9), Quantum Software (QNX), and Alcyon (Regulus). This list of holdouts would be longer, if it weren't that only a few months ago, Cromemco, maker of Cromix, and Charles River Data Systems, maker of UNOS, handed over their dough for the tools to make their products compatible with System V.

There's even a level of Unix system compatibility lower than this —MS-DOS. Yes, MS-DOS and Xenix are moving closer together (AT&T says Xenix and System V will grow closer together as well—what's the real industry standard here?) and will eventually share multitasking, multiuser functions. For instance, MS-DOS 2.x has Unix-like pipelines.

THE WHY OF WORK-ALIKES

Even with the software tools, writing an operating system largely from scratch isn't a task a company takes on lightly. It's even tougher to write a Unix-like system without having any source or binary code as a guidepost.

It took Timothy Williams, chairman of the board at Oasis Technology, more than 3½ years of solitary toil to develop the Oasis operating system, and he's since spent even more time refining it. If he had it to do over again, he says, "it might be better to have three high-level programmers. It's becoming more and more complex for a single person to write."

Williams says he's never used the Unix system. Instead, he apparently looked at the VM/CMS system from IBM as a model. He had to complete another step before that, as well—since for portability's sake he wanted the operating system to be compatible with an existing high-level language, he wrote it in C, and since at the time "there was no C compiler for the Z80, I wrote my own," says Williams. He based it on the "small-c" in *Dr. Dobb's Journal.*

"Oasis, designed for business users in a business application environment, runs on any Z80 processor with no porting time," says Oasis' president, Susan Catalano. So that Oasis, too, can grab hold of the System V coattails, Williams is currently writing a version of Oasis for the 80286 processor, endeavoring to make it compatible with System V via the AT&T *User's Manual.* He'll be enhancing Oasis with some important features of vanilla Unix systems, adding, among other things, a fork system, pipes, and redirected I/O.

Ted Sartell, vice president of product development at Whitesmiths, notes that his company's Unix system look-alike, Idris, also grew from the seed of a C compiler, though unlike Williams the developers took a gander at some actual code. (It would have been hard to avoid some connections with the original Unix system code, because Whitesmiths was founded by Bell Labs refugee P.J. Plauger.)

According to Whitesmiths' Sartell, "The company was formed in 1978 to produce C compilers for other DEC operating systems. They couldn't afford to purchase a big enough computer; they had to make do with an LSI-11/02 with no memory management." What the

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A TALE OF CROMIX: THE FIRST WORK-ALIKE

When you watch the evening weather report spill clouds across your TV screen, there's a good chance that you're watching the granddaddy of Unix system work-alikes in action.

A customized version of Cromix, the Unix system work-alike from Cromemco Inc., Mountain View, Calif., is the power behind the weather/news displays at more than 350 television stations nationwide. The reason, according to Cromemco co-founder Dr. Roger Mellon, is that Cromix permits a great deal of stop-and-go operation.

"Cromix doesn't make any distinctions between physical and logical memory," said Mellon. "You can disable it and leave it, and then return with a warm start in the middle."

Cromemco decided to incorporate features like these into Cromix back in 1978, when this forebear of Unix work-alikes was first designed. Mellon, new executive vice president for R&D, said Cromemco aimed to develop a compact multiuser, multitasking system that could be easily adapted for all the configurational variations encountered in micros.

They decided to assume that RAM was plentiful and hard disks undesirable. As a result, Cromix is a RAM-resident system; it can run with a 5-Mbyte hard disk or on a floppy-disk system in a pinch. It offers no requirement for hardware mapping, so the system can be mapped one to one. Mellon says its overhead is quite small, so it can run as quickly as the AT&T Unix system even though more hardware may be attached. They made it easy to write device drivers and easier to adapt—the first editions of Cromix were written with OEMs in mind, with source code opened for easy customization.

Approximately 10,000 to 15,000 units currently run Cromix, says Mellon. Most of these installations are in aerospace, government, and research groups, with a growing number of commercial users. Cromix has developed from an 8-bit system, to an 8-bit/16-bit hybrid, to the recently rewritten version for the 68000 chip. Cromemco has also added common Berkeley enhancements, fast-file capability, and a hard-disk caching function.

One of its chief virtues is its compactness, Mellon claims. "The actual operating kernel is only 90K," Mellon claims, "and it can be made to be less than 60K." Cromix could even run on a Macintosh, he added, though the primary target for Cromix is the OEM who needs a high-performance tool.

Another more recent addition is compatibility with System V Unix. The company now sells vanilla System V, and it bundles Cromix with it at no additional charge. This way, they hope, the OEMs can tinker and customize as they wish while the standard software available for System V is still within their reach. "We've adhered to as many standards as we can find," says Mellon. Users can go back and forth without changing hardware because the systems in this version operate in different portions of the hard disk.

Co-existence between Cromix and AT&T System V Unix system lies behind Cromemco's marketing decisions for its operating system. Mellon says they have excellent results in compatibility, with Cromix-to-Unix-system transitions easier to perform than the reverse. But like almost everyone, Cromemco tweaks AT&T's nose for writing such non-intuitive system calls. Says Mellon, "Cromix is more user-friendly than the Unix system, more menu-driven, much easier to configure and change."

firm ended up doing, says Sartell, is buying a binary version of Unix Version 6—based on that it wrote a kernel for the LSI-11/02 so that it could execute Unix system facilities with the binary package unchanged.

"The beginning of Idris was that complete from-the-ground-up implementation," he says. No doubt because of that early environment, Idris was designed to work without memory management. Gradually the company started writing its own utilities to replace the ones that came in the Unix system because they wanted the utilities shaped into a unified set. "For instance, a library routine that would get all the command line arguments, we made that portable to other systems; we gave the utilities a little bit more structure and convention in the arguments."

Whitesmiths designed Idris to work with real-time and embedded systems, such as applications involving multiprocessing, process control, data acquisition, robotics, and embedding in communication systems.

At first, says Sartell, the various incarnations of Idris were "replications of Unix." As time passed, however, the Idrises became a mixture of the best features. "On the resident level, Idrises have the same system calls, but they've been expanded in a way that's useful for real-time systems."

IS AT&T NECESSARY?

AT&T is doing its best to cut Unix systems everywhere to fit its pattern. And in a market segment starving for standards and common ground, this is good business practice not only for AT&T but also for the Unix system compatibles. Still, not everybody is happy with the idea of AT&T setting the standard for what is and what is not a look-alike/work-alike.

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Jim Isaak, director of product management for Charles River Data Systems, points out that System V is very close to the /usr/group and IEEE standards. "The differences between System V and the /usr/group standard amount to one system call, depending on how it's worded," says Isaak. Once the IEEE standard is set, people will be able to use that as a base for discussion, rather than AT&T handiwork.

"System V will be important during the next twelve to eighteen months, while people can point to it," he says. "Someone can say, 'I need that plus virtual memory' or 'I need that plus continuous file management.' People have realized the value of multiple vendors for a standard, though, and the buying community, particularly large corporations —Hughes, Boeing—will realize they should start talking in terms of generic products."

Adds Isaak, "Once the standards are set by IEEE and /usr/group, we can respond like any supplier who can meet those standards. We won't have to be AT&T-licensed anymore. We'll play both sides of the fence until it becomes no longer necessary to do that."

An entirely different tack to writing a Unix system work-alike (and to expressing displeasure with using AT&T as the sole touchstone for the Unix system) is the approach of Richard Stallman. Stallman, a Cambridge, Mass. consultant, was billed by Steven Levy as "the last of the hackers" in his book *Hackers*. In an extremely interesting hack, Stallman has become the founder and central coordinator of an ongoing project called GNU, which recursively enough stands for Gnu's Not Unix, a public-domain version of the Unix system.

A public-domain Unix system? Certainly, says Stallman. He's looking for volunteers to help write selected Unix system utilities—one person to write `grep`, another to write `find`, another for `sort`, and so on—which he and a colleague later will smooth into a single operating system.

Ideally, hopes Stallman, his volunteer-built Unix system will not only be a decent work-alike but also a tangible response to the proprietary urges of AT&T.

WORK-ALIKES' FUTURE

Work-alikes or look-alikes—nonstandard versions of the Unix operating system—will require some form of System V compatibility to survive. Most firms realize this. Even Bill Joy of Sun Microsystems, flagship company for 4.2BSD, agrees, according to Novon's Brian Boyle; Sun's recently announced product with "4.2 on the inside and System V on the outside" would seem to support that view.

The time of the 31 flavors of the Unix system is over—System V is on the ascent, work-alikes are on the descent. But without a few look-alikes and work-alikes, innovation will be stifled and special needs may be ignored. So despite the need for standards, we shouldn't restrict ourselves to vanilla—there are times when raspberry chocolate truffle is simply the only thing that will do. □

Vanessa Schnatmeier, a frequent contributor to UNIX/WORLD, lives in Redwood City, Calif. Her latest work for the magazine appeared in our June 1985 issue.

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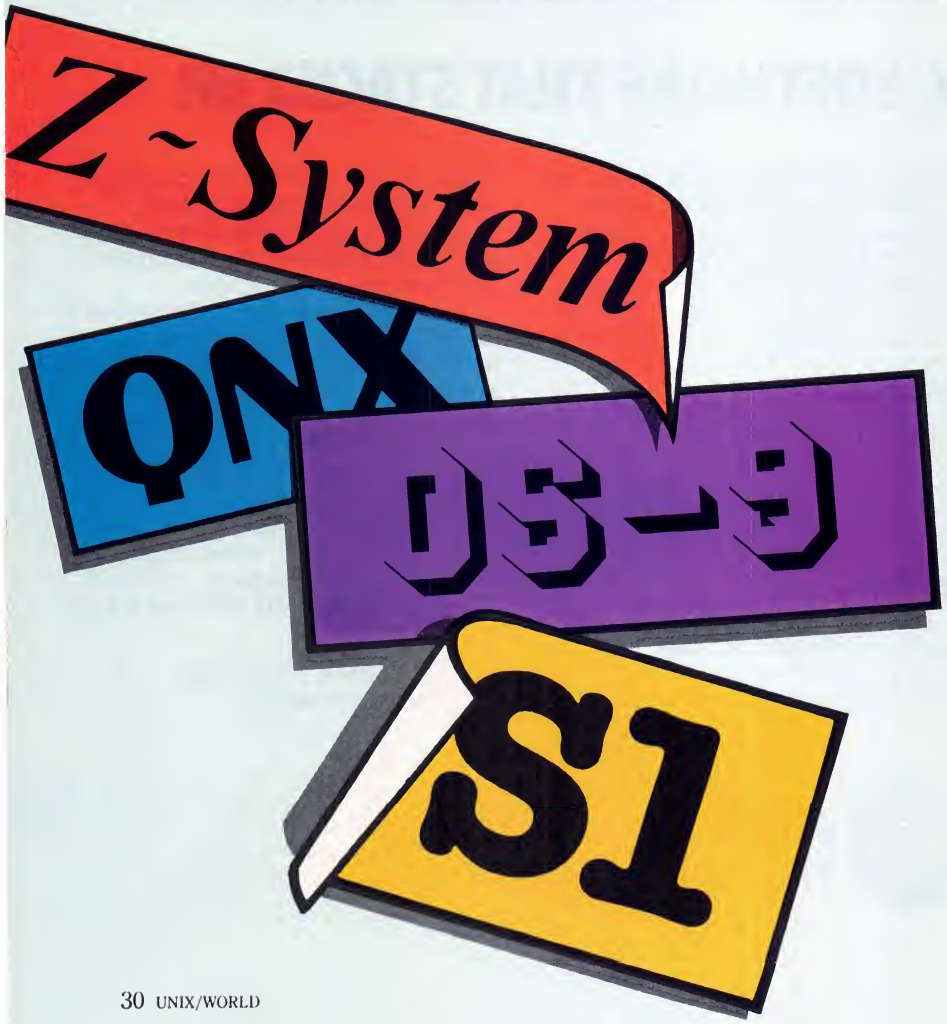
CHOOSING WORK-ALIKE SYSTEMS

Each Unix system work-alike has its own virtues. Here's a look at their individual capabilities, as well as some input from their users.

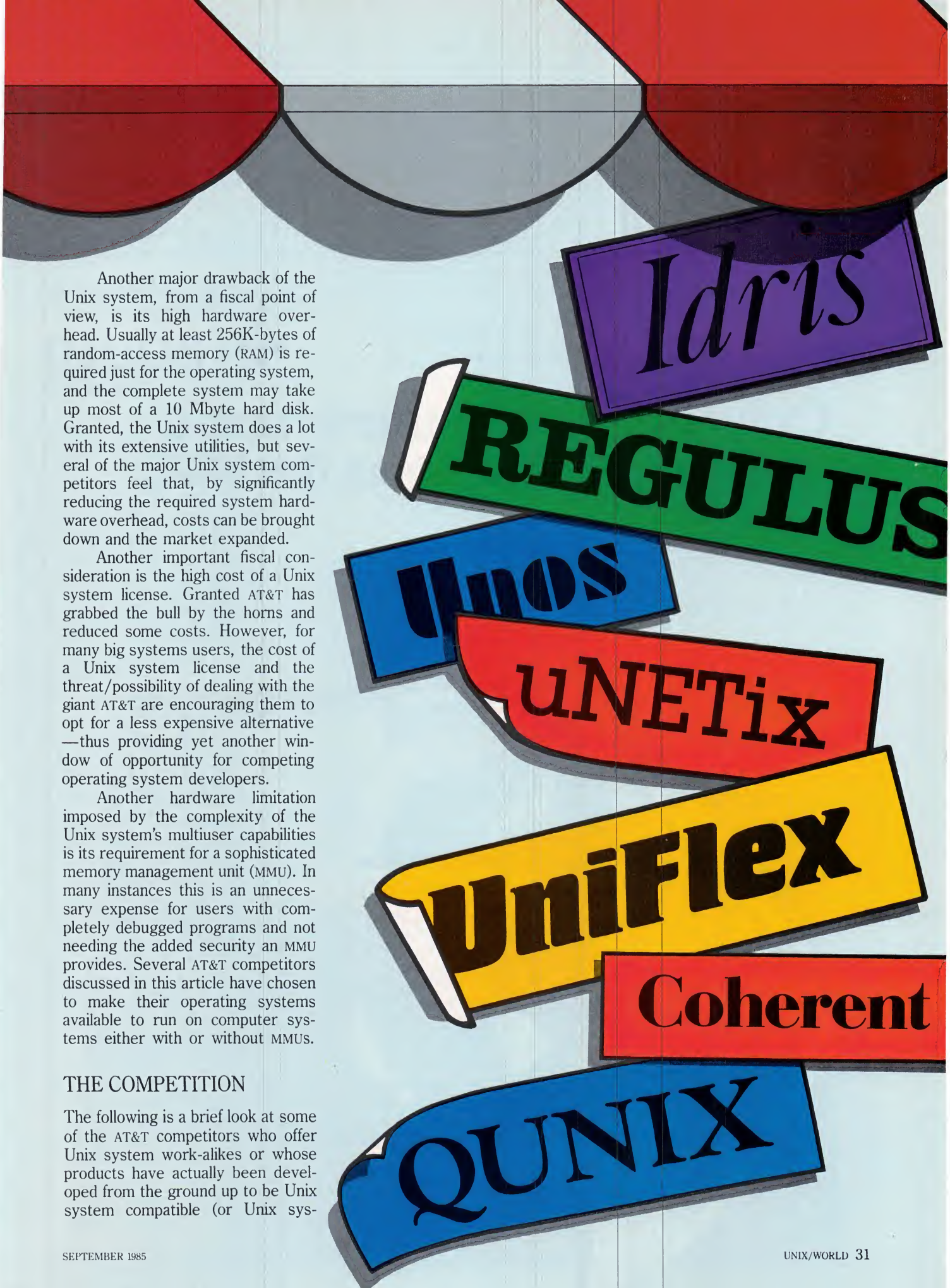
BY DAVID C. KEITH



With the Unix operating system rapidly gaining strength as the multiuser system of choice throughout most of corporate America, why would several sensibly minded corporations decide to actively market competing operating systems to essentially the same end-user group? In this article we will attempt to examine the logic behind such apparent folly and take a brief look at some of the competition.

Aside from the axiom that competition is the American way, several significant shortcomings in the Unix system have presented what may be seen as choice opportunities for companies able to circumvent those factors. Consider for a moment that the Unix system was initially designed by Ken Thompson of Bell Labs in the late 1960s as an environment for computer science research, and that it was later expanded into an extremely powerful programming tool.

One of the first cracks that a few forward-thinking entrepreneurs observed in the Unix system armor was speed. The Unix system was designed to support time-sharing tasks, often resulting in extended wait periods for processing or printing, for example. And Unix time-sharing tasks may be swapped out to disk at any time, to the never-ending frustration of the user. Several of the Unix alternatives, therefore, have made it a point to bring about significant speed changes. Some have even increased speed enough to effectively support "real-time" tasks such as robotics control, laboratory instrument control, and telecommunications control. These faster systems permit real-time tasks to maintain control of the central processing unit (CPU) until it finishes the current process or until a higher-priority real-time task is activated.



Another major drawback of the Unix system, from a fiscal point of view, is its high hardware overhead. Usually at least 256K-bytes of random-access memory (RAM) is required just for the operating system, and the complete system may take up most of a 10 Mbyte hard disk. Granted, the Unix system does a lot with its extensive utilities, but several of the major Unix system competitors feel that, by significantly reducing the required system hardware overhead, costs can be brought down and the market expanded.

Another important fiscal consideration is the high cost of a Unix system license. Granted AT&T has grabbed the bull by the horns and reduced some costs. However, for many big systems users, the cost of a Unix system license and the threat/possibility of dealing with the giant AT&T are encouraging them to opt for a less expensive alternative —thus providing yet another window of opportunity for competing operating system developers.

Another hardware limitation imposed by the complexity of the Unix system's multiuser capabilities is its requirement for a sophisticated memory management unit (MMU). In many instances this is an unnecessary expense for users with completely debugged programs and not needing the added security an MMU provides. Several AT&T competitors discussed in this article have chosen to make their operating systems available to run on computer systems either with or without MMUs.

THE COMPETITION

The following is a brief look at some of the AT&T competitors who offer Unix system work-alikes or whose products have actually been developed from the ground up to be Unix system compatible (or Unix sys-

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tem clones, if we may borrow a phrase). The accompanying chart provides a brief overview of some of the offerings' general features and capabilities.

A detailed look at all the available utilities offered by each of the competitors is beyond the scope of this article, but you can assume, unless it is otherwise indicated, that each of the companies provides powerful, versatile products. Generally, the work-alike makers will not offer as many utilities, or "bells and whistles," as the Unix system. In some instances, the competitors have simply recompiled various Unix system utilities and applications to run under their operating system. In each case, however, these companies have sought to gain some competitive edge over the Unix system, be it price, lower hardware overhead, user friendliness, or speed.

COHERENT

The Mark Williams Company developed its Coherent operating system independently of Bell Labs, yet has strived to maintain the highest possible level of compatibility with Unix Version 7. The advantages that Mark Williams Company claims for its operating system include a smaller code size, speed improvement, stability, and a much lower cost. For $495 (and with no hidden costs) the user can be a full-power player in the Unix system game without selling his shirt to enter the field.

> **A Coherent user can be a full-power player in the Unix system game without selling his shirt.**

Ralph Phraner, a user of Coherent, feels that "the basic advantage of Coherent is that you get most of the functionality of the Unix system without having to deal with Bell Labs." He doesn't see Coherent as having any particular features beyond those of the Unix system. Coherent stays as close to the Unix system design as possible. Even the commands are the same wherever appropriate.

Coherent does save some space over its big brother, however, because the total system, including utilities, takes up only 2-Mbytes of hard-disk space. The Mark Williams Company also claims its operating system comfortably handles more users on any given hardware.

IDRIS

Whitesmiths Ltd. has developed an operating system, Idris, that will run on smaller machines without an MMU, even though the system still supports one. Because Whitesmiths offers device driver sources (in C), and because special capabilities within the core operations of the Idris' operation system, users can easily configure device drivers to their own hardware. One of Idris' strongest advantages over the Unix system, however, is what Whitesmiths calls its "Hybrid" scheduler, which provides the benefits of event-and-priority-driven schedulers. By establishing a priority between process' priority and the time quantum (time period) to which it is allocated, Idris can adjust priorities as these time quantums expire. A built-in mechanism ensures a kind of "fairness" relative to how long a given job must wait in order to run.

According to user John Latham, Idris is a Unix system rewrite from the ground up, but is a bit better and has few crashes. He also raves about Whitesmiths' C compiler and its excellent company support. He

A GUIDE TO UNIX SYSTEM WORK-ALIKES

OPERATING SYSTEM	COMPANY ADDRESS/PHONE	BINARY LICENSE	MINIMUM HARDWARE REQUIREMENT	SPELLING DICTIONARY	ELECTRONIC MAIL	ON-LINE COMMUNICATION
Coherent	Mark Williams Company 1430 W. Wrightwood Ave. Chicago, IL 60614 312/472-6659	$495	256K RAM 5–10 Mbyte hard disk drive	Not included	Included	Included
Idris	Whitesmiths Ltd. 97 Lowell Rd. Concord, MA 01742 617/369-8499	$1000–$2500	128K RAM hard disk drive	Not included	Included (system users only)	Included
OS-9	Microware Systems Corp. 5835 Grand Ave. Des Moines, IA 50312 515/224-1929	$250–$300	16K RAM; 24K ROM no disks required (not terminal independent)	Not included	Not included	Optional $85
QNX	Quantum Software Systems 215 Stafford Rd., Suite 105 Napean, Ont. Canada K2H 9C1 613/726-1893	$450	68–192K RAM 215 floppy disk drive PC-AT or work-alike	Optional $235 55,000 words	Optional—$195	Included/ conferencing QCHAT—$125
QUNIX	Computer Systems 26401 Harper St. Clair Shores, MI 48081 313/779-8709	$2000	½-1M RAM 10 Mbyte hard disk drive	Not included	Optional, cost not available	Optional, cost is system dependent
REGULUS	Alcyon Corporation 8716 Production Ave. San Diego, CA 92121 619/578-0860	$70–600 $2000–1	256–512K RAM 5 Mbyte hard disk drive clock or timer	Optional $700 25,000 words	Included	Included
S1	Multisolutions, Inc. 123 Franklin Corner Rd., #207; Laurenceville, NJ 08648 609/896-4100	$400–$1100	CPU floppy disk drive (or ROMable)	Not included	Included	Included
uNETix	Lantech Systems, Inc. 9635 Wendell Rd. Dallas, TX 75243 214/340-4932	$99.95	329K RAM 2 floppy disk drives IBM-PC or compatible	Not included	Not included	Optional PowerLink $150
UniFlex	Technical Systems Consultants 111 Providence Rd. Chapel Hill, NC 27514 919/493-1451	$600	512K RAM/MMU hard disk drive (ROMable)	Not included	Included	Included
Unos	Charles River Data Systems 983 Concord St. Framingham, MA 01701 617/626-1000	$1500	512K RAM 10 Mbyte hard disk drive 32-bit CPU	Not included	Included	Included
Z-System	Echelon Inc. 10925 Stonebrook Dr. Los Altos Hills, CA 94022 415/941-2219	Free–$128	64K RAM 500K floppy (no multiuser/ multitasking)	Optional $150 45,000 words	Optional—$99	Optional free

ACTIVITY CALENDAR	ON-LINE MANUAL	LANGUAGES/ COMPILERS SUPPORTED	BIT-MAPPED GRAPHICS	VIRTUAL MEMORY	CPU SUPPORT	JAN 1, 1985 INSTALLED	TEXT EDITOR TYPE-SETTING	TEXT PRINT FORMATTING
Included	Optional Free	C, PASCAL, MWC86	Included on new Commodore C900 Version	Not included	8088, 8086, PDP-11, 68000, Z8000	Not released	Included (`me` & `elle`) / included	Included (`nroff`)
Not included	Not included	C, PASCAL	Not included	Included	8086, 68000 PDP-11, VAX-11	app. 2500	Included / included	Included
Not included	Not included	C, BASIC, PASCAL, FORTRAN, assembler	Not included	Not included	6809, 68008 68000, 68010	>200,000	Included (screen & line) / not included	Not included
Not included	Not included	C, BASIC, PASCAL, DIBOL, COBOL, (soon)	Included— graphics libraries	Not included	8088, 8086, 80186, 8087 80286 80287	>12,000	Included (screen / not included	Optional— $250
Not included	Not included	C, FORTRAN, BASIC	Included—	Optional cost is hardware dependent	8086, 80186 80286, 680XX	Not released	Included / included	Included
Not included	Included	C, FORTRAN, PASCAL, COBOL, BASIC, DIBOL, assembler	Optional— $900	Not included	68000, 68010, 68020 (in 3Q85)	>3000	`ed` included `vi` optional / not included	Included
Not included	Help files	C, PASCAL, FORTRAN, SL	Included hardware dependent	Included	8086, 80186 80286, 68000, 68010	Not released	Included / not included	Not included
Not included future option	Not included	Lattice C—$200, Assembler—$50	Not included (future option)	Not included	8088, 8086, 80186, 80286	>80	`ed` included `vi` optional / not included	Not included
Included	Help files	C, FORTRAN, BASIC, COBOL	Optional— cost is hardware dependent	Included w/68010, 68012, & 68020	6809, 680XX Series	20,001	Included / not included	Optional— $200
Not included	Included	C, BASIC, FORTRAN, COBOL, PASCAL	Not included	Not included	68000 Universe 68 & 2400, Datapoint	>20,000	Included (screen) / not included	Included
Not included	Included 460K menu driven	C, BASIC, PASCAL, assembler	Not included	Not included	Z80, 8080, HD64180	app. 40,000	Optional $29–$249 / not included	Not included

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maintains that Idris is "the best Unix [-like] system around, but it needs some additional utilities." Latham has found that Idris can support three or four users without slowing a 68000, unless there are large background processes. Apparently, a real-time version of Idris is in the works.

> **Idris is a Unix system re-write from the ground up.**

OS-9

The advantages of Microware Systems' OS-9 Unix-like product include very low hardware overhead (64K-byte RAM and no disks needed if system is ROMed), real-time capabilities, greater speed, a "crash-proof" file system, and a modular design concept that affords easy customizing. Libraries of program modules link together easily to form a complex system, and read-only memory (ROM) modules may be replaced on the fly with RAM for a particular application. The real-time capabilities and modularity lend themselves to manufacturing and laboratory control processes. Peter Dibble, a computer industry writer, feels that "OS-9 has the important parts of the Unix system." He cautions that OS-9 is not nearly as powerful as the Unix system because OS-9 was originally designed for 64K-byte systems. It also suffers from less powerful C shells, no wild cards, and no job control. It is faster than most, but the input/output (I/O) is not so fast.

For those who require a compact, inexpensive, ROMable system that has proved itself to be reliable and easy to configure, OS-9 might be worth consideration. But don't expect anywhere near the "horsepower" of the Unix system.

QNX

Speed is again the big plus with the QNX operating system from Quantum Software Systems of Canada. The firm claims that QNX is 25 times faster than the Unix system and 18 times faster than Xenix, although it is still written in C. QNX is also System V and conforms to the December 1984 user group standards. There are fewer hardware overhead requirements, and a hard disk is not required. With this added speed, real-time processing becomes practical (robotics process control, point-of-sale processing, and other high-speed operations).

QNX user Gunner Hansen (of Control Data) sees the system as an inexpensive, versatile entry into the Unix world. He has found it to be a fast real-time system with very low overhead. In his application there are nine automatic medical testing instruments running in a real-time environment.

QUNIX

You sometimes discover a company with no sense whatever of the value of public relations. Computer Systems first ignored our short questionnaire and then, when we called, gave our diligent writer a less than enthusiastic reception. After four calls, we were able to scrape together the minimal information for our comparison sidebar, but the firm provided no user contact and only the absolute minimum information about the benefits of its system. Those benefits follow (and we quote the company's spokesman, Mr. Wyrod, in full): "It is less expensive than Unix, expandable, has real-time capabilities, and is easier to use."

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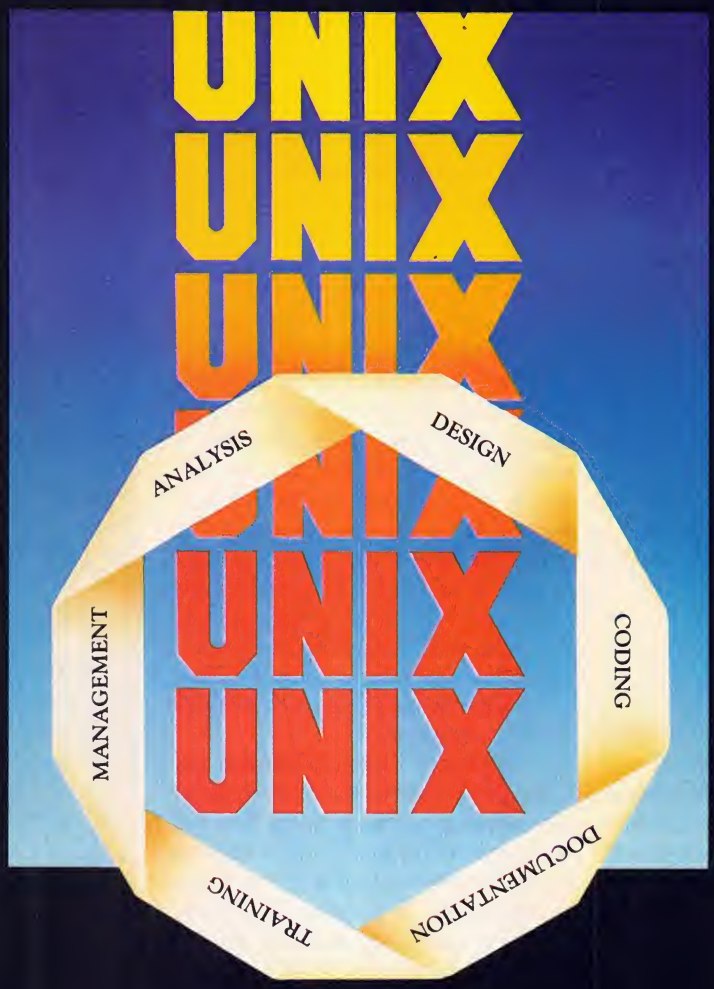

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REGULUS

Although Alycon's powerful Regulus operating system does not offer significant hardware overhead advantages compared to the competition, the company does stress

> One of the first cracks in the Unix system armor was speed.

the system's Unix system compatibility and Regulus' real-time capabilities. Any C program designed to execute under the Unix system will purportedly run under Regulus after it has been recompiled with the Regulus C68 compiler. By designing its operating system specifically for the 68000 CPU family, Alcyon claims several speed and I/O advantages over the Unix system. With Regulus, real-time tasks are locked into RAM, and their priorities remain static for the lifetime of the task. With Unix system time-sharing, by contrast, processes may be swapped out to disk at any time. This method of locking real-time processes in RAM is shared by some other operating systems in this survey. The Regulus code may also be compressed considerably for dedicated applications and placed in ROM. The minimum Regulus kernel is about 70K bytes. A dedicated system in ROM, therefore, might require as little as 128K bytes of ROM. You can also use Regulus with either MMU or non-MMU computers, although multiple programmers running new programs with bugs should not use non-MMU machines.

Regular user Bill Gage, finds some criticism with Regulus because the documentation is minimal (from a user's point of view) and because the utility Unix commands are just as cryptic as those Unix operating systems. However, he still finds Regulus fairly easy to understand and to work with. His wish list for expansion of Regulus' capabilities would include support of 64-bit floating point variables and Unix System V compatibility (Regulus is currently compatible with Unix system Version 6, 7, and System III).

S1

This product is one of those that claims to "do everything for everyone on any machine," with little or no facts to back it up. Although Multi Solutions Inc., the makers of S1, still are not able to give us figures as to number of users or the name of a specific user, the impression we gained was that S1 is finally about to be delivered and that a number of contracts have been signed with major OEM (original equipment manufacturer) firms. Multi Solutions spokesperson Patty McMahon claimed S1 would actually be out on the market by early June.

The system's claimed advantages over the Unix system are that it is smaller, ROMable, more functional, more flexible, has a faster file system, record files, multiprocessor capability, windowing and bit-mapped displays, dynamic resource

> S1 claims to "do everything for everyone on any machine."

allocation, user-friendly (less cryptic) commands, modularity for easy reconfiguration, a high level of portability, better networking, indexed files, real-time capability, and record locking. Multi Solutions claims S1 contains a number of fea-

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tures not supported by the Unix system, and it runs on a wide variety of machines. Hopefully, by the time this article is published, users will be able to spend some time with the final, shipped S1 product to decide for themselves.

In the meantime, given the excessive hype and lack of marketing support and application software, the jury is still out on this one.

uNETix

And now for something a little different. How about the prospect of getting into the Unix system market with a versatile little operating system that will even run on an 8088 and costs only $99.95—including a windowing environment that will run up to ten simultaneous foreground applications and a PC-DOS emulator to allow execution of most popular PC-DOS applications. With a minimum of 32K-byte RAM on a two floppy disk drive IBM-PC, you can be off and running and learning about Unix-type systems, with their nice shell scripts and other goodies. For OEMs and VARs (value-added retailers) uNETix promises a low-cost, high-performance, sophisticated applications environment that will not plunge a budding firm into Chapter 11. This should be the ideal tool for educational institutions on a low budget that wish to provide instruction on how the Unix operating system works. Lantech Systems even offers a PC-DOS-compatible C compiler.

Lantech Systems provided us with a most interesting user contact. Durk Pearson is the co-author of a national best seller on health and longevity, and he has been the most frequent guest on the Merv Griffin show because of his wide-ranging knowledge about so many interesting topics. What we have here is a certified genius, a "computer techie." Durk feels that the high points of uNETix a powerful networking system, much lower hardware overhead, and very low cost. "uNETix provides the first rational (read 'cheap') approach to networking." His company is using uNETix as part of an artificial intelligence system for health professionals. Changes he feels would make the system ideal are TAR compatibility and the development of a RAM disk driver.

UniFLEX

Rather than write its UniFlex operating system in C, Technical Systems Consultants has chosen to take advantage of the increased speed and more compact code provided through the use of assembly language. The company claims that the system provides 1 1/2 to 5 times the performance of the Unix system. Its kernel takes up only from 38K bytes to 50K bytes, and requires only 1 Mbyte of disk storage. Claimed advantages include multiprocessor capabilities, C source level compatibility with the Unix system, user-friendly (understandable) commands, easy end-user configuration to support special devices, 1 Gbyte maximum file size, 8 Gbyte maximum disk capacity, locking tasks in main memory for real-time processes, device-independent I/O ability for users to share programs in memory, record locking, and a greater number of users on any given hardware than the Unix system (or more efficient use by the same number of users).

UniFlex features recognizable command names that permit system usage by less sophisticated users. The company also claims that there are a large number of available applications programs written by third parties running on UniFlex.

Randy Lewis of Federal Express has had no problems at all with UniFlex and sees it as a particularly fast system with very little hardware overhead. In his operation—sorting packages at the main Federal Express hub location—he has found that UniFlex provides almost real-time throughput. "It is the fastest, cleanest, most user-friendly Unix work-alike I have ever seen," Lewis said. He has found it extremely configurable, with a fast and excellent C compiler.

UNOS

Charles River Data Systems has an interesting marketing approach. It sells both UN/System V, which is derived from AT&T Unix System V, and its own Unos operating system, which the firm calls "Unix-inspired." Officials feel that Unos has some distinct advantages over the Unix system, but they are obviously hedging their bets. For multitasking, real-time projects, Unos provides a process synchronization mechanism called "Eventcounts." In addition to real-time facilities, Unos provides ISO standard networking and a claimed high level of reliability.

Unos is not as hardware efficient as several of the other competitors listed in this comparison, but it perhaps offers a richer variety of utilities than most. Bob Russ of Unity Systems says that Unos is very versatile, although there is a fairly lengthy learning curve before the system can be fully utilized. He feels that Unos' strong point is reliability. "It is a steady workhorse," he said. The Unity Systems office uses it 24 hours a day and 7 days a week. He would suggest that Unos is all you need, except perhaps for a few missing utilities. He is generally very happy with the system.

Z-System

Although its Z-System is not a multiuser, multitasking operating system like the others in this article, Echelon has approached business computing with a different perspective—one that is shared by a lot of computer pioneers, by the way. Consider for a moment that there are an awful lot of very adequate 8-bit computers out there with tons of software available. What if a company should provide most of the features and utilities of the Unix system to this wide group of users and could solve the multiuser problem for offices with sophisticated networking in which users could have their own files and programs and could share the files of any other user on the system? This system would run all available CP/M programs right out of the box, but in a greatly improved environment, with most of the shells and bells and whistles available to the Unix power user. One of the biggest benefits of this arrangement is a low equipment cost: You can buy a good Z80 computer for several hundred dollars.

With over 40,000 users out there, Echelon must be doing something right. Benefits of the Z-System include increased speed over CP/M (and even over MS-DOS in many cases), easy menu generation, low

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hardware overhead, full high-performance facilities, multiple hierarchy directories, shells, command file search paths, two-level password security, dynamically-loaded command sets, fast keyboard response, easy creation of turnkey user interfaces, and very flexible batch-command processing.

CONCLUSIONS

There is much more to be said for most of the Unix work-alike operating systems we have briefly looked at. In most cases, the systems are

> **Work-alikes could make a significant dent in AT&T's armor.**

available at considerably less cost than the Unix system, are usually faster, and often provide a few useful features neglected by AT&T's product. However, the road will not be an easy one now that AT&T is charging into the fray at full steam. But with the perceived advantages offered by some of the competitors, and assuming effective marketing and wooing of OEMs, several of these companies should be able to make a significant dent in AT&T's armor. The Unix system may in fact become the standard, but that need not eliminate a substantial market for work-alikes that provide both compatibility and distinct advantages for the end-user and developer alike. □

David Keith has been working as a freelance computer journalist and market researcher for the past two years. Prior to that, he worked as an editor of a radio science and health newsletter.

FEATURE

GETTING STARTED:

The RULES *of* THE UNIX SYSTEM GAME

BY NEAL NELSON

Computers . . . because of the Unix system, it's a whole new ball game, with new rules, new players, and a new chance to win (and win BIG!). But what are the new rules and how do you get into the game?

The first, most astonishing new rule is this: *Choose your hardware last!*

Traditionally, people have selected a brand of equipment as a first step, and then designed their entire system around that one machine. This is still possible in the Unix system environment, but it is both unnecessary and inefficient.

It is unnecessary because of the ease of moving programs from one Unix computer to another, and it is inefficient because there are always two steps in a computer installation: Get some hardware, and get some software.

In the old world, it was essential to choose hardware first because all software was so closely tied to a particular brand or model of equipment. This meant that programming could not begin until the hardware choice had been cast in stone, and


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once someone made a hardware choice, it would stand for years. The selection process thus became truly heart wrenching, with people fearing for their careers in case they erred in hardware selection.

With all this responsibility, people took a long time to choose hardware, and since programming had to wait until hardware was chosen, the whole process could drag on and on.

In the Unix system environment, this has changed. The Unix system machines are very similar, so it is easier to make valid comparisons during the hardware selection process. The user can quickly compare cost, maintenance, capacity, and speed on a true "apples to apples" basis. This removes a great deal of stress from the process because the user can easily correct an error in machine selection by switching to one of the other 80 brands of Unix-based computers.

In addition, the user can design, write, and even test the software in actual user sites before making the final hardware decision.

Users can easily attain these benefits if they exercise care in choosing languages, databases, and programming techniques. Under the Unix system, complete application libraries (consisting of over a hundred programs) have been moved from one brand of equipment to another in a single day.

The second new rule is this: *Pick two, not one.* In the old days when you chose a hardware vendor, you became HIS customer (sometimes in more ways than one). But today, the Unix system offers software portability that allows you to be independent of the hardware vendor. And there is no better way to emphasize your independence than by choosing two vendors.

This comment will apply only to

larger organizations that might be installing multiple computers at local or regional sites. If these customers choose to install at least one site with a "nonstandard" brand name, they can reap big rewards.

A decision to keep the applications running on two brands of equipment completely changes the relationship with both of the equipment manufacturers. The vendor sales representatives are constantly aware that each time a machine is installed, it is just as easy for you to dial the other company and place the order with the competition. This provides a real incentive for an equipment manufacturer to continually provide a high level of support and the lowest possible prices.

Some non-Unix system readers might assume that it would be difficult to maintain a software system on two brands of equipment simultaneously, but it is actually fairly easy if you know what techniques to use. Some of the software houses offering database and word-processing packages now maintain their code on over 40 different brands without undue hardship.

I recommend to all of my larger customers that they choose one "big-name" vendor (such as an AT&T, DEC, or NCR) and one smaller vendor (such as an Altos, Plexus, or Pyramid). These smaller vendors offer some very powerful machines at prices that will give a big-name sales representative a mega-migraine headache.

A truly diabolical sequence might be the following:

(one) Develop a major portion of the application in the C programming language under Xenix on an Altos 986T-80. (Altos offers nine ports, 1024K bytes of memory, 80 Mbytes of disk, a streaming tape drive that puts over 60 Mbytes on a single tape cartridge, plus the Xenix run-time software for a list price of $14,695. Substantial volume and dealer discounts are available.)

(two) Invite the sales representatives from the major computer vendors and show them the sample programs. Explain that the code is written in C under Xenix (a form of the Unix system) and that you intend to test all machines by running your code under simulated user conditions.

(three) Mention the specifications and price of the Altos.

(four) Offer them some Excedrin or Alka Selzer as appropriate.

You actually have a very good reason to select two vendors. For years the choice in data processing has been reduced to *price* versus *security,* with the smaller manufacturers offering lower prices and the larger manufacturers offering relatively high security and stability. The standard and portable software under Unix allows major customers to have *both,* by selecting two vendors and then dividing the purchases between the two.

Under these circumstances, even the smaller single-machine customers will benefit because all vendors will reduce prices and improve

services as the best way to retain or attract customers.

The third new rule: *Independence means self-reliance.*

In the old days, the computer vendor would supply all components, including terminals, printers, and modems. If you asked, "Which terminal, printer, or modem?" the salesperson would always answer, "Our terminal, printer, or modem!" The Unix system is very flexible, and most of the Unix system computer manufacturers focus on offering the best possible central processing unit. So if you ask the same question of the salesperson for a Unix system computer, the reply will most likely be, "Almost any terminal, printer, or modem."

This freedom to choose can be quite a shock to someone who has spent years having the salesperson dictate exactly what had to be bought (down to the last cable). Customers accustomed to this type of "support" will find the Unix system vendors generally unable or unwilling to provide these specifications. Because all customers don't have the time or desire to research each of these technical questions, independent system-integration consultants are stepping in to provide this type of technical support. The word *independent* has more than one meaning in this context because the consultants are not tied to any particular brand of computer. They can be truly independent in their recommendations for computers, terminals, printers, or any other required devices.

Another area where self-reliance becomes significant is training and support. It is not possible in the Unix world to ship some hayseed off to school with a note that reads, "Teach him what he needs to know." Programmer support in the Unix system environment is provided primarily by other Unix system users (sometimes through user groups) and by independent programmers and consultants.

There are, however, four absolutely essential elements that must be available to every programmer expected to be productive in the Unix environment.

(one) A copy of the Bell Laboratories Unix reference manual. This thick book (approximately 2 inches) is divided into sections (I, II, III, and so on), with each section alphabetically arranged. A copy of this is usually shipped with every Unix system-based computer as part of the documentation for the compilers and utilities. At first glance the manual seems confusing, but once you have mastered the organization and notation, this manual quickly and clearly explains how to effectively use virtually every one of the 300 plus Unix system routines.

(two) Access to a person with some knowledge of the Unix system, someone willing to answer occasional questions. This person could be a friend, consultant, or someone in technical support with one of the Unix system equipment manufacturers. This individual does

GETTING STARTED IN THE UNIX SYSTEM BUSINESS

If I were asked by an individual programmer how to get into the Unix system, I would suggest the following approach:

***(one)* Investigate courses offered by local colleges on the Unix system and C.**

***(two)* Read the magazines written for the Unix system community. Their articles will provide "tips and techniques," and the ads will explain which brands of equipment offer the Unix system as an operating system.**

***(three)* Contact the sales offices for some of the various manufacturers of equipment and ask if they have a machine with a modem in their demonstration area. Ask if you could use a guest account on evenings or weekends; or if they have any small "odd-job" programming assignments available. Ask if any consultants or systems houses in the area that are active in the Unix system might consider taking on a part-time trainee.**

***(four)* Consider attending one of the Unix system trade shows to take part in the tutorials and visit exhibits.**

If I were asked by a business with a staff of programmers or a library of applications how to get into the Unix system, I would suggest this approach:

***(one)* Establish a relationship with a consultant experienced in the type of applications programs you have.**

***(two)* Obtain an inexpensive development machine that runs a common form of the Unix system.**

***(three)* Have the consultant work with one of your staff programmers to learn how to use the Unix system. Write a sample application, choose appropriate tools such as databases, and establish programming standards. This person will become the "lead programmer" to answer the day-to-day questions while the other programmers learn the Unix system. (If the lead programmer doesn't know the answer to a question, then the consultant should be contacted.)**

***(four)* Obtain some type of self-paced instruction materials to train other programmers.**

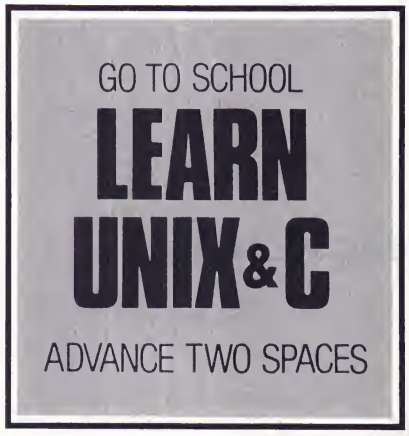
not have to be a Unix system wizard, nor will she or he need vast amounts of time. But it is important that someone be available for occasional questions such as "What command do I use?" or "Which option do I specify?"

(three) Access to a Unix system for some hands-on experience. It is not necessary to buy a machine because many of the manufacturers' sales offices have demo machines with auto-answer modems. It is quite common for someone to be given a "guest" account on one of these machines for the purpose of testing or learning. All the student need do is gain access to a terminal with a modem and arrange for the guest log-in ID (frequently at no charge).

(four) Introduction to and continuing contact with the Unix community. There is a fantastic amount of activity in the Unix system market. Almost daily, companies announce new machines and new program packages. Those who are serious about the Unix system, should have an awareness of what's going on, and they can gain this awareness by subscribing to special magazines, joining user groups, and possibly attending one of the trade shows that focus on the Unix system.

For over 15 years, the great majority of people who learned about the Unix system used these four elements to build their skills. Even now, when there is a wide selection of formal training aids, these basic elements remain essential for any serious programmer in the Unix system environment.

Now that you know the new rules, how do you go about getting into this world where all computers are powerful and all software is portable? I have listed below seven ways to learn more about the Unix system.



First, learn all you can about the Unix system and C, its mainstay programming language. In the Chicago area, many of the local colleges offer day and evening courses in the Unix system or C. (Some use the Unix system-based computers for laboratory work in courses for FORTRAN and other languages. In these cases, students learn some things about the Unix system as a byproduct of taking another course.)

Courses offered by local community colleges are by far the best value if someone is looking for formal training in the Unix system or C. They offer knowledgeable and experienced instructors who are available to answer questions, machine time for hands-on experience as part of training, and a reasonable schedule with classes once a week so that new information has time to sink in. You can obtain all of these benefits at a very reasonable cost.

Second, consider professional training firms. In addition to classes offered by colleges and other similar institutions, a variety of specialized classes and seminars are offered by professional training firms. You can find many of these by watching the ads in the trade magazines that focus on the Unix system.

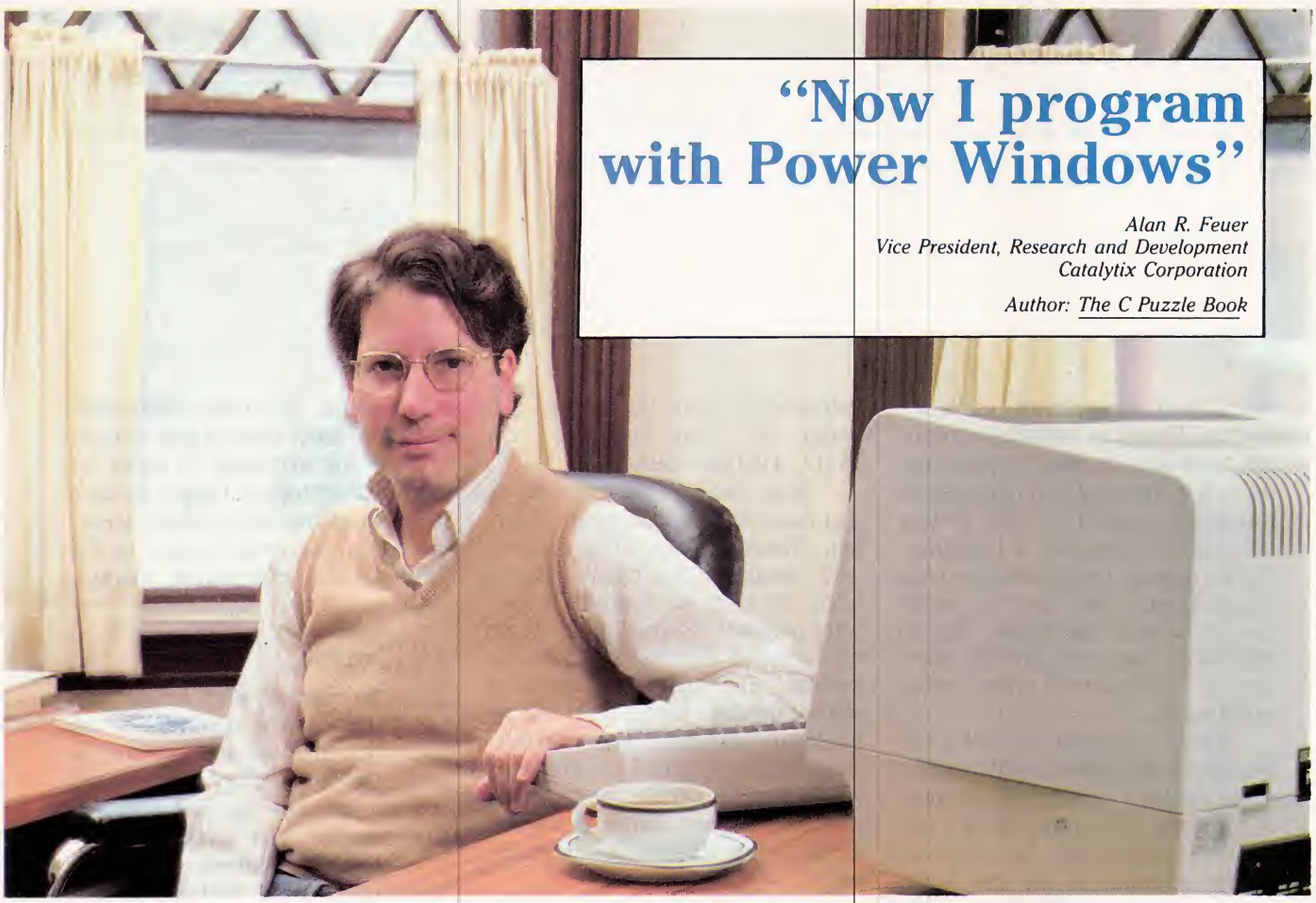
Others are offered as part of the total program at one of the Unix trade shows or conventions. These classes are frequently more specific, intense, and expensive than the college courses. The classes or tutorials offered in conjunction with a trade show or convention will sometimes be scheduled on the day before the conference officially opens. You can usually find details about these classes in the brochures for the conferences.

Large organizations may arrange for some of the professional training firms to conduct in-house classes for whole groups of programmers.

Third, consider self-paced instruction, of which there are two forms in the Unix community: A well-respected series of video tapes that explain much about the Unix system and related programs such as text editors, as well as a unique audio cassette series that encodes keystrokes on one track of a stereo cassette with explanatory text on the other. The device connects into a CRT so that the keystrokes appear on the user's display as the topics are explained.

Both of these options are a little expensive for an individual programmer to consider, but if a company has a staff of programmers and needs to train more programmers in the future, these may be very attractive options. The video tapes are offered by Computer Technology Group, 310 S. Michigan Ave., Chicago, IL 60604; 312/987-4000. The audio tapes are available from The Santa Cruz Operations Inc., 500 Chestnut St., Santa Cruz, CA 95060; 408/425-7222.

Fourth, consider some consultants and systems houses that spe-



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cialize in Unix systems as a resource. They can provide software and hardware to meet a particular need, but they can also become the connection into the Unix system network for a company or individual. For a company, consultants can train programmers and can be available to answer questions. For an individual, they can provide part-time or "entry-level" programming assignments.

Fifth, a number of books and magazines now provide information about the Unix system and C. Some of the major bookstores stock a few of these publications, but the best source is either of the two bookstores that specialize in Unix system-related publications. They offer wider variety with almost everything in stock, and they can inform you about which items are new and which items are particularly popular. Contact Cucumber Bookshop Inc., 5611 Kraft Dr., Rockville, MD 20851; 301/881-2722; or The Independent Unix Bookstore, 520 Waller St., San Francisco, CA 94117; 415/621-1593.

Sixth, don't forget trade shows that focus on the Unix system market. These shows offer sessions with speakers, tutorials, and exhibits for both hardware and software products. You can meet others who are also interested in the Unix system, and they are excellent places to learn about the various hardware offerings. The organizations listed in Figure 1 are currently sponsoring Unix trade shows. Some of them sponsor shows in various cities during different times of the year.

UniForum is sponsored by:
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Unix Systems Expo is sponsored by:
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Redwood City, CA 94063
415/364-4294

UnixExpo is sponsored by:
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New York, NY 10018
212/391-9111

FIGURE 1: UNIX SYSTEM TRADE SHOWS AND THEIR SPONSORS

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408/986-8840

Usenix
P.O. Box 385
16951 Pacific Coast Highway
Sunset Beach, CA 90742
213/592-3243

FIGURE 2: MAJOR NATIONWIDE USER GROUP

Seventh, two major nationwide groups of Unix system user groups provide for exchange of ideas on Unix system topics: Usenix focuses on the academic and scientific areas, while the /usr/group focuses on the business and commercial marketplace.

WARNING!

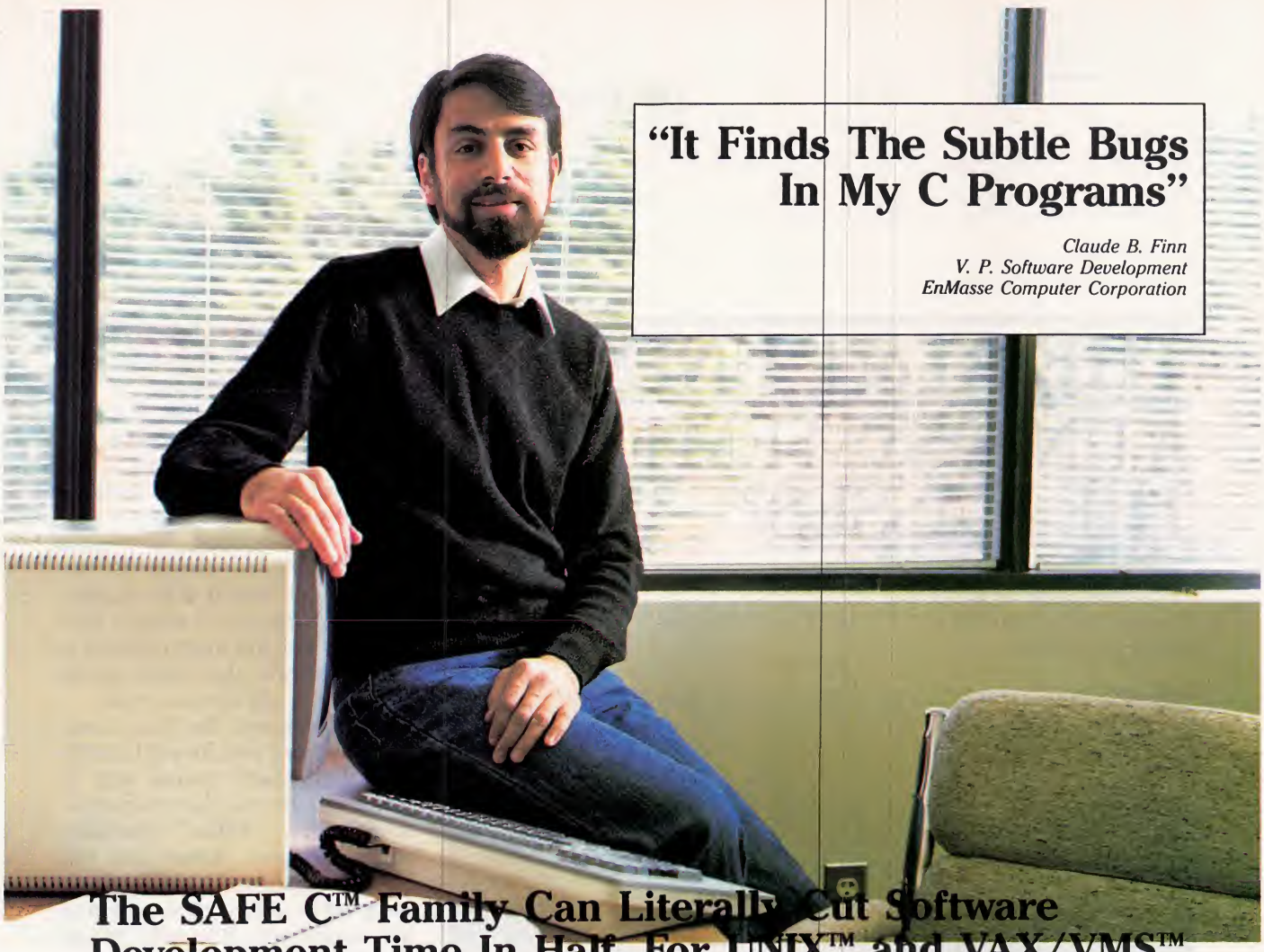
Some businesses want to get into the Unix system marketplace so badly that they decide to "buy" a staff of experts. They hang around the parking lots at Bell Labs or Berkeley and offer sacks of money to everyone they meet.

This is a big mistake for two reasons. First, it's been done before (on many occasions). The most talented individuals, who were willing to leave the academic environment, have already left. You might end up paying top dollar for someone who writes good résumés rather than good programs. And second, even the best programmers in these laboratories have limited skills and experience with business applications. Their background is more likely to center on writing system software such as compilers.

Intelligent businesses will avoid making this expensive mistake. It is much easier to teach Unix system skills to a good business programmer than it is to teach business skills to a good Unix programmer.

We have entered the Unix world, learned how to prosper under the new rules, and have found it to be a very fine place indeed. The rules are fair, and the game is fun; please feel free to join in. □

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



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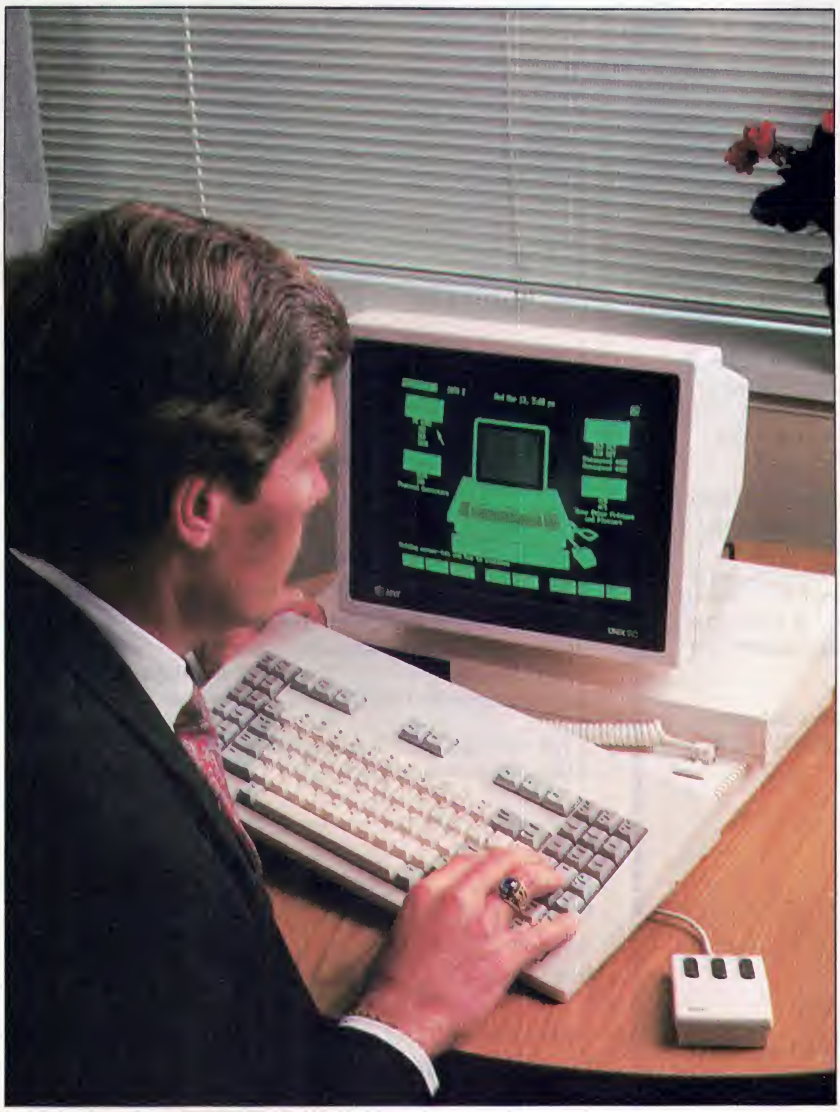
THE AT&T UNIX PC: A UNIX SYSTEM FOR THE MASSES?

BY HARRY AVANT

Although it isn't perfect, AT&T's new Unix PC goes a long way toward making the Unix system palatable to a mass audience.



AT&T's Unix PC is the first real attempt to make the Unix system palatable to the masses. As such, it can be excused for not being perfect: the new Mac-like interface is not as fast as I expected, although the system's internal speed is impressive; it supports up to three users, but this is a possible problem—due to the decreasing and limited disk storage, and though the cost is modest for a computer with this much power, it is more expensive than most MS-DOS computers it will compete with.

Nevertheless, the Unix PC represents a major step forward in making a Unix-based system easy to use. A new interface environment—dubbed the "Office"—combines windows, menus, forms, and real English commands, so that first-time users will be able to get a system up and running with little help; though modified to accommodate the new user interface, it remains a very powerful, competitively priced Unix system; and although designed for business users, it will not escape the notice of any savvy Unix user.

Users can manipulate AT&T's new Office user interface ("User Agent," in AT&T jargon) either with a mouse or with the keyboard. At first blush, the Office might remind you of an Apple Macintosh because of the mouse and windows. It is not a Mac clone, however, nor is it really similar to anything else yet on the market.

AT&T provided UNIX/WORLD the following for this evaluation: a Unix PC with a 10 Mbyte hard disk, 1 Mbyte of memory, Unix System 5.2, System V Utilities, the Supercomp 20 spreadsheet, the Unix PC Word Processor, and the Unix PC Business Graphics packages.

Four components make up the Unix PC: an 18-inch square base unit that houses power supply, electronics, disk drives, and two noisy

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- All code reentrant
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Increased programmer productivity
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- Hierarchical file structure
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fans; a well-designed, 103-key, detached keyboard suitable for both secretaries and non-typists; a three-button (for enter, command, and mark) mouse with a four-foot connector cord; and a 12-inch, high-contrast, bit-mapped, green-phosphor monitor with a 20 MHz bandwidth that displays 720 by 348 pixels.

The Unix PC is a major step forward in making Unix easy to use.

The Unix PC uses a 10 Mhz Motorola 68010 microprocessor, which features 16-bit memory transfers but a 32-bit, internal data path for computations. It easily handles multiuser assignments, memory partitions for multiple users, and multiple tasks.

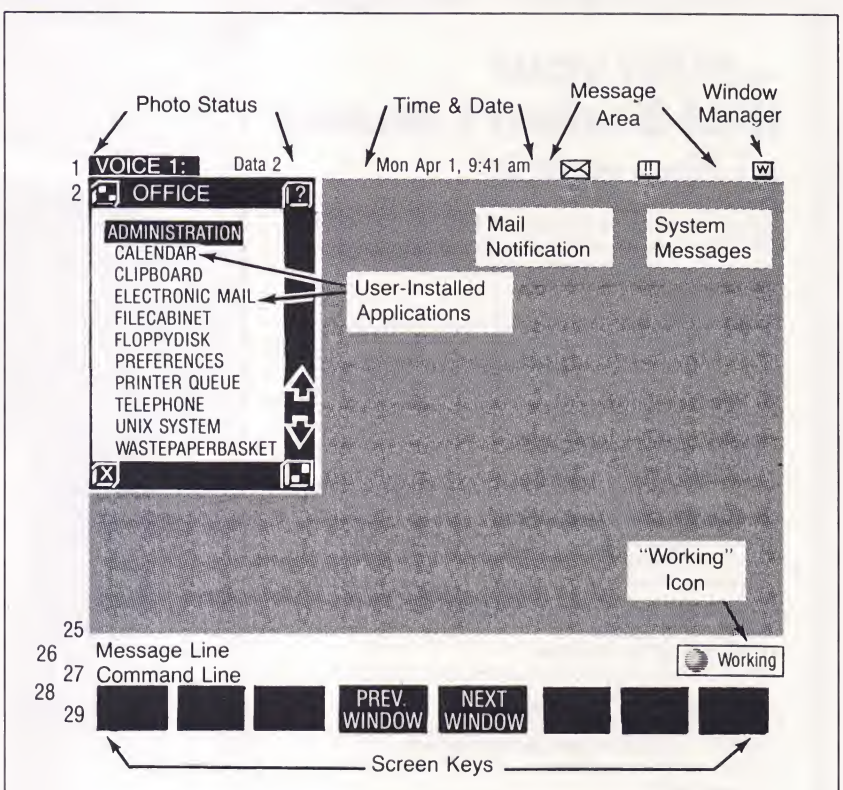
This is a true virtual memory system, which means that disk space is used as an extension of physical memory. Pages of programs (a page is 4 kilobytes) are moved in and out of real memory as needed. Maximum process size for a virtual memory program is 2.5 Mbytes, but may be reduced by hard disk limits.

Real limits of memory program size are determined by the free space on disk, which is marginal given the system's standard 10-Mbyte drive. The system may be purchased with as little as 512K bytes of main memory, but can be expanded up to 2 Mbytes in 512K increments. Disk memory is either a 10- or 20-Mbyte Winchester and a 320K, formatted floppy.

A complete rundown of the Unix PC's hardware and software is listed in the "Product Overview" sidebar.

I have a few problems with the basic hardware configuration. As noted, the evaluation unit contained a 10 Mbyte Winchester. I'm not sure why a 10 Mbyte drive is offered for a computer as powerful as this—especially since the Unix system, with its utilities, is a disk hog. Added operating system enhancements also take up a lot of space. On my evaluation unit with a spreadsheet, word processor, and the Development Set (C compiler) loaded, about 18 percent of the disk space was left. That's not enough for a computer that will do all of the things this machine does. Moreover, the hard disk rivaled the fans in creating noise pollution, producing a sound reminiscent of a defective water pump on an old car. Well, at least you know it's there.

I hope I'm wrong, but I'll bet a lot of people are going to ruin this monitor. As with any Unix system, the owner is advised in the documentation to leave the system on all the time (or run the shut down utility if required to power off). Many people will forget to dim the video at the



The Unix PC's has a 29-line by 80-column screen divided into several areas, as illustrated above. Line 1, the status line, displays telephone status for voice and data lines, current date and time, notice area for both the arrival of electronic mail, and the Window Manager icon that displays a list of current windows. Lines 2-25 are the user work area, where all user-controlled windows reside. Line 26 displays command feedback. Line 27 is for command entry. Lines 26-27 display a "System Busy" Icon at the right edge of the video. Lines 28-29 are for 8 function key legends, which change depending upon the operation and applications.

FIGURE 1: A SAMPLE UNIX PC SCREEN.

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end of the day, and after some time an etched image of either the Office window or the login request will appear. I wish the system had provision to automatically dim the video after some period of inactivity.

USER INTERFACE AND OFFICE

While this is a real Unix system, running a fully implemented System V, the Unix system characteristics in general are hidden from less sophisticated users. AT&T refers to this interface as the "User Agent." It provides users with windows and menu-based access to the Unix file system, applications, and communications at log on and displays a menu that uses familiar office terms whenever possible.

This first window (see upper left hand corner of Figure 1), the Office, provides several options: Administration (for system administration), Clipboard (for transferring data between applications), Filecabinet (containing user created files), Unix system (which opens up a window with the Bourne shell), and so on.

The top border also contains the window identifier or name, in this case "Office." Each corner has an icon within the border. A move icon is used to reposition the window, a shape icon to alter height or width, a close icon to cancel or close a window, a help icon to bring up context-sensitive help files, and scroll icons to scroll text.

Users move the mouse pointer over the desired item to select items, or "Tools" as AT&T refers to them, within the window Filecabinet, Unix, Clipboard, and so on. This converts the selected item into an inverse video mode. For the non-mouse user, keyboard cursor keys also may be used. A third selection method is to type either the name of an object within the window or as many characters as are required to uniquely identify it.

I'm sure that several people labored mightily to produce the mouse interface for this computer. However, I have never been a fan of anything that required taking my hands off the keyboard or running a gadget around the minimal clear space on my desk.

Therefore, being able to bypass the mouse either with cursor keys or typed commands—an option unique to this machine amongst machines employing similar interface technologies—is a real plus. In some cases you must use the mouse, as in reshaping or moving a window; but for most tasks, it can be avoided. Even devoted mouse lovers will find keyboard entry is required too—especially in some system set-up parameters—where it is necessary to hit the Enter or Create key. With the PC keyboard, the Enter and Return keys are separate and not always interchangeable.

The speed of this new interface is acceptable, except when resizing or relocating a window. During these operations the video just can't keep up, a bother and surprising since the overall performance is quite fast.

TELEPHONE

Another innovation incorporated in the Unix PC is the Telephone Manager program. As one would expect from AT&T, this software is full of fancy features: Two phone lines, autodialing, keyboard dialing, and last number redial are among the supported features. Users can create an on-screen telephone directory that not only lists telephone numbers but electronic mail addresses as well. An on-screen note pad may be set to come up with each call, allowing a convenient way to take notes about the call.

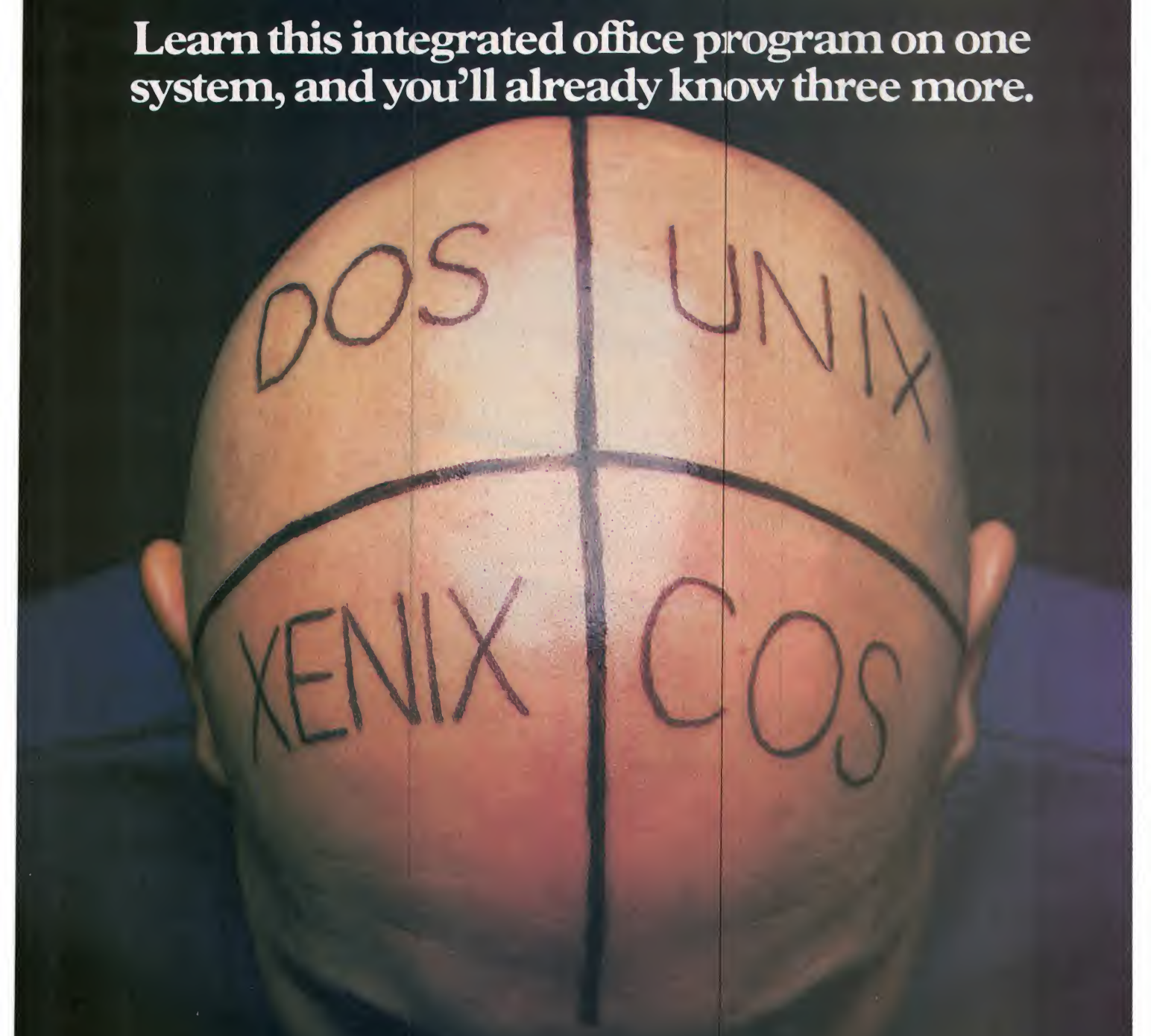
The Telephone Manager automatically generates a history file that records date, duration, callers, and their numbers. A window into the Telephone Manager may be opened either by using the shift F2 key or the mouse pointer at the VOICE 1 display at the top of the video screen. When the Telephone Manager is activated, soft programmable keys are activated for functions as Hold, Hangup, Redial, and Start Timer. This software also manages data calls. An optional integrated electronic mail program is also available.

SHELL

Placing the mouse over the Unix system object listed in the opening or Office menu and pressing the first button will bring up the familiar dollar sign shell prompt. You can also move into the shell at any time by typing `sh`. This will open a window with the shell even in the middle of an application program. Die-hards who want to defeat the entire user interface can edit `.profile` and remove the `exec /bin/ua` line. This will bypass all menus when you log in; but if you call up an application program that has been interfaced to the User Agent, you will find windows on your screen, and only a less than elegant procedure will get you back to the original un-windowed Bourne shell. My advice is, since you paid good money for a system with a neat interface, use it.

If you are trying to use the system via an external terminal or over the phone, then you may want to bypass the User Agent. Only a couple of terminals are able to handle the screen commands, a VT-100 and a BCT-513. With any other type you must log in as `root` to avoid the User Agent interface. If this were my system and I expected to have others calling it, I would set up a dummy, none root login without the

Learn this integrated office program on one system, and you'll already know three more.



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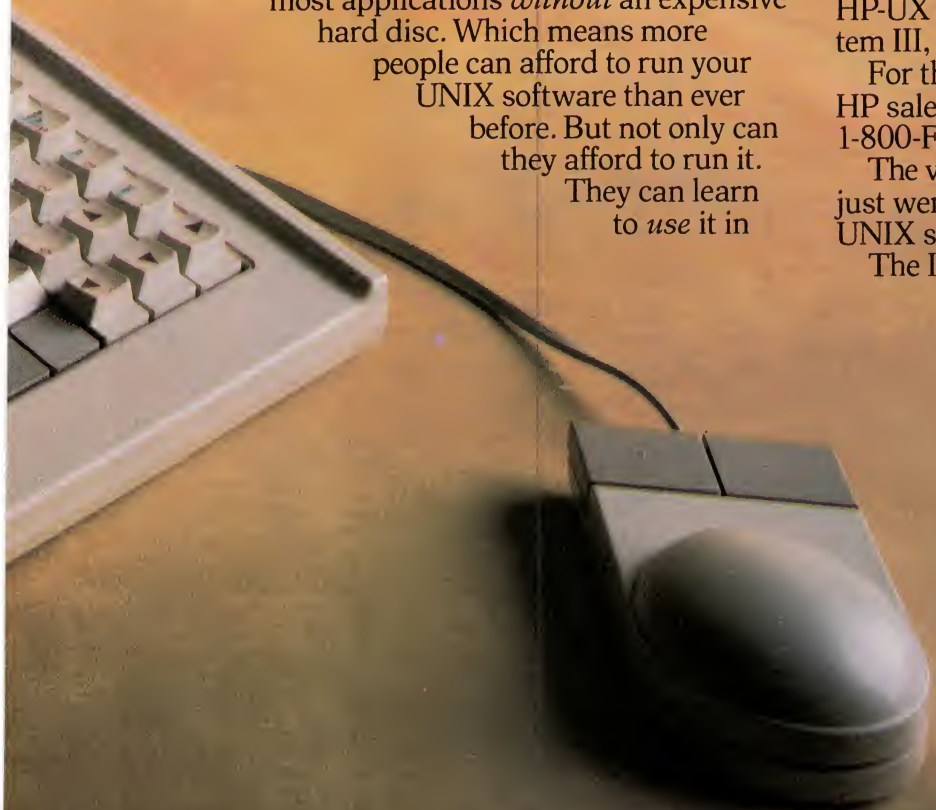

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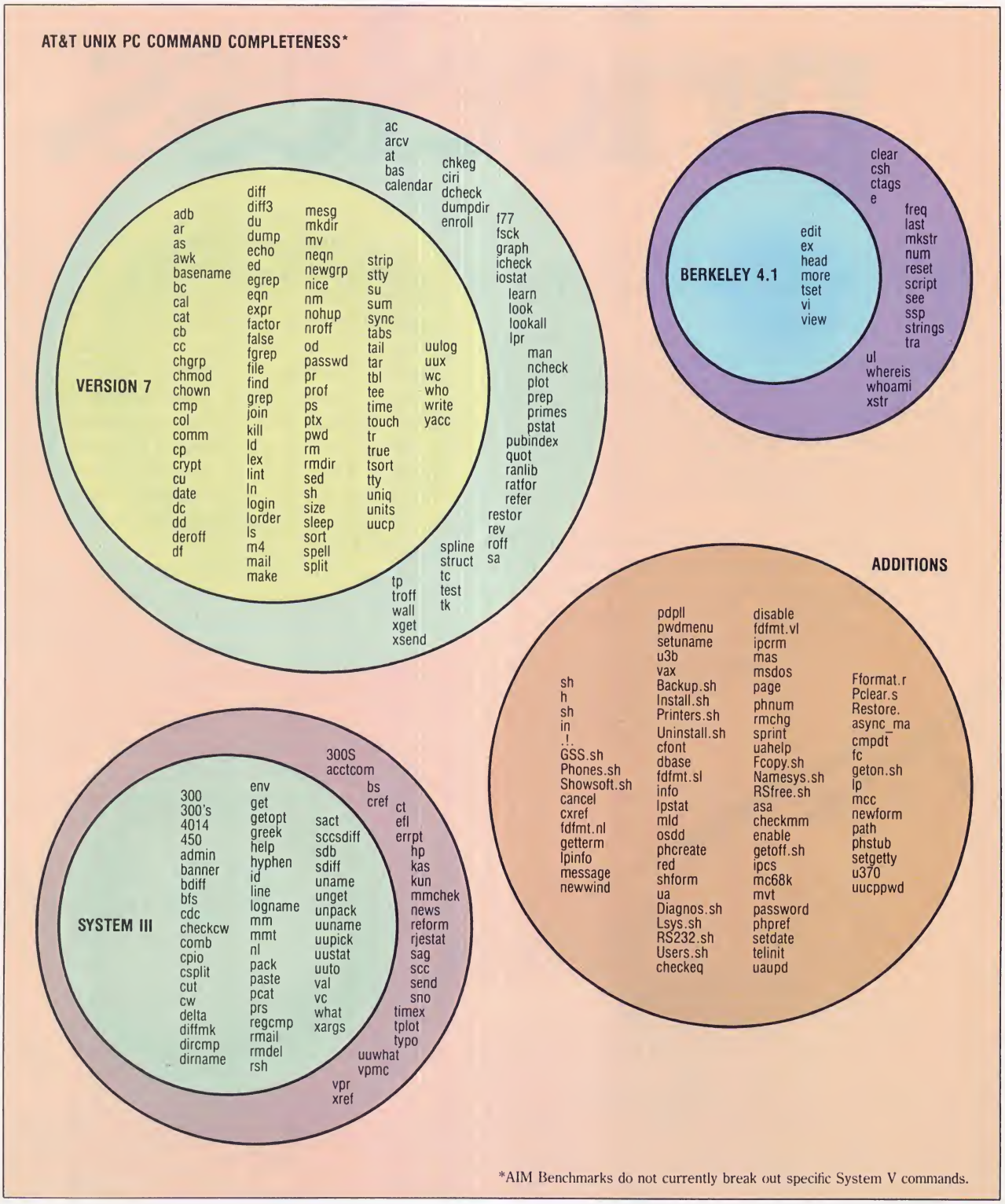
AT&T UNIX PC COMMAND COMPLETENESS*
VERSION 7
adb
ar
as
awk
basename
bc
cal
cat
cb
cc
chgrp
chmod
chown
cmp
col
comm
cp
crypt
cu
date
dc
dd
deroff
df
diff
diff3
du
dump
echo
ed
egrep
eqn
expr
factor
false
fgrep
file
find
grep
join
kill
ld
lex
lint
ln
login
lorder
ls
m4
mail
make
mesg
mkdir
mv
neqn
newgrp
nice
nm
nohup
nroff
od
passwd
pr
prof
ps
ptx
pwd
rm
rmdir
sed
sh
size
sleep
sort
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tabs
tail
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time
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tsort
tty
uniq
units
uucp
uulog
uux
wc
who
write
yacc
ac
arcv
at
bas
calendar
chkeg
ciri
dcheck
dumpdir
enroll
f77
fsck
graph
icheck
iostat
learn
look
lookall
lpr
man
ncheck
plot
prep
primes
pstat
pubindex
quot
ranlib
ratfor
refer
restor
rev
roff
sa
spline
struct
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test
tk
tp
troff
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BERKELEY 4.1
edit
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clear
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freq
last
mkstr
num
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script
see
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ul
whereis
whoami
xstr
ADDITIONS
sh
h
sh
in
.!.
GSS.sh
Phones.sh
Showsoft.sh
cancel
cxref
fdfmt.nl
getterm
lpinfo
message
newwind
pdpll
pwdmenu
setuname
u3b
vax
Backup.sh
Install.sh
Printers.sh
Uninstall.sh
cfont
dbase
fdfmt.sl
info
lpstat
mld
osdd
phcreate
red
shform
ua
Diagnos.sh
Lsys.sh
RS232.sh
Users.sh
checkeq
disable
fdfmt.vl
ipcrm
mas
msdos
page
phnum
rmchg
sprint
uahelp
Fcopy.sh
Namesys.sh
RSfree.sh
asa
checkmm
enable
getoff.sh
ipcs
mc68k
mvt
password
phpref
setdate
telinit
uaupd
Fformat.r
Pclear.s
Restore.
async_ma
cmpdt
fc
geton.sh
lp
mcc
newform
path
phstub
setgetty
u370
uucppwd
SYSTEM III
300
300's
4014
450
admin
banner
bdiff
bfs
cdc
checkcw
comb
cpio
csplit
cut
cw
delta
diffmk
dircmp
dirname
env
get
getopt
greek
help
hyphen
id
line
logname
mm
mmt
nl
pack
paste
pcat
prs
regcmp
rmail
rmdel
rsh
300S
acctcom
bs
cref
sact
sccsdiff
sdb
sdiff
uname
unget
unpack
uuname
uupick
uustat
uuto
val
vc
what
xargs
ct
efl
errpt
hp
kas
kun
mmchek
news
reform
rjestat
sag
scc
send
sno
timex
tplot
typo
uuwhat
vpmc
vpr
xref
*AIM Benchmarks do not currently break out specific System V commands.

exec file, so as to prevent someone else having total run of the system.

TERMINAL EMULATION

The Unix PC can be configured as a dumb terminal emulating either an AT&T 513 or a DEC VT-100. While this is a great way to under-utilize the power of this computer, it could come in handy if you have no other terminal. If nothing else it is a heck of a nice VT-100 with a built-in modem.

REMOTE BUGS

As part of my testing I configured the serial port for use with a terminal using procedures specified in the documentation. I connected my MS-DOS PC into the Unix PC using a null modem cable, with software running at 1200 baud. The remote terminal worked fine for a while. After irregular periods of inactivity from the remote terminal, the Unix PC would drop the serial connection, and I would get a new log on message displayed on my MS-DOS machine. I verified this several times over a couple of days.

In addition, and again at irregular intervals, the Unix PC would lock up its serial port. It was then necessary to shutdown to free up the port and re-establish normal operations. I also tried using the system with the terminal as above, while a second terminal was tied in using the telephone line. No problems were encountered having all three ports active until I tried to use `write` from the hard wired terminal. On the Unix PC, I had a Unix window opened over the Office window. When I sent a "write" message to the PC, it tried to place the message in the Office window and at the same time filled the screen of the terminal tied in via the data line with garbage. I was able to restore the Office window to its normal appearance only by logging off the system and back on again. When I tried using `write`, from the Unix window, to write to the system tied in via the data phone line, it disconnected the remote user.

The fact that the system dropped connection to a hard wired

terminal—and even worse, required running shut down to restore the line was not what I expected. I called AT&T about these problems, and they stated that `write` had not yet been integrated into the User Agent. They had no answer for the serial line problem, except that the evaluation unit may have had some defect. AT&T claims, and I believe them, that they use Unix PCs extensively with external terminals and have not experienced problems.

SYSTEM ADMINISTRATION

Finally a Unix system has arrived that does not need a system administrator! Selecting "Administration" from the opening window allows you to configure phone lines, set up for electronic mail, configure the serial port, install and or remove software, format floppy disks and make duplicates, assign or remove new users and even read, but not write to, MS-DOS disks in standard IBM-PC format. Routine functions that need to be performed by a "System Administrator" on a multitasking, multiuser computer have become a menu selection on the Unix PC.

AT&T UNIX PC APPLICATIONS SOFTWARE

Programming and Development Tools: Microsoft BASIC Interpreter, RM/COBOL Compiler, RM/COBOL Run Time, LPI-C, LPI-COBOL, LPI-Pascal, LPI Run Time, LPI-Debug, AT&T Unix PC Unix Utilities, AT&T Unix PC Development Tools, AT&T Unix PC BASIC Interpreter, AT&T Unix PC BASIC Compiler, SVS-FORTRAN, and SVS-Pascal; **Communications:** AT&T Unix PC, and Electronic Mail; **Word Processors:** Microsoft Word, and AT&T Unix PC Word Processor; **Spreadsheets:** Multiplan (by Microsoft), and Supercomp 20; **Databases:** dBase III (by Ashton-Tate); **Graphics:** GSS-Chart, Sound Presentations by CDI, and AT&T Unix PC Business Graphics; **Accounting:** AT&T Business Accounting System, General Ledger, Accounts Receivable, Accounts Payable, Payroll, and Order and Inventory Management.

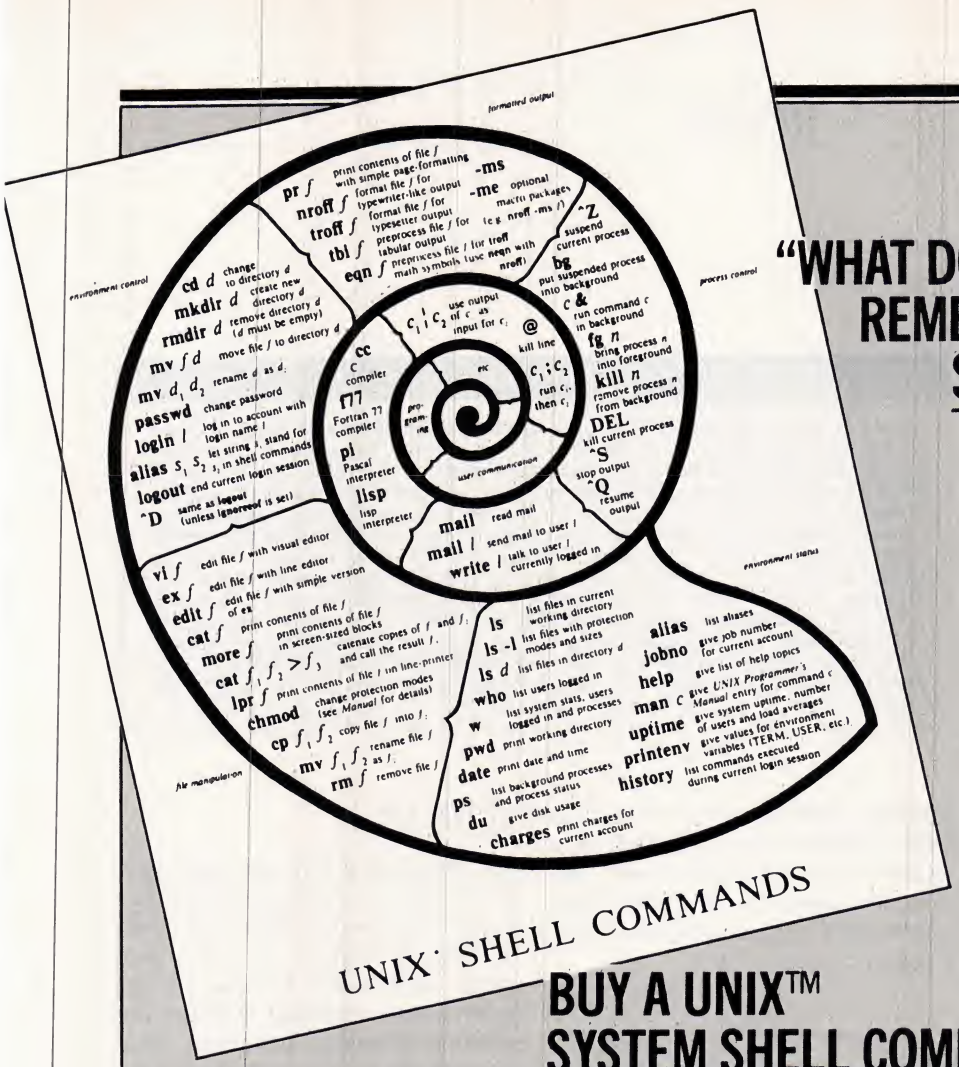
DOCUMENTATION

AT&T has done a good job in documentation for this new computer, addressing both the beginning and the experienced user. For the beginner, the *Owner's Manual* and *Getting Started Guide* are easy to follow and offer nearly all information required to set-up and use the Unix PC.

A full complement of standard Unix system documentation is provided for more knowledgeable users, including coverage of all new system calls unique to the PC's User Agent. I was glad to see the software system interface covered in depth. AT&T evidently wants to make writing application programs that interface to the User Agent as easy as possible. *Quick Reference Guides* are also provided, saving a great deal of time. Good job AT&T!

PERFORMANCE

There are benchmarks and there are benchmarks. I'm not sure just how much any of them really mean. What counts is how a computer performs the way *you* use it. I ran benchmarks that Andy Felong and I have used to



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	Unix PC	3B2	IBM AT
Test 1	2.0	3.7	3.4
Test 2	2.4	3.7	3.1
Test 3	4.0	6.7	4.0
Test 4	4.4	8.0	6.6

FIGURE 2: BENCHMARK COMPARISONS OF UNIX PC, 3B2/300, AND IBM PC AT WITH XENIX 3.0.

AT&T UNIX PC PRODUCT OVERVIEW

Model: Unix PC; **Price:** $5,500-$7,000; **Configuration reviewed:** Base unit, keyboard, 10-Mbyte hard disk, 512K bytes of main memory, three-button mouse, and display; **Related Models:** None at this time; **Processor:** a 10 Mhz Motorola 68010; **Min. Memory:** 512K bytes; **Max. Memory:** Up to 2 Mbytes in 512K byte increments; **Display:** 29 lines by 80 columns, green-phosper, bit-mapped, tilt-and-swivel; **Keyboard:** 103-key, detached keyboard, Qwerty layout, 8 programmable keys, four cursor-control keys, and numeric pad; **Mass Storage:** One 320k byte, formatted 5 1/4-inch floppy and a 10-Mbyte hard disk standard, with optional 20-Mbyte hard disk available; **Backup:** floppy disk; **Communications Ports, Capabilities:** One Centronics-compatible parallel printer port, one RS-232C asynchronous DTE communications port, two phone lines for simultaneous voice and data, and a built-in, auto-dial, auto-answer modem; **Communications and Networking Protocols Supported:** CU, UTC; **Shells:** Bourne; **Languages:** C, Pascal, BASIC Interpreter, Cobol, RM Cobol, and Fortran.

compare many previous systems. Part of these are four different versions of a sieve program. The comparisons between the Unix PC, a 3B2/300, and an IBM AT running the new IBM Personal Computer Xenix are shown in seconds in Figure 2.

Yes, the AT&T Unix PC is fast!

As I noted elsewhere, the redraw and resize are not as fast as expected. I tried to measure the minimum time it took to redraw the Office window from its default size to full screen. Over five tries, the time averaged 3.5 seconds. This seems slow for an otherwise fast computer.

SUMMARY

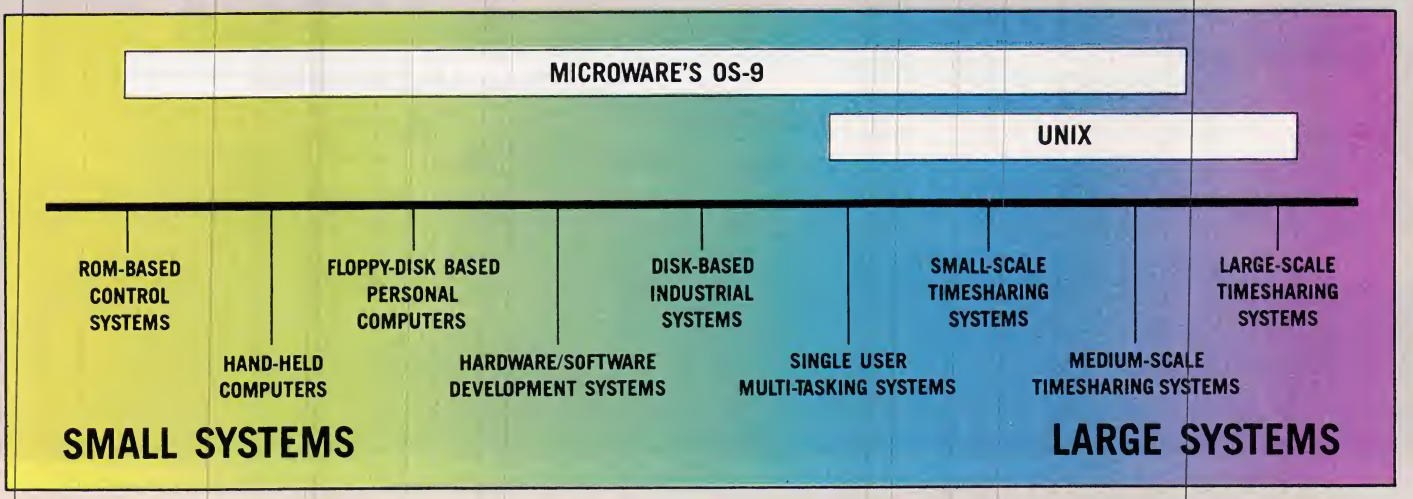
Just how good is this new user interface? Well, it's a matter of who uses it. For someone with little or no Unix system experience it will seem great. Also, if you are like me and believe that operating systems are things to be paid for and never seen, you will like it. (After all, it's the applications that really count.)

If you think Macintosh technology is the only way to go, you will wonder how AT&T was able to take a computer with a very fast CPU and slow it down so much when moving or reshaping windows.

If AT&T can convince the public that there really is adequate software of acceptable quality for the PC, it could make a sizable dent in the marketplace. Indeed, the Unix PC is something new and improved in the world of the Unix system, packaged in a modern manner and full of fancy features. AT&T has come a long way from the old days of black telephones. □

Harry Avant is a member of the technical staff at the Jet Propulsion Laboratories, Pasadena, Calif. His work involves evaluating micro- and minicomputers and their related software for office automation applications. Mr. Avant's last work for UNIX/WORLD appeared in Vol. 2, No. 5.

Only Microware's OS-9 Operating System Covers the Entire 68000 Spectrum



Is complicated software and expensive hardware keeping you back from Unix? Look into OS-9, the operating system from Microware that gives 68000 systems a Unix-style environment with much less overhead and complexity.

OS-9 is versatile, inexpensive, and delivers outstanding performance on any size system. The OS-9 executive is much smaller and far more efficient than Unix because it's written in fast, compact assembly language, making it ideal for critical real-time applications. OS-9 can run on a broad range of 8 to 32 bit systems based on the 68000 or 6809 family MPUs from ROM-based industrial controllers up to large multiuser systems.

OS-9'S OUTSTANDING C COMPILER IS YOUR BRIDGE TO UNIX

Microware's C compiler technology is another OS-9 advantage. The compiler produces extremely fast, compact, and ROMable code. You can easily develop and port system or application software back and forth to standard Unix systems. Cross-compiler versions for VAX and PDP-11 make coordinated Unix/OS-9 software development a pleasure.

SUPPORT FOR MODULAR SOFTWARE — AN OS-9 EXCLUSIVE

Comprehensive support for modular software puts OS-9 a generation ahead of other operating systems. It multiplies programmer productivity and memory efficiency. Application software can be built from individually testable software modules including standard "library" modules. The modular structure lets you customize and reconfigure OS-9 for specific hardware easily and quickly.

A SYSTEM WITH A PROVEN TRACK RECORD

Once an underground classic, OS-9 is now a solid hit. Since 1980 OS-9 has been ported to over a hundred 6809 and 68000 systems under license to some of the biggest names in the business. OS-9 has been imbedded in numerous consumer, industrial, and OEM products, and is supported by many independent software suppliers.

Key OS-9 Features At A Glance

- Compact (16K) ROMable executive written in assembly language
- User "shell" and complete utility set written in C
- C-source code level compatibility with Unix
- Full Multitasking/multiuser capabilities
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- Rugged "crash-proof" file structure with record locking
- Works well with floppy disk or ROM-based systems
- Uses hardware or software memory management
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Chiba 273, Japan
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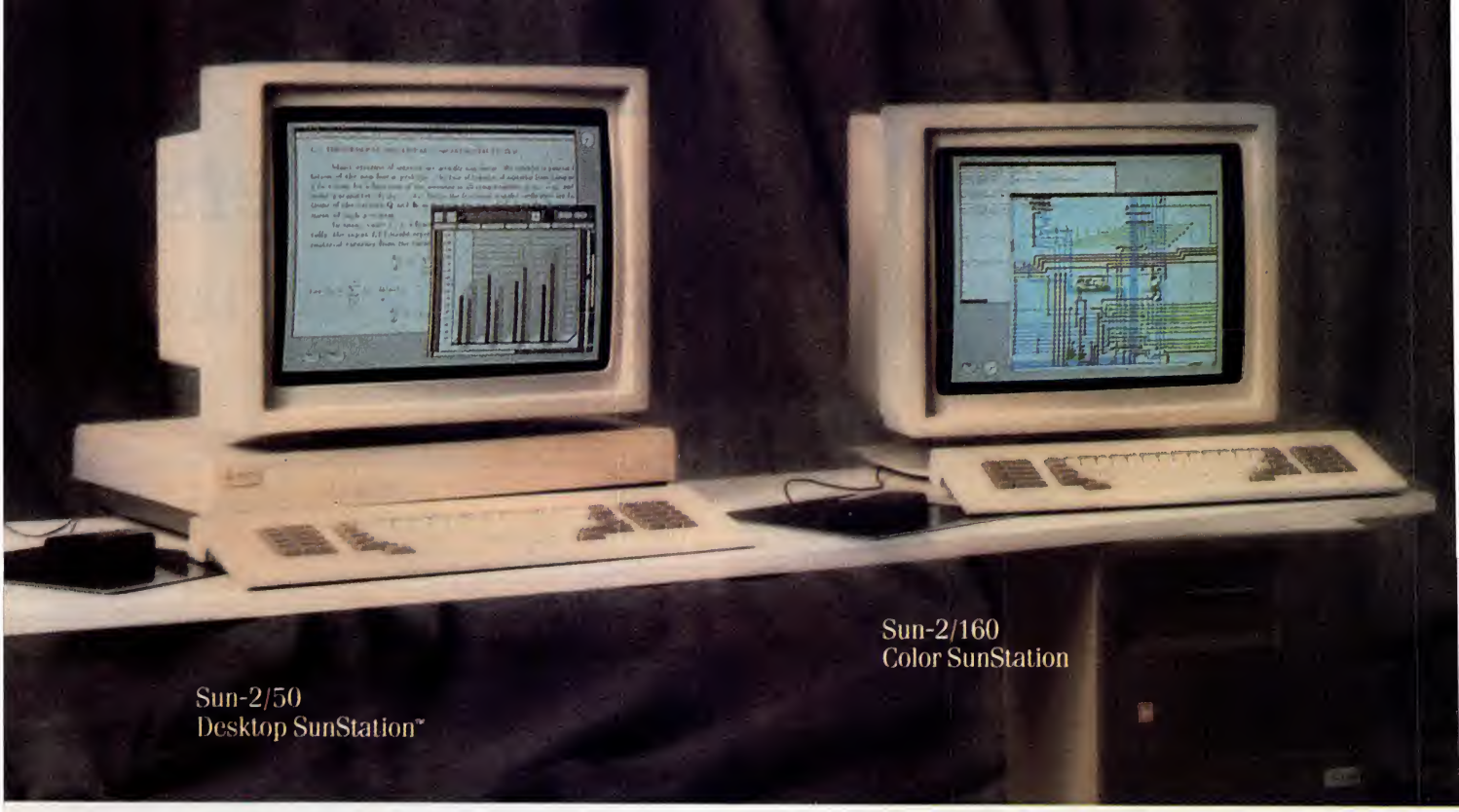

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Sun workstations are in the vanguard of the open rebellion against proprietary computer systems. And the closed minds that design them.

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Sun's entire family of workstations is built around the same powerful "standard" features, including: A Motorola 68010 microprocessor. Ethernet 10 megabit/sec. local area network (LAN). An advanced UNIX™ operating system, supporting up to 16 megabytes of virtual memory space per process. 9-slot Multibus® (IEEE-796) or 15-slot VME cardcages. High resolution, 1152 x 900 pixels, display and 66Hz non-interlaced refresh. Two RS-423 serial ports with full modem control. Mouse pointing device. Latest Sun software release including: SunWindows,™ SunCore™ graphics library, Sun Network File System, C/Fortran/Pascal compilers, a 68010 assembler. And more.

Sun keeps your options open by allowing you to configure your workstations with or without disk, as standalone units, nodes in a network, or as fileservers. Sun Workstation® options include: Main memory expansion of up to 8 megabytes. Up to 380 megabytes (formatted) disk subsystem. ¼″ cartridge tape and ½″ tape drive subsystems.

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Sun microsystems

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SOFTEST SIGNS RCA

SofTest Inc. has signed a contract with RCA Service Corp. under which RCA will sell SofTest's new communication product, Sweet Talk.

Sweet Talk provides access to a wide range of on-line database services, electronic mail services, electronic bulletin boards, and remote computers. Sweet Talk is a Unix system-based product that brings all of the features of the popular MS-DOS communication products, such as Crosstalk, SmartCom, and PFS:Access, to the Unix system.

Sweet Talk is currently available on Altos computers and Radio Shack 16Bs and 6000's. The cost for single copies on Unix systems is $300.

For more information, contact SofTest Inc., 555 Goffle Rd., Ridgewood, NJ 07450; 201/447-3901.

Please circle Reader Service Number 160.

AT&T LINKS VOICE, DATA

AT&T extended its office automation networking capabilities with the introduction of new products and enhancements designed to link voice and data communications into integrated systems.

The products include: the general availability of AT&T enhancements to AT&T's Information Systems Network, a packet-switched local area network that includes synchronous support for IBM's Systems Network Architecture and other industry-standard protocols; enhancements to the AT&T System 75 digital PBX, including the capability to function as a hub switch in a business' private Electronic Tandem Network; a new, low-cost digital voice terminal; and new AT&T 3270 Data Modules that allow 3270 displays to switch through the System

The AT&T 7404 is a new low-cost digital voice terminal.

75 and System 85 to cluster controllers for greater flexibility than is found with traditional dedicated coaxial connections.

For more information, contact AT&T, 100 Southgate Pkwy., Morristown, NJ 07960; 201/898-8337.

Please circle Reader Service Number 161.

AUTOMATIC DIAL BACKUP FROM BACKUS

Backus Data Systems Inc. has brought out a new automatic dial fall back (ADF) option.

The ADF feature is available for users who purchase either Dialmux units for operation over the switched dial-up telephone network with intention to eventually convert to leased lines, or those customers who install the Linemux version and have an immediate requirement for fall-back protection to an alternate circuit in the event the primary line becomes disrupted.

The ADF feature will automatically sense when data is not being transmitted or received properly and will issue a prestored telephone number to a standby auto dial modem. Pricing for the new ADF option is $195 per unit.

For more information, contact Backus Data Systems Inc, 1440 Koll Cir., Ste. 110, San Jose, CA 95112; 408/279-8711.

Please circle Reader Service Number 162.

CSI OPENS IBM NET

Communications Solutions Inc. (CSI) has introduced Access/DIA, a new software package that allows any non-IBM workstation or processor to

Dialmux from Backus now offers a new automatic fall back option.

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communicate with IBM office products.

Access/DIA provides a high-level interface to perform the three primary functions of DIA—document distribution, library searches, and remote application processing.

With Access/DIA, users can distribute documents to one or more recipients in an IBM office network, and can retrieve documents that have been distributed by others.

Written in the C language, Access/DIA is compatible with CSI's entire line of SNA communication products. The cost to system manufacturers is approximately $225 per unit in low volume shipments. Access/DIA is available for immediate delivery.

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

Please circle Reader Service Number 163.

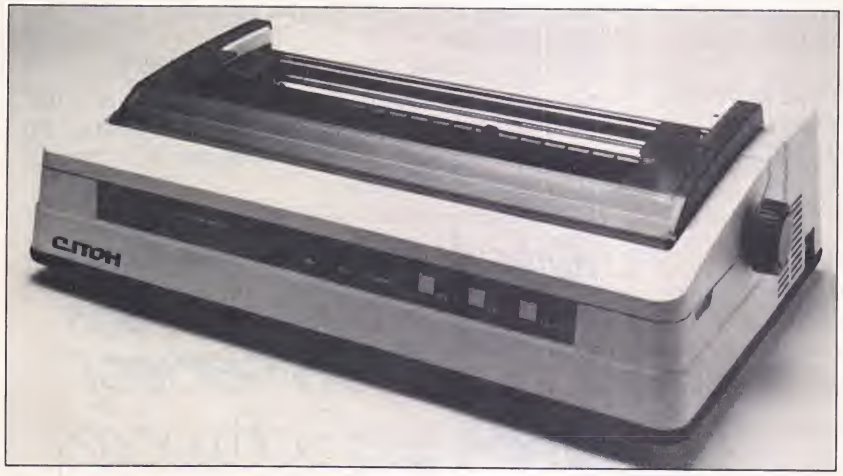
C. ITOH'S DOT-MATRIX PRINTER

C. Itoh Digital Products Inc. has introduced a high-speed, 200 character-per-second, letter-quality, 24-pin print head, seven-color, dot-matrix printer with suggested retail price of $1295.

The 24LQ operates at up to 200 characters-per-second (CPS) for data processing, 133 CPS for memo quality, and 67 CPS for letter-quality printing. The 24LQ features a 16K-byte buffer, movable tractor and friction feed, plug-in LQ character generation, and either Centronics parallel or RS-232C serial interface. In addition, it features print characters for 14 foreign languages, including a Greek character set for medical and scientific applications.

For more information, contact C. Itoh, 19750 So. Vermont Ave., Suite 220, Torrance, CA 90502; 1-800/423-0300.

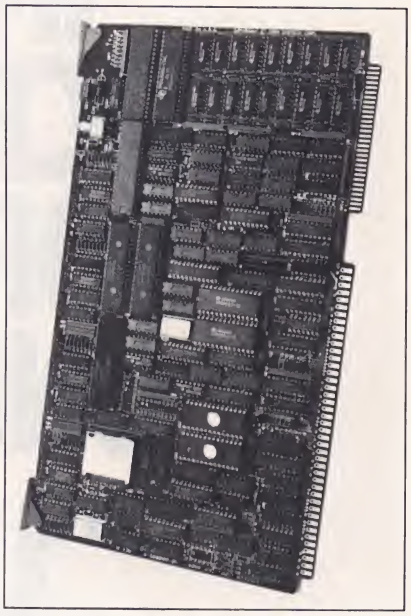
Please circle Reader Service Number 164.



C. Itoh's Prowriter 24LQ, is a new high speed dot-matrix printer.

SYSTECH DATA COMM PROCESSOR

Systech Corp. introduced its Data Communications processor (DCP)-8804, a computer board with a half million bytes of main memory designed to provide serial interfaces



A new Data Communications processor from Systech Corp.

with a wide range of standard and custom communication protocols.

A four channel, IEEE-796-compatible, high-performance general purpose communications processor on a single printed circuit board, the DCP-8804 significantly raises system throughput by offloading communications related functions from the main computer.

The company provides its OEM customers Unix-system-compatible software drivers.

The DCP-8804, with 256K bytes of RAM, sells for less than $2000 in OEM quantities of 100 or more.

For more information, contact Systech, 6465 Nancy Ridge Dr., San Diego, CA 92121; 619/453-8970.

Please circle Reader Service Number 165.

NEW HARRIS SUPERMINI

Harris Corp. has introduced a new family of high-performance superminicomputers based on an ad-

TEXT EDITING

NEW RELEASE

UNIPRESS EMACS™

VERSION 2

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

Subject: Multi-window, full screen editor.

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

New Features:

- *EMACS is now smaller and faster.*
- *Sun windows with fonts and mouse control are now provided.*
- *Extensive on-line help for all commands.*
- *Overstrike mode option to complement insert mode.*
- *New arithmetic functions and user definable variables.*
- *New manual set, both tutorial and MLISP guide.*
- *Better terminal support, including the option of not using unneeded terminal drivers.*
- *EMACS automatically uses terminal's function and arrow keys from termcap and now handles terminals which use xon/xoff control.*
- *More emulation—TOPS20 for compatibility with other EMACS versions, EDT and simple WordStar™ emulation.*

Features:

- *Multi-window, full screen editor for a wide range of UNIX, VMS™ and MS-DOS™ machines.*
- *"Shell windows" are supported, allowing command execution at anytime during an edit session.*
- *MLISP™ programming language offers extensibility for making custom editor commands! Keyboard and named macros, too.*
- *"Key bindings" give full freedom for defining keys.*
- *Programming aids for C, Pascal and MLISP: EMACS checks for balanced parenthesis and braces, automatically indents and reformats code as needed. C mode produces template of control flow, in three different C styles.*
- *Available for the VAX™ (UNIX and VMS), a wide range of 68000 machines, IBM-PC,™ Rainbow™ 100+, and many more.*

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VAX/VMS	$2500	7000
68000/UNIX	395	995
MS-DOS	475	*

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vanced 32-bit architecture and a native Unix operating system. These new HCX-7 systems achieve 7 MIPS.

Harris has chosen AT&T System V with Berkeley 4.2 extensions for the HCX-7, which also features an instruction set that has been simplified and reduced in complexity.

Main memory supported by Harris HCX-7 systems is based on either 64K or 256K RAM circuits and employs four-way interleaving. To prevent disruption of data, single-bit and double-bit error correction schemes have been incorporated.

A basic configuration of the HCX-7 is priced at $225,000.

For further information, contact Harris Corp., 2101 W. Cypress Creek Rd., Ft. Lauderdale, FL 33309; 305/973-5125.

Please circle Reader Service Number 166.

PHILON COMPILERS FOR ALTOS 3068

Philon Inc. said it will supply its compilers for the Altos 3068 multi-user supermicrocomputer, which is based on the new Motorola 68020 chip.

The new Altos 3068 is compatible with the Unix System V operating system, and supports up to 30 users.

For more information, contact Philon, 641 Avenue of the Americans, New York, NY 10011; 212/807-0303.

Please circle Reader Service Number 167.

OPTOTECH'S OPTICAL DISK

Optotech Inc. has introduced the Optical Disk Drive 5984, a 5¼ inch, write-once-read-mostly (WORM) storage system designed to be integrated into personal and small-business computers and workstations. Its double-sided, 400-Mbyte, removable cartridges offer more than 200 Mbytes of on-line storage.

For more information, contact Optotech Inc., 770 Wooten Rd., Ste. 109, Colorado Springs, CO; 303/570-7500.

Please circle Reader Service Number 168.

CCI ADDS FLOATING POINT

Computer Consoles Inc.'s Commercial Products Group has introduced a floating point/math accelerator option to the Power6/32 superminicomputer.

The floating point/math accelerator is a high-speed co-processor that maximizes the performance of the Power6/32 system.

The basic Power6/32, with 4 Mbytes of memory, tape and disk controller, console terminal, battery backup, asynchronous controller, and Unix system license starts at $146,000. The floating point/math accelerator option is $16,500.

For more information, contact Computer Consoles Inc., 97 Humboldt St., Rochester, NY 14609; 716/482-5000.

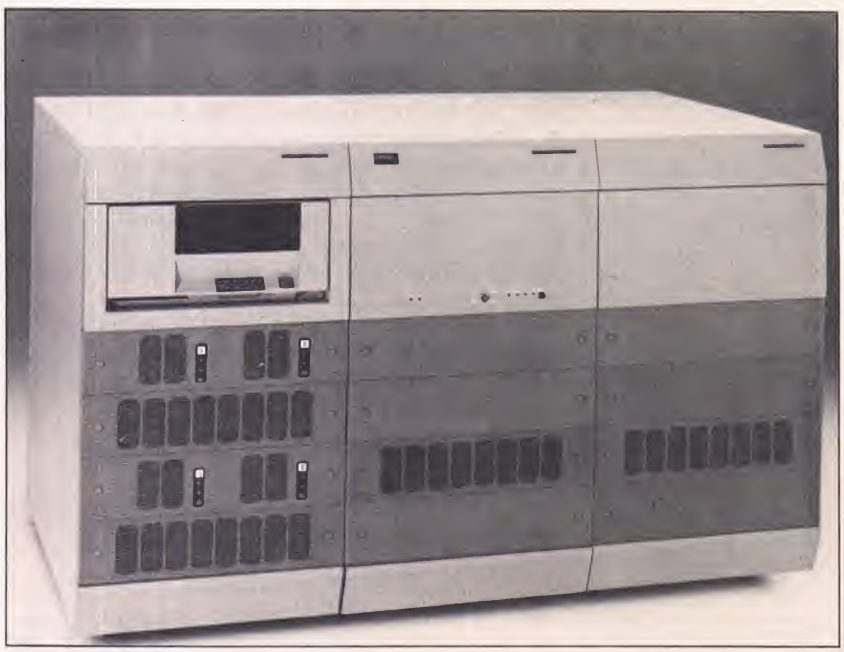
Please circle Reader Service Number 169.

MICROSOFT OFFERS XENIX VERSIONS OF HIGH-LEVEL LANGUAGES

Microsoft Corp. has released Microsoft Xenix versions of four high-level languages: Microsoft FORTRAN, Microsoft Pascal, Microsoft COBOL, and Microsoft BASIC.

Each of the language releases allows users to link directly into the Xenix system libraries, so that their programs can take full advantage of the operating system's multitasking and multi-user capabilities.

Three Xenix features that pro-



CCI's Power6/32 superminicomputer now has a floating point/math accelerator option.

grammers will find useful are shell support, pipes, and record and file locking.

For more information, contact Microsoft Corp., 10700 Northup Wy., Box 97200, Bellevue, WA 98009; 206/828-7400.

Please circle Reader Service Number 170.

ADAX X.25 FOR UNIX SYSTEMS

An X.25 network communications product for Unix systems has been introduced by Adax Inc.

X.25 for Unix systems can serve as a communications front-end that allows a Unix system machine to be used as a timesharing host. X.25 can also operate in local or global networks and work with large mainframe computers which speak X.25.

Compatible with Version 7 and System V, X.25 for the Unix system is complemented by a line of compatible hardware for X.25 bit-synchronous transmission on Multibus, VME and S-100/IEEE-696 standard bus formats.

The price for software is $750 and the hardware begins at $850.

For more information, contact Adax, Inc., 737 Dwight Way, Berkeley, CA 94710; 415/548-7047.

Please circle Reader Service Number 171.

FLORIDA DATA LOWERS PRINTER PRICE

Florida Data Corp. has lowered the suggested retail price on its Model 3000 matrix printer from $3795 to $3395.

This decision is a direct result of the increased VAR request for the

FDC printer in DP applications related to financial, accounting, medical, inventory control, and manufacturing, multiuser environments, the company claims.

The Model 3000 DP matrix printer uses FDC's high-speed stored energy printhead technology to produce high-speed draft quality at up to 675 characters per second (11.25 characters per inch DP font). The 3000 offers a high-level common parts with FDC OSP series for easy field maintenance and support.

For more information, contact Florida Data Corp., 600D John Rodes Blvd., Melbourne, FL 32935.

Please circle Reader Service Number 172.

FLEXIBLE INKS ADA LICENSE

Flexible Computer Corp. has signed a licensing agreement with Verdix Corp. that will provide Verdix's Ada programming language compiler for Flexible's Flex/32 MultiComputer. The Flex/32 incorporates parallel hardware and concurrent software.

Ada is a new, high-order language developed for and mandated by the Department of Defense to reduce software development and maintenance costs by establishing a standard programming language for mission-critical procurements. For more information, contact Flexible Computer Corp., 1801 Royal Ln., Suite 810, Dallas TX 75229; 214/869-1234.

Please circle Reader Service Number 173.

LOTUS TO OFFER BLAST FOR SYMPHONY

Lotus Development Corp. and Communications Research Group have signed an agreement to develop a Blast driver or interface for Lotus' Symphony integrated software package. The driver will add Blast communications capabilities between Symphony and 23 leading operating systems.

Symphony's Blast driver is available immediately. Products are priced at $250 (micros), $495-$895 (minicomputers), and $1295 to $5500 (mainframes).

For more information, contact Communications Research Group, 8939 Jefferson Hwy., Baton Rouge, LA 70809; 504/923-0888.

Please circle Reader Service Number 174.

TWO IBM PC PRINTERS

IBM has announced two low-cost, desktop printers that produce graphics and near-letter-quality text for personal computers.

The $549 IBM Proprinter, which prints at three speeds, is designed for office or home use. Continuous-form paper, from the top, can be used for high-speed drafts or long reports and left in place while letters and envelopes, for example, are inserted in front.

The $745 IBM Color Jetprinter is designed for business professionals who want to incorporate up to seven colors into charts, graphs, spreadsheets, or high-quality text.

For more information, contact IBM, 900 King Street, Rye Brook, NY 10573; 914/934-482.

Please circle Reader Service Number 175.

PRINT ENGINE FROM DELPHAX

Delphax Systems has introduced the 2490, a 90-page-per-minute, continuous-feed print engine for electronic print environments that require up to two million pages per month.

The 2490 print engine uses the proprietary Delphax ion printing technique with cold-pressure fusing to produce a resolution of 240 dots-per-inch. The 2490 prints on plain bond paper with mean copies between failure (MCBF) of one million sheets.

For more information, contact Delphax Systems, 315 University Ave., Westwood MA 02090; 617/461-1410.

Please circle Reader Service Number 176.

NEW LOW-END PLEXUS SYSTEM

Plexus Computers Inc. has introduced the Plexus P/20, a high-performance, Unix system-based multiuser microcomputer incorporating dual 68010 microprocessors, SCSI and multibus interfaces, and a full implementation of Unix System V release 2.0.

The 8-user P/20 system with a 24 Mbyte hard disk, 1 Mbyte unformatted floppy, and half a Mbyte of memory, is priced at $10,950.

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

Please circle Reader Service Number 177.

ONYX ENTERS XENIX MARKET

Onyx Systems, Inc. has released Xenix for its Onyx 6001 multi-user microcomputer.

The Onyx 6001 in the desktop model allows up to six users and provides a separate parallel printer port. The vertical model of the 6001 (available this fall) will allow fourteen RS232C ports plus a parallel printer port.

System prices begin at $7996

for a 512KB, 20MB disk system, including floppy backup and terminal.

For further information, contact Onyx, 25 East Trimble Rd., San Jose, CA 95131-1162; 408/946-6330.

Please circle Reader Service Number 178.

STYLE 2.3 FROM FOOTHILL RESEARCH

Foothill Research has enhanced STYLE, a high-level programming language for 32-bit minicomputers, to include windowing and user programmable function keys. In addition, they have added familiar programming terms (constructs) found in other languages, software tools, and advanced data base features.

A single copy license for STYLE ranges in price from $15,500 to $45,000, depending on the type of computer system. Deliveries will begin third quarter, 1985.

For more information, contact Foothill Research Inc., 1301 Shoreway Rd., Ste. 300, Belmont, CA 94002; 415/593-6696. □

Please circle Reader Service Number 179.

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.

SYSTEMS ADMINISTRATION: CURES FOR BUSINESS ILLS

PART 5, BACKING UP YOUR FILE SYSTEM

BY DR. REBECCA THOMAS

Remember from our first installment the scenario in which that important file just "disappeared" from your Unix system? If you have a backup copy—fine. You can restore it and be back in business. But if you didn't take the time (or didn't know how) to back up that file, it's too late now—no one can help you. However, read on and learn how to back up your files before one disappears again....

Backing up a file simply means to create another duplicate copy that can be used to replace the original one in case it was destroyed. It's best to place the backup copy onto a storage device different from the working system disk. That way even if the system disk or the data on it is ruined you haven't lost your work.

As system administrator, you should back up all the files on your system disk when you place your new Unix computer system in operation. This backup should be archived away permanently as your "system files archive." Also, add any software that has been customized to run on your system to this archive so you won't have to reconfigure the software if it's lost. Now, if necessary, you can recreate your initial file system configuration from this backup.

At the end of each work session you should make copies of data files, programs, and commands that have been modified or added during that session. Now you have both a full system backup and incremental backups from each work session. You can recreate the most recent version of your file system except for work performed since the last backup. However, after a short time the number of incremental backup copies will become unmanageable. At this point, you should perform another full-system backup, consolidating all incremental backups. Then begin the incremental backups anew.

a. Archiving a file to your "backup" directory:
cp *filename* **$HOME/Backup**

b. Retrieving a file from your "backup" directory:
cp $HOME/Backup/ *filename* **.**

c. Creating a filename link in your "backup" directory:
ln *filename* **$HOME/Backup**

d. Archiving a file to the `/tmp` directory:
cp *filename* **/tmp**

FIGURE 1: ARCHIVING YOUR PERSONAL FILES

USERS SHOULD BACK UP THEIR FILES WHILE WORKING

As an ordinary system user (not the system manager) you should back up your files periodically while working on them. This way if you inadvertently destroy or lose a file during your work session, you will have a relatively recent copy with which to begin again. Several Unix system utilities are available for performing such backups.

One simple approach is to use the Unix file copy command, `cp`, to create a duplicate copy of the file. You might copy it to a "backup" directory in your personal work area. For instance, from your home directory enter `mkdir Backup`. Then, whenever you wish to create a duplicate from anywhere in the file system, enter the command line shown in Figure 1A. Figure 1B shows the command line you'd use to retrieve the backup file.

If you're editing a file you should "back up" the disk copy periodically by writing the memory buffer to your system disk. This way, if you messed up the buffer beyond repair, you could retrieve a recent version from your work area.

If disk space is an issue, you could use the link command, `ln`, to create another name for the same file in your "backup" directory. Figure 1C shows the command to use. Note this approach will not save you if the original file contents are destroyed (as the link is simply an alternate name for the same file), but it will give you another chance in case you erase the original file by mistake (with `rm`).

Copying or linking files is only good for short-term backup (during your current work session). You must archive files off the system disk for permanent storage.

ARCHIVING FILES OFF THE SYSTEM DISK

The best backup approaches actually make duplicate copies of the files on storage devices other than the system disk. Several ways accomplish this, and all generally require superuser privileges. We discuss two of the most common techniques by presenting a simple scenario that lets you recover almost all of your files even if the worst possible disaster happens—the entire file system or system disk becomes inaccessible.

How often you, as system administrator, should back up the file system depends on file system activity. The more quickly files are created, or changed, the more often you should back up the file system. Once a week should suffice for a full backup unless you are a large facility with hundreds of users. Perform an incremental backup of all files added or changed before shutting down the system or leaving for the day.

Larger Unix systems generally use nine-track magnetic tape as the backup medium. Smaller systems use floppy disk or cartridge magnetic tape media. The tape media does not have to be formatted, but disk media must be because the disk address and timing information must be recorded first. (See last month's installment on formatting a disk.)

The first backup method we will describe is well suited for archiving the entire system.

DUMPING AND RESTORING THE ENTIRE FILE SYSTEM

Each major Unix system release seems to have new utilities for backing up the file system. Instead of documenting the "latest" ones, we show you how to use two "old tried and true" programs—`dump` and `restor` (spelt `restore` on 4.x BSD)—still in widespread use today, especially on Berkeley Unix system installations.

The `dump` command conveniently copies the entire file system from the system disk onto backup media. Later, the complementary `restor` program can recover the file system from the backup media and write it to the system disk. For example, let's say you had to rebuild your file system from scratch after a file system crash. First, you'd format the disk, then make a new file system with `mkfs`. Finally, use `restor` to extract all the files from the last full system backup onto the system disk.

You may also use `dump` and `restor` to back up individual files,

a. Archiving a file system using `dump`:

/etc/dump [*key* [*argument...*] *filesystem*]

b. An example of a full-system backup with `dump`:

```
#/etc/dump 0ufsd /dev/mt0 600 6250 /dev/hd00
      date = Mon Jan 2 16:23:02 1984
dump date = the epoch
dumping /dev/hd00 to /dev/mt0
I
II
estimated 162000 blocks on 4 volumes(s)
III
IV
change volumes
change volumes
change volumes
DONE
163400 blocks on 4 volume(s)
# □
```

c. Retrieving individual files using `restor`:

/etc/restor xf *sourcedevice filename*

d. Retrieving a file system with `restor`:

/etc/restor rf *source destination*

FIGURE 2: USING `dump` AND `restor`

but that is complex and beyond this article's scope. Instead, we will illustrate how to back up individual files with the `tar` utility, our second backup method.

Figure 2A illustrates the general command line syntax for using `dump`. Here *filesystem* is the name of the file system to be copied to backup media. The *key* may be one of the decimal digits zero through nine that specify a *dump level*. We use a dump level of zero in our example, which causes `dump` to back up the entire file system.

Specify the `u` (update) key if you want the current date and time for a given dump level to be recorded in the `/etc/ddate` dump history file after the backup operation is complete. Follow the `f` (for file) option key with an *argument* that specifies the filename of the destination device if it's other than the default (generally named `/dev/mt`*n*, where *n* is a decimal number).

If your backup media is magnetic tape, you may have to indicate the `s` or `d` key options. You would follow the `s` (for size) option with an *argument* that specifies the length of the dump tape in feet if different from the default (usually 2300 feet). You would follow the `d` (for density) option with the recording density of the tape, expressed as BPI (bits per inch), if different from the default (1600 BPI).

In our example (Figure 2B), we illustrate backing up the entire file system (named `/dev/hd00` for hard disk drive zero) onto 600 foot tape volumes at a density of 6250 BPI.

Here the key option `0` specifies a zero level dump (the entire file system is backed up). The `u` option causes the current date and time to be written to the history file, `/etc/ddate`. The `f /dev/mt0` argument specifies the destination device `/dev/mt0`. The `s` key with the associated argument, `600`, specifies the tape length, 600 feet. The `d` option with `6250` indicates a recording density, 6250 BPI. The source device name is indicated by the last argument, `/dev/hd00`.

The `dump` command begins by displaying the current date and time. All files created after the "dump date" will be "dumped." In this example, the dump date is "epoch." "Epoch" is guaranteed to be earlier than the date stamp of any file on any Unix system, since it is January 1, 1970 at 12:00:01 A.M. (GMT).

Remaining messages inform you about the current operating stage of the backup procedure. At each "change volumes" prompt, change your backup media (use a fresh disk or tape), and then press the RETURN key to continue. Since files are backed up onto more than one volume, this backup operation is known as a "multivolume dump." Finally, `dump` displays the actual number of blocks written during the backup operation.

Figure 2C shows a command line for recovering an individual file, *filename*, from the "dump tape" using the `restor` program. The `x` option tells `restor` to extract the file onto the system disk. The name of the device containing the backup copy of the file is the argument to the `f` option, *sourcedevice* in this case. Note that with older versions of `restor` the recovered file will appear in your current directory named with its original inode number. The file can be extracted to its proper location in the directory hierarchy with the newer Berkeley versions.

You may retrieve the entire file system using the command line shown in Figure 2D. Here *destination* is the name of the file system that you want to retrieve; and *source* is the name of the dump tape device. The `f` key is necessary for the de-

a. General format for using the `tar` command:

tar *key* [*option*...] [*file*...]

b. The required *key* must be exactly one of the following:

c Create a new backup tape. Any previous files on the tape are overwritten.

u Update a tape; the named *files* are added to the backup media if they are not already present or if they have been modified since they were last written.

r The *files* are appended to the end of the tape.

x Extract the named *files* from the backup tape. If you specify a directory, all files and subdirectories of that directory are extracted. If no *file* argument is given, *all* files are extracted from the backup tape. Any existing files with the same pathname will be overwritten.

t List the names of the files from the backup tape.

c. The following *keys* are used to modify the action specified by one of the keys listed above:

f *devicename*. Use *devicename* as the backup device name. If *devicename* is a dash (`-`), `tar` reads from its standard input or writes to its standard output as appropriate for *key*. If *devicename* is omitted, the default device, `/dev/mt1` is assumed.

v Provides informational messages, such as the name of each file as it is encountered.

w Work interactively—that is, `tar` prints the action to be taken followed by a filename. Type a word beginning with `y` to process the file; any other input skips taking any action on the named file. The `tar` command continues until all files specified on the invocation command line have been processed.

m Updates the modification time of the extracted file to be the time of extraction; otherwise it is not changed.

FIGURE 3: COMMAND LINE FORMAT FOR USING `tar`

vice name if it's different from the default; and the `r` option indicates that the entire file system is to be copied (as opposed to a single file).

Before you use this form of the `restor` command, be sure that the destination device contains *no* files of value, since the restored files will overwrite existing information on the system disk. Dumping and restoring the file system may be used to change the size of a file system. You'd archive all files, remake the file system with `mkfs` (`newfs` on 4.2 BSD), then restore the archived files. After the `restor` command has completed, run the `fsck` file system check utility, as `restor` doesn't always update the free block list correctly.

BACKING UP FILES USING TAR

The `tar` (for tape archiver) utility program is used to copy files from your file system to the backup device and then restore them. This command is generally available on most Unix systems—whether Bell or Berkeley-derived. Even though, in general, everyone can execute `tar`, it is only applicable for backups off the system disk for those who have permission to read from or write to the backup device.

One advantage of the `tar` program over older versions of `dump` and `restor` is that `tar` knows about the Unix system hierarchical directory structure, so files may be restored with their original pathnames. A disadvantage is that even if you are using a randomly accessible disk, `tar` must read the disk as if it were a tape—sequentially block by block from the beginning until it finds the particular file it's searching for—a time consuming process.

Figure 3A shows the general command line format for using `tar`. Here *key* is required and should be one of the options shown in Figure 3B that specify the action to be performed. In addition, you may use one or more of the options shown in Figure 3C to modify the action. Note that the term "tape" here means the backup medium, whether it be magnetic tape, hard, or floppy disk.

Figure 4A illustrates the general command line you could use with `tar` to back up the file system onto device *devicename*. If *dirname* is the root directory, (`/`) the entire file system will be archived. Archiving all the files on even a small system will take a long time to complete.

Alternatively, to save time you may elect to back up only those directories whose contents change frequently. Thus, you would want to back up the `/usr` and `/etc` directories since most Unix systems have user files located in `/usr` and system files in `/etc`. However, files in `/bin` and `/lib` rarely change unless you install new software on the system so they don't need to be archived regularly.

Continuing with our example—the `c` key tells `tar` to create a new backup tape (and overwrites any previous information on the tape). Generally, we recommend using the verbose option (`v`) with `tar` to monitor whatever operation is being done.

The argument to the `f` option, *devicename*, is the destination for the duplicated files. As a convenient shortcut, link your actual *device-*

a. Archiving the contents of a directory:
tar cvf *devicename dirname*

b. Linking your device name to the default, `/dev/mt1`:
ln *devicename* **/dev/mt1**

c. Backing up one or more individual files:
tar uv *pathname...*

d. Retrieving selected files:
tar xv *pathname...*

FIGURE 4: USING THE `tar` UTILITY

a. Start with a full-backup of the file system:
tar cv /

b. Backup files updated since last backup operation:
tar uv /

FIGURE 5: INCREMENTAL BACKUPS USING `tar`

a. Retrieving all files from backup tape:
tar xv /

b. Retrieving selected files from the backup tape:
tar xv *pathname...*

FIGURE 6: FILE RESTORATION WITH `tar`

name to the default `tar` device, `/dec/mt1` and you won't have to specify the `f` *devicename* argument when you invoke `tar`. Figure 4B shows the command line for creating this link. After such a link is established, the command line shown in Figure 4A could be shortened to `tar cv` *dirname*. We assume the link has been made in the remaining examples.

You may request `tar` to add files to a backup tape if they aren't already there, or if they have been modified since last written on that tape using the update (`u`) key option as seen in Figure 4C. If *path name* names a directory, then all files beginning with that directory in the file system tree that have been created or updated since the last backup operation will be copied from the system disk to the end of the backup tape.

Figure 4D shows the command line for retrieving selected files from the backup tape. Note that you must use the same *path name* to retrieve the file that was used when the file was archived. You may determine the path name of the archived files by displaying the "table of contents" of the backup tape by entering `tar t` (or `tar vt` for a long listing).

As before, if *path name* names a directory, then that directory and all files contained in that directory will be restored from the backup tape. Thus a portion or even the entire file system tree can be retrieved with `tar`. If no *path name* argument is indicated, all files on the tape will be extracted. *Caution*: Since you are writing to an existing file system, any files on the source backup tape will overwrite the corresponding files with the same path name on the destination file system.

Note that backup tapes created by `tar` and `dump` aren't interchangeable. That is, you can't use `tar` to extract files from a backup tape that was created with `dump`, nor can you use `restor` to retrieve files archived with `tar`.

Now we show you an approach for incrementally backing up your file system. You begin by first backing up your entire file system. Use the `tar` command line shown in Figure 5A to accomplish this. If you don't wish to archive the entire file system, use the command form shown in Figure 4A and replace *dirname* by the particular directory you wish to archive.

At the end of every work session use the command line shown in Figure 5B to back up those files that you added or changed since the last time you backed up the system. Those new or updated files will be added to the end of the tape. Note that earlier instances of the same file will remain on the tape and not be overwritten by the later versions.

You may retrieve all your files from the backup device using the command line shown in Figure 6A. Alternately, you may retrieve any selected file by specifying its full path name, as shown in Figure 6B. Note that the last (most recently added) instance of any file that occurs more than once on the `tar` tape will overwrite any earlier ones on the system disk with the same path name.

The commands covered in this article may have been customized for your particular Unix implementation. Thus you should consult the documentation for your particular system. For instance, systems that use floppy disks for backup need to modify `tar` so it knows the capacity of the disks.

The Unix system is a multiuser operating system which means that more than one user may access the

system at the same time. Generally, each system user has their own personal account. In addition, certain accounts are created to perform system related functions, such as the superuser account for system management duties. In our next installment of this series on Unix system administration you will learn how to add and remove user- and system-related accounts. □

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Acknowledgement

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

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.*

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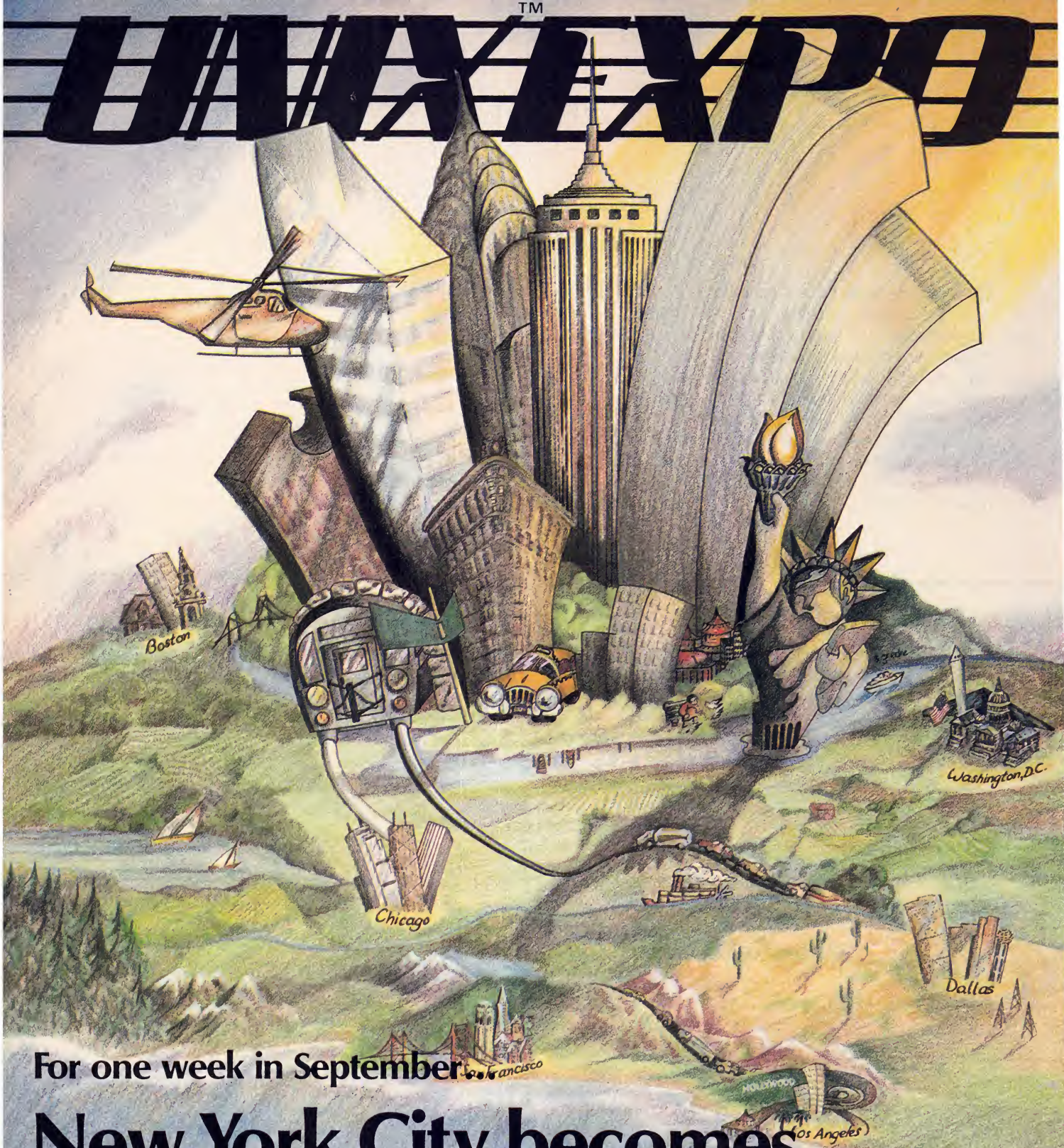

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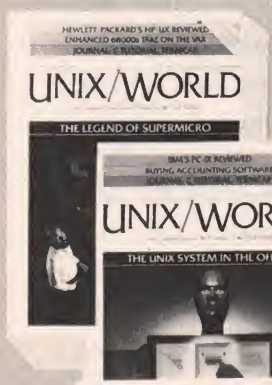

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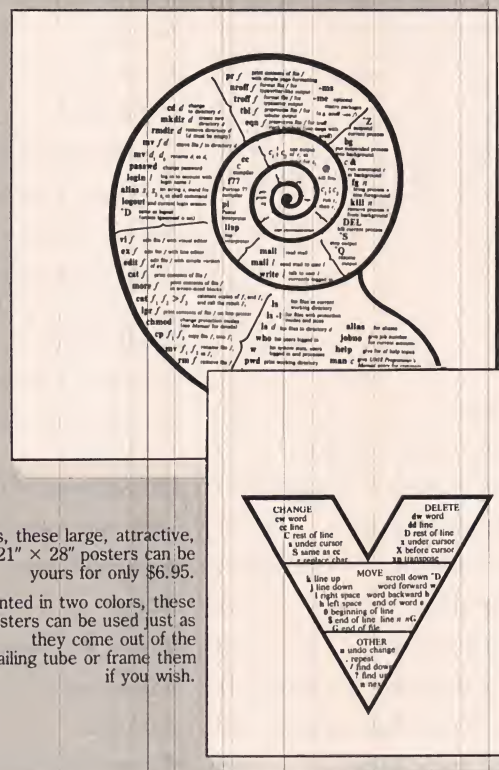

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WHEN BEST INTENTIONS AREN'T ENOUGH

BY DR. REBECCA THOMAS

A few weeks ago I received a desperate telephone call from a Mr. Steve White. He related an alarming scenario—alarming in that the story he told could happen to any well-intentioned Unix system user.

Let's say that you've been backing up your file system religiously from day one and following the manufacturer's directions to the letter. And you're using the `tar` utility to back up your files onto several floppy disks (perhaps some 30-plus disks for a full system backup). Then one day you have a system crash and the file system on the system disk is destroyed. No problem, you say. Just format the disk, make a new file system, and restore all your files from the last full system backup. Okay, fine—in theory. Here's the wrinkle that Mr. White discovered the hard way:

His `tar` command lets one "dump" the file system onto a series of floppy disks. When a disk fills up, his version of `tar` prompts the operator to insert the next disk. Furthermore, files can cross over a disk boundary; that is, some blocks are written on the end of one disk and continued onto the beginning of the next disk in the series. This feature is convenient for archiving the entire file system with a single command line, such as `tar cv /`.

The wrinkle came when Mr. White had to restore his file system from the backup disks. The `tar` utility began extracting the disks—number one, two, three, and oops

Pathname (100)
Permissions (8)
User ID (8)
Group ID (8)
Filesize (12)
Modification time (12)
Checksum (8)
Linked? (1)
Pathname of link (100)
The byte count is shown in parentheses. Numerical values are stored in octal.

FIGURE 1: THE `tar` FILE HEADER

a. Listing the `tarskip` program

```
$ cat -n tarskip.c
 1  #include <stdio.h>   /* Use standard I/O library */
 2  #include <fcntl.h>   /* Open file control */
 3  #include <string.h>  /* String manipulations */
 4  #define TARBLKSZ 512 /* Block size on tar disk/tape */
 5  #define STDOUT   1   /* Standard output file descriptor */
 6  #define FALSE    0   /* Boolean false */
 7  #define TRUE     1   /* Boolean true */
 8
 9  /* Global variables: */
10  char fd;    /* file descriptor for tar device file */
11  char buf[TARBLKSZ]; /* buffer for "tar blocks". */
12  /* Substitute your actual device name in the next line */
13  char *tardev = "/dev/dj0a";
14
15  main(argc, argv)
16  int argc; char **argv;
17  {
18      int match;
19      char *pathname;
20      void getblk();
21      match = FALSE; /* Initialize to zero */
22
23      /* Process command line arguments */
24      if (argc == 1 || argc > 3) { /* Correct number of args? */
25          fprintf(stderr, "Usage: tarskip pathname [tardevice]\n");
26          exit(1);
27      }
28      pathname = argv[1]; /* The pattern string to search for */
29      if (argc == 3)
30         tardev = argv[2]; /* Use device different from default */
31      if ((fd = open(tardev, O_RDONLY)) < 0) { /* Open for reading */
32          fprintf(stderr, "tarskip: Can't open %s\n", tardev);
33          exit(2);
34      }
35
36      /* Find block containing desired pathname */
37      do {
38          getblk(tardev);
39          match = strncmp(pathname, buf, strlen(pathname));
40      } while (match);
41
```

Continued

FIGURE 2: THE `tarskip` PROGRAM

```
42      /* Then read and process disk blocks "forever" */
43      while (TRUE)
44      {
45      write(STDOUT, buf, sizeof(buf));
46      getblk(tardev);
47      }
48  }
49
50  void
51  getblk(device) /* Read the next block into buffer */
52  char *device; /* The tar disk/tape device name */
53  {
54      int c, done, n;
55  begin:
56      n = (read(fd, buf, sizeof(buf))); /* Read a block */
57      if (n == 0) { /* End of tape */
58          done = query("\nEnd of disk/tape, read another (y/n)? ");
59          if (!done) { /* Not done */
60             close(fd); /* Close previous device */
61             fprintf(stderr, "Insert next disk/tape ");
62             fprintf(stderr, "and press RETURN when ready\n");
63             while ((c = getchar()) != '\n' && c != EOF)
64                 ; /* wait for RETURN */
65             if ((fd = open(device, O_RDONLY)) < 0) { /* Open */
66                 fprintf(stderr,"tarskip: Can't open %s\n",device);
67                 exit(2);
68              }
69              goto begin; /* Get first block from next disk/tape */
70          } else /* Done */
71              exit(0);
72      } else if (n < 0) { /* Tape read error */
73          done = query("\nRead error, ignore (y/n)? ");
74          if (done) {
75              close(fd);
76              fprintf(stderr, "Goodbye...\n");
77              exit(2);
78          }
79      }
80  }
81
82  query(msg) /* Display message and prompt for continuance */
83  char *msg;
84  {
85      int c, c2;
86
87      fprintf(stderr, "%s", msg);
88      c = c2 = getchar();
89  while (c2 != '\n' && c2 != EOF)
90      c2 = getchar(); /* Ignore remaining input */
91  if (c == 'y') /* First character was a "y" */
92  return(0); /* Not done */
93  else
94  return(1); /* Done */
95  $ □
```

b. A command line for using `tarskip` to recover files

```
$ tarskip pathname [ tardevice ] |tar xvf -
```

FIGURE 2: continued

—there was a read error on disk four so `tar` just gave up. So now what to do? Okay, forget disk four and put in number five and continue. Right? Wrong. When one of the floppy diskettes in a series can't be accessed, `tar` cannot resume processing from the "middle" of the set.

Mr. White made at least 15 phone calls—to dealers, the manufacturer, and even people who taught Unix courses. But no one was able to offer any concrete advice. It was at this point that Mr. White contacted me. My associate, Rik Farrow, and I began to take a closer look at a file on a "tar tape." Apparently each file is preceded by a 512-byte header, which contains all the information needed to restore the file that follows—pathname, user ID, group ID, permissions, linkage information, etc. Figure 1 shows a diagram corresponding to the beginning of a typical "tar file" header.

A consultant working with Mr. White, Jeff Hecker, wrote a "quick and dirty" C program that would scan a "tar disk" to search for a particular pathname at the beginning of the header block and if found, the program would begin writing the contents of the tape from that point onto the standard output—ignoring any read errors. Using this approach Mr. White and Mr. Hecker were able to laboriously recover most of the files from their backup disks.

The moral to this story? Check to make sure that you can read your backup tapes after you create them. For instance, list the table of contents for the disk set, typing `tar t`. Otherwise your best intentions for backing up your system may be for naught.

I doubt that this scenario is an isolated incident. It could happen to any of us who assume that we can recover our files without problems

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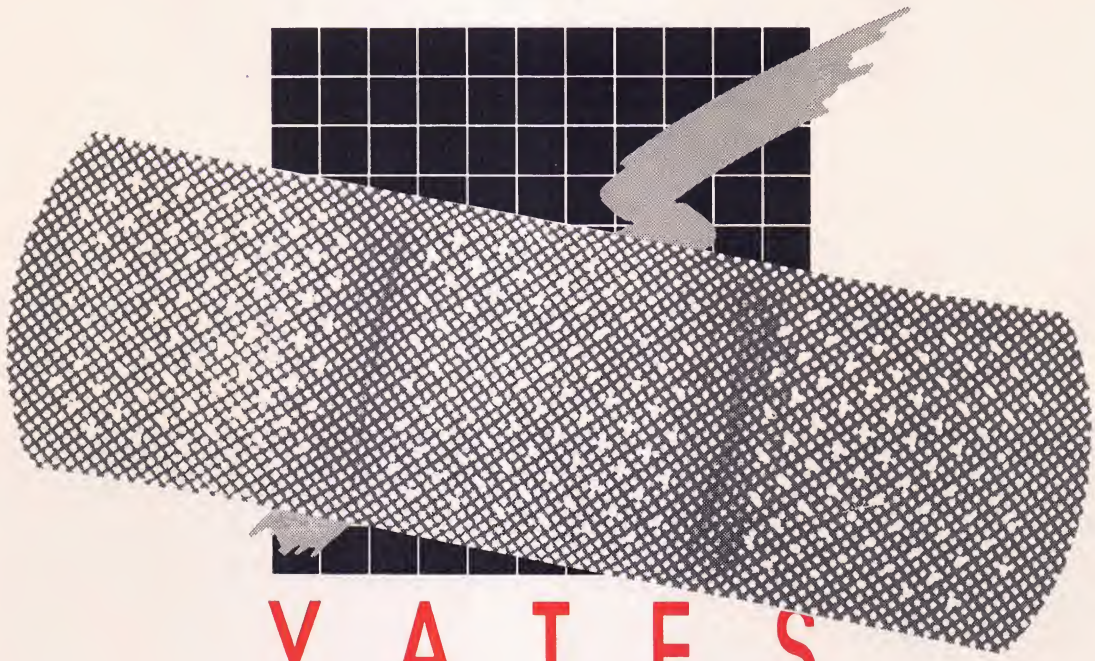

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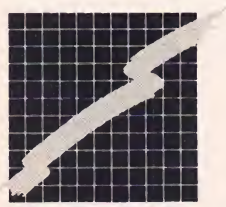

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from our backup medium. However, to help our readers who might fall into such a trap, Rik Farrow and I took the quick fix program developed by Jeff and wrote a "cleaned-up" version with better error recovery. We hope you never have to use it, but just in case, Figure 2A lists our version of `tarskip`. Figure 2B shows one command line for using this program to recover the file(s) from your system disk while ignoring read errors.

Another way to avoid such a dilemma is to archive your files a directory at a time onto floppy disks so that no files cross over disk boundaries. And perhaps a duplicate set of backup disks might be in order for really important data. For more information on backing up your file system see this issue's installment on Unix system administration.

Perhaps some of our other readers have had similar experiences. If so, drop us a line c/o UNIX/WORLD Magazine or send electronic mail to my account at U.C. Berkeley, `ucbvax!ucbpopuli!rathomas`. We'll publish any contributions that would be of general interest to our readers in a future installment of this column.

Contributions by Steve White, New England 800 Company, Rockland, Me.; Jeff Hecker, Presentation Graphics by ARENS, Gaithersburg, Md.; and Rik Farrow, Sirius Computing, Fairfax, Calif.

"Wizard's Grabbag" is a regular feature of UNIX/WORLD. Submit your shell scripts, C programs, or tips and techniques that ease the burdens of system administrators and programmers to "Wizard's Grabbag," UNIX/WORLD, 444 Castro St., Suite 1220, Mountain View, CA 94041. Authors of published entries receive $50 for shell scripts, `awk` scripts, `sed` scripts, `lex`, `yacc`, and C programs, or tips.

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

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

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THE COMPANION BOOK TO "K&R"

A Book on C, by Al Kelley and Ira Pohl
PUBLISHED BY BENJAMIN-CUMMINGS, READING, MASS.
362 PAGES, $21.95

REVIEWED BY RAY SWARTZ

I have two C books next to my terminal. One is Kernighan and Ritchie's *The C Programming Language,* which I reviewed in the May 1985 issue of this magazine. The other is *A Book on C,* by Al Kelley and Ira Pohl.

Kelley and Pohl, professors at UC Santa Cruz, are well-respected authors in their fields: Kelley in math, Pohl in computer science. Given their reputations, their collaboration holds the promise of a significant work on the C language, a promise that *A Book on C* fulfills.

Although the book is subtitled "An Introduction to Programming in C," *A Book on C* is not for first-time programmers because it often uses computer science terminology and examples. However, the book is a good first text for programmers experienced in other languages and who want to learn about C. More importantly, because of the completeness with which *A Book on C* covers the language, it is an excellent choice for those who have some C experience and want to know more about the language.

The book uses a "reference" computer system—a DEC VAX running the Berkeley 4.2 Unix system. This is an advantage to the readers who have access to such a system because it gives a consistent viewpoint to the material; it is a disadvantage, however, to those who must use other systems or have no interest in using C on the Unix system. (Yes, they do exist.)

AN INTRIGUING DISTINCTION

An intriguing distinction exists among C books: It seems that those written by computer scientists begin numbering their chapters with *zero* while those written as more basic introductions start with Chapter *one.* True to its roots, *A Book on C* begins with Chapter 0.

This first chapter is a short discussion of the history of C and why someone should learn the C programming language. It provides a good accounting of the strengths and weaknesses of C in broad, nontechnical language. Its only weakness is a machine-dependent, obscurely written treatment of Kernighan and Ritchie's first program example, "Hello, World."

The second chapter, "An Overview of C," begins by explaining the "problem-solving process" and how to compile a C program on a Unix system. The chapter briefly introduces every major aspect of the C language, including variables, control structures, pointers, functions, preprocessor usage, and file I/O.

Chapter 2, "Syntax and the Lexical Level," defines the general rules that govern the C language. The authors explain how tokens are used by the compiler, C's syntax, legal and illegal identifiers, string and numeric

constants, and symbols that represent operators and separators.

The fourth chapter, "Declarations, Expressions, Assignments, Data Types," describes C's fundamental data types, how to declare them, and how to change their values. Also covered are increment/decrement operators, data type conversions and casting, and operator associativity. The information is detailed and complete. A nice feature of this chapter is that each data type is individually explained with examples and limitations. The discussion on data type conversion is especially well done.

Chapter 4, "Flow of Control," describes C's structured control statements: `if`, `while`, `for`, and `do-while`. Also, the relational, equality, and logical operators are fully documented, as are compound and empty (null) statements.

CREATING AND USING C FUNCTIONS

The next chapter, "Functions," discusses how to create and use C functions. The authors explain how to define a function and use `return`, C's "call by value" invocation of functions, and the scope rules of variables. A nice touch is that each storage class is individually treated and demonstrated.

Chapter 6, "Branching Statements, Bitwise Expressions, and `enum`," covers those C commands that interrupt control flow—the `goto`, `break`, and `continue` constructs. Also included are the `switch-case` construct, the conditional operator (`?:`), and a detailed account of bitwise operators and bit masking. `enum` types are then introduced and demonstrated, and the chapter concludes by developing a program to

play the game called "paper, rock, scissors."

The eighth chapter, "Pointers, Arrays, and Strings," begins with a brief description of pointers and addresses. It goes on to talk about passing parameters to functions with pointers, single-dimensional arrays, strings, multidimensional arrays, pointer arrays, and passing arguments to the `main()` function. The material is covered in detail but relies heavily on the examples, many of which are two-and-three-line code fragments.

Chapter 8, "Recursion, Functions as Arguments, and the Preprocessor," starts with a description and simple illustration of recursive functions, as well as a caution about using them inappropriately. The chapter continues by demonstrating the use of functions as arguments and concludes with a full discussion of the preprocessor and the use of `#define`, `#if`, `#ifdef`, `#ifndef`, `#else`, and `#elif`. Also included is a good section on declaring macros with the `#define` facility.

DATA-STRUCTURING CONSTRUCTS

Chapter 9, "Structures, Unions, and `typedef`," covers C's data-structuring constructs. The authors show how to use `typedef` to create "new" data types. This is followed by a complete discussion of structures, and the chapter ends with unions. Included in the section on structures are passing them by value to functions (a new part of the language) and doing the same via pointers to structures. This chapter makes extensive use of example programs, including one that does complex arithmetic and another that plays poker.

Chapter 10, "Structures and List Processing," shows readers how to create data structures. The authors discuss list insertion and deletion, stacks, queues, binary trees, and linked lists. Also demonstrated is the use of the Unix `malloc()` and `calloc()` library subroutines. This chapter does not contain much new C language material; rather, it does a good job of explaining how C can be used to structure data. It is especially useful for the readers not familiar with data structures in general.

The last chapter, "Input/Output and the Unix Environment," discusses the functions contained in C's standard library and some of the tools available with the Unix system to help C programmers. This chapter begins with a truly outstanding section on the `printf()` and `scanf()` functions and continues with a nice listing of standard I/O functions in the library and the macros in the include file, `ctype.h`. The chapter concludes with a discussion of file descriptors, functions in the standard library that use them, coverage of the Unix C compiler (`cc`), the `lint` syntax checker, the C source code formatting program (`cb`), and the `make` program.

The book contains one appendix (a listing of the ASCII character set) and two indices—the first lists selected programs and functions included in the text, and the second is a subject index.

CONCLUDING REMARKS

The overall quality of this book is very high. The topics are well organized and the discussion complete. As I read this book, I quickly gained respect for the authors' knowledge and facility with the C language. Even though I am an experienced C programmer, I gained subtle insight into a number of C language issues.

I have two stylistic complaints about this book, however. First, the authors assume that the eventual program users will not make mistakes. No attempt is made to show code that traps errors or allows operator input to be corrected. As a result, I am afraid that readers may get the wrong idea about interactive programming.

One of the book's strengths is that it contains many programming examples. However, many of them have no usefulness beyond illustrating a point. In addition, very few comments are included in the sample programs. This could give readers the mistaken idea that comments are not necessary in C programs.

This book compares very favorably to Kernighan and Ritchie's *The C Programming Language.* In fact, *A Book on C* surpasses "K&R" in two ways. First, it is an excellent reference guide, containing many tables that show how a good deal of the C language is used (I refer to it often). Second, *A Book on C* contains the major extensions to C that have taken place since "K&R" was first introduced. □

REVIEW SUMMARY

- Not recommended for beginning programmers
- Highly recommended for experienced programmers who want to learn C and for those who know C and want to learn more about it
- Maximum recommendation for advanced C programmers looking for a good C language reference

Ray Swartz is the founder and president of Berkeley Decision/Systems Inc., a Santa Cruz, Calif.-based computer consulting and training firm specializing in C and Unix.

CALENDAR

SNA—Concepts, Design, and Implementation: August 26–28, Scottsdale, Ariz. Contact Center for Advanced Professional Education, 714/261-0240.

Configuration Management Of Software Programs: September 4–6, Washington, D.C. Contact Merrill Ferber, 202/676-8522.

International Microcomputer Annual Conference And Expo: September 4–6, Washington, D.C. Contact Sam Slack, 609/848-1000.

Unix Shell Programming: September 3–5, New York, N.Y. Contact Alice Moss, 212/807-9444.

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Unix System Administration: September 9–12, New York, N.Y. Contact Alice Moss, Lucid, 212/807-9444.

Microprocessor Software, Hardware, and Interfacing: September 10–13, Washington D.C. Contact Ruth Dordick, ICS, 800/421-8166, inside Calif. 800/352-8251, from Canada 800/267-7014.

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Unix System Internals: October 1–4, New York, N.Y. Contact Alice Moss, Lucid, 212/807-9444.

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 108

an advertisement for AT&T. The problems I've related regarding the alternate services are based both on my own actual experiences and on those related to me over time. I can only interpret the facts as I see them.

Some aspects of the current telecommunications environment seem more like bad jokes than anything else.

For instance, on a recent trip to Portland I noticed that the public phones (coin and "charge-a-call" types) seemed to give no information about how to dial long distance calls if you *weren't* already a subscriber of a non-AT&T long distance service. On the charge-a-call phones, big tags told you how to reach the local access numbers for the alternates (only useful if you already have an account with them), but what about AT&T?

Well, it turned out that one line instructions for using AT&T *were* on the phones—in almost microscopic non-contrasting type printed across a fold on the information card. It seems that in an effort not to show favoritism toward AT&T, the local telephone company created something best described as laughable.

One hopes that all of the alternates will eventually find it in their best interests, whenever possible, to bring their systems up fully to the standards of AT&T, including the critical issue of call charging. However, it seems indisputable that many of the alternates we see now will no longer exist in five or ten years. They are learning something that AT&T has known all along—that providing quality telephone service is a lot of work and costs a lot of money. To the extent that the alternates are willing to do the work and spend the money, their services may be able to compete effectively with those of AT&T in the long run—but the alternates still have a lot of work to do.

It's amazing how quickly the world of long distance services changes and becomes ever more convoluted. IBM's recent purchase of a large chunk of MCI stock, and the purchase of SBS (prior to this, SBS was already primarily owned by IBM) will most likely help AT&T in the long run! It was obvious that MCI was going to get funding from somewhere in any case, and the recent developments will greatly spur the push for full deregulation of AT&T. Already, murmurings from the FCC indicate the AT&T deregulation process may be substantially accelerated. A fully unregulated AT&T may be truly a remarkable competitive entity. So AT&T should do just fine. The losers in this situation may well be the smaller carriers, who may not be able to compete effectively with the giants in the long run.

Over time, we can expect to see AT&T's long distance rates begin to drop and the alternates' rates continue to rise. This will result in pricing partly for AT&T and the alternates, a significant change from the pricing advantage that the alternates have tended to enjoy for some services. At that time, we'll all presumably be freer to make all of our long-distance service choices based more completely on quality. It will be interesting to see what transpires. □

```
--Lauren--
UUCP:  decvax,ihhnp4,
       seismo,clyde,
       bonnie}!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. He has particular expertise in the fields of computer networking, the Unix system, microcomputer technology, and telecommunications systems.

EQUAL ACCESS—UNEQUAL SERVICE PART II

BY LAUREN WEINSTEIN

Greetings! Last month, as you may recall, we explored some aspects of the "brave new world" of long distance telephone services. Now let's look specifically at one particularly complex aspect of the current long distance environment, the mystical area known as "equal access."

"Equal access," as you probably know, is the procedure under which you can specify which long distance company is to provide your default long distance service. Equal access services are more expensive to provide than the more typical "dial a local number then enter your account code"-type service used by the alternates up to now—that's why equal access is driving up the alternates' rates. That's also why the alternates seem to have little interest in providing equal access, except in metropolitan areas—many smaller communities will apparently never get equal access capabilities.

The alternates originally viewed equal access as the answer to all their problems. Of course, as they realized the true costs, they've started to kick and scream. They've also finally started to realize that equal access might bring them enough new customers to completely swamp their networks—making the current call quality problems on their nets look trivial in comparison. These problems affect both the private network operators and the WATS resellers—they both must deal with equal access costs and with saturated facilities as they sign up more customers.

CHARGE!

But I've saved the best for last. There is a fascinating fundamental difference between the way AT&T handles call charges and the manner in which most of the alternates have been (and to a vast extent still are) handling call charges. The AT&T network is completely set up to provide a positive indication of when a call is truly answered in a "chargeable" manner, and billing is done on this basis. However, to an overwhelming degree, the alternates have used a different technique.

Most of the time, their charging has been based on how long a call has been in progress, regardless of the answering status. If you sit there letting the phone ring too long, or talking to an intercept operator, or even listening to noise waiting for a ring that never comes, you often have been charged after a fixed time interval elapses (typically ranging from 30 to 45 seconds or so from the completion of dialing).

In other words, they often haven't known when the calls were being answered. So they guessed—in a manner that usually tended to err in their favor. The alternates often seem rather reluctant to discuss the way their charging is done—for pretty obvious reasons. People tend to be rather surprised when they learn that, in many cases, charges for unanswered calls may appear on their bills.

One of the goals of equal access was to help abolish this problem by making the appropriate "call answering supervision" information more widely available for the alternates' use. When an alternate goes equal access in a city, it can simultaneously receive the call answering information for calls placed *to* that city. Calls placed to cities without equal access via the alternates do not necessarily receive this information (depending upon the type of interconnect in use at the destination city). Note that the issue here is whether or not equal access is in place in the *destination* city—the charging information isn't based on whether or not equal access is in use in the city from which you're placing a call.

Even when the answering supervision information *is* available for the alternates' use in a given city, the alternates have generally not stampeded to actually use this information for charging purposes. That is, even when the call answering data is provided, most alternates still often ignore it. Their "guessing game" has been continuing pretty much unabated as a result.

For the occasional long distance caller, a small overcharge now and then may be no big deal. But for the heavy long distance user, it can become a major hassle to keep calling the alternates' business offices to have call after erroneous call removed from the bill every month.

The problem becomes acute with automated data calls, as the dialers typically wait a fixed length of time (usually pretty long to give plenty of time for connection) before aborting a call. We generally assume that we won't get charged for a call if it isn't answered. But the way many of the alternates have tended to operate, an automatic modem call that hits a busy signal or non-answered ringing, or just doesn't go through for some other reason, might well show up on the bill anyway. With enough calls, this could cost quite a bit of money, to say the least.

I really didn't intend for these last two months' columns to sound like

Continued on page 107

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