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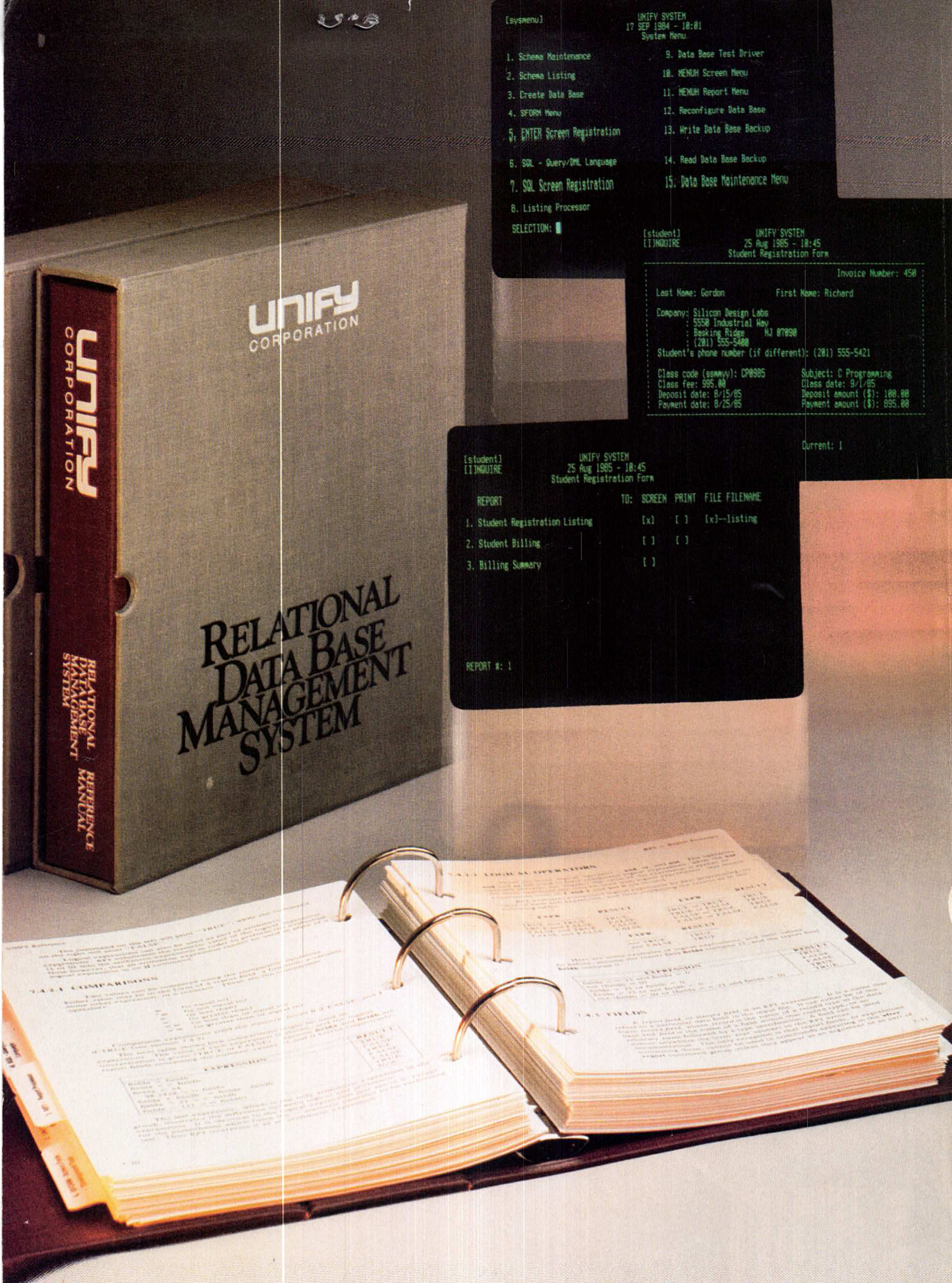

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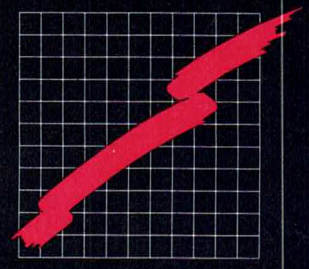

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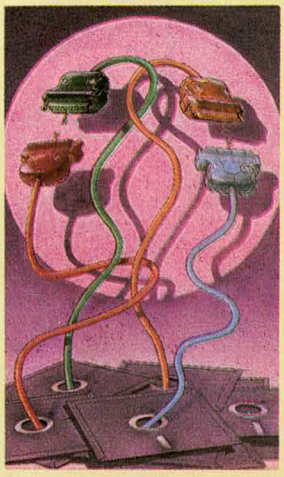

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FROM THE PUBLISHER'S DESK

What kind of person reads UNIX/WORLD? A schizophrenic, apparently. Our first readership study tells us that our readers, like the Unix system market itself, are sharply divided.

Almost as many of you work for very small companies as work for the Fortune 100: Thirty-seven percent work for firms with under $10 million in sales; 33 percent for companies with over $100 million in sales. In fact, fully 20 percent are in businesses with over $1 billion in sales!

You use all varieties of hardware with equal aplomb: Thirty-six percent use supermicros; 34 percent use PCs; 32 percent use minicomputers; and fully 25 percent use a supermini or mainframe. In terms of brand names represented, the big winner is "Other," with 51 percent. Hardly surprising—the Unix system made its name as the great equalizer, running as well, if not better, on a Brand X beige 68000 as on a Big Blue. You're still buying brand names, nonetheless: Forty-two percent of you work with DEC equipment; 33 percent with IBM; 15 percent with AT&T; and 12 percent with Hewlett-Packard.

And you certainly know how to spend money! Last year you spent an *average* of $1.1 million on hardware and $457,000 on software. (Even the under-$10-million companies spent up a storm: $44,000 on hardware, and $31,000 on software.)

You're also doing quite well in your personal and professional lives. Fully 30 percent of you are taking home $70,000 or better in combined family income; 59 percent have some form of luxury car; 10 percent have boats. Twenty-one percent of you are corporate officers! (We hardly think that IBM's John Opel is hanging on our every word; we can readily believe, however, that in small companies the guy signing the checks is making all the purchase decisions and has to read UNIX/WORLD to keep up.)

We're proud to say that an unprecedented 74 percent of you read every issue of UNIX/WORLD avidly. (You should also know that we have carefully read your comments and criticisms and will be acting on them to make that figure 100 percent.)

Everybody loves to read about themselves. It's been my pleasure this month to introduce you to your divided egos; I hope in the future to have an excuse to tell you more. □

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President & Publisher

UNIX/WORLD

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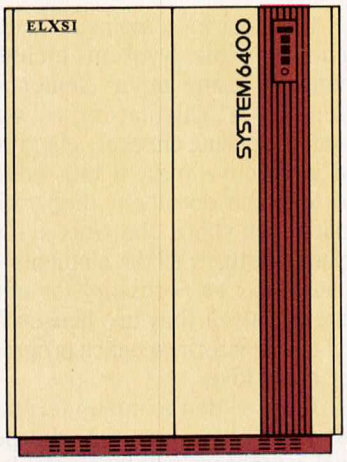

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EDITOR'S CONSOLE

Remember a few years ago when we were all debating what the office of the future would look like? Every time the discussion started, I'd begin daydreaming about the office of the past, of a daguerreotype with Victorian women in high-collared dresses slaving away on clunky manual typewriters.

Now, however, when the subject of the future office comes up, my mind conjures up completely different images. Today I see glimpses of a brightly lit office where stand-alone personal computers and aging, technologically obsolete dedicated word processors constitute a given company's best efforts to date at true office automation.

However, it seems to me that this image is clearly *not* one of the office of the future, but is instead merely a new image (one that replaces the Victorian daguerreotypes) of the office of the past.

Despite many widespread misconceptions by the public and an unconscionable amount of marketing hype by the industry, today's personal computers *do not* represent the culmination of the industry's grasp for true office automation. The computer industry's reach should, and will, stretch much, much further, into new kinds of desktop workstations and departmental office computers that are just now coming to market.

It is also true that the majority of these new workstations and departmental computers will run some variant or other of the Unix system. In fact, the Unix system's unique capabilities and eternal flexibility make it the ultimate operating system for the office to date. A tour around the floor at the Comdex/Fall '84 Show in Las Vegas proved to me that the Unix system is currently the *only* environment in which advanced office systems design and development are now occurring.

Consider for a moment that the standard Unix system includes among its many other elements a calendar, a calculator, a word counter, spelling checker, electronic and interactive mail, a text editor, and text and document preparation facilities. In short, the Unix system includes virtually all the elements we define today as necessary for office systems, albeit they are housed behind a user interface only a programmer could love.

Please don't misunderstand me. I am not saying that the personal computers you know and love today (and which cost you or your company several thousand dollars) are worthless piles of junk to be tossed in the wastebasket. They are, however, running out of gas as stand-alone devices and are entering a new phase of their lives. In the future, more and more PCs will be used as local workstations with preprocessing capabilities, tied to larger and more powerful multi-user Unix system-based departmental computers (either directly or through local-area networks).

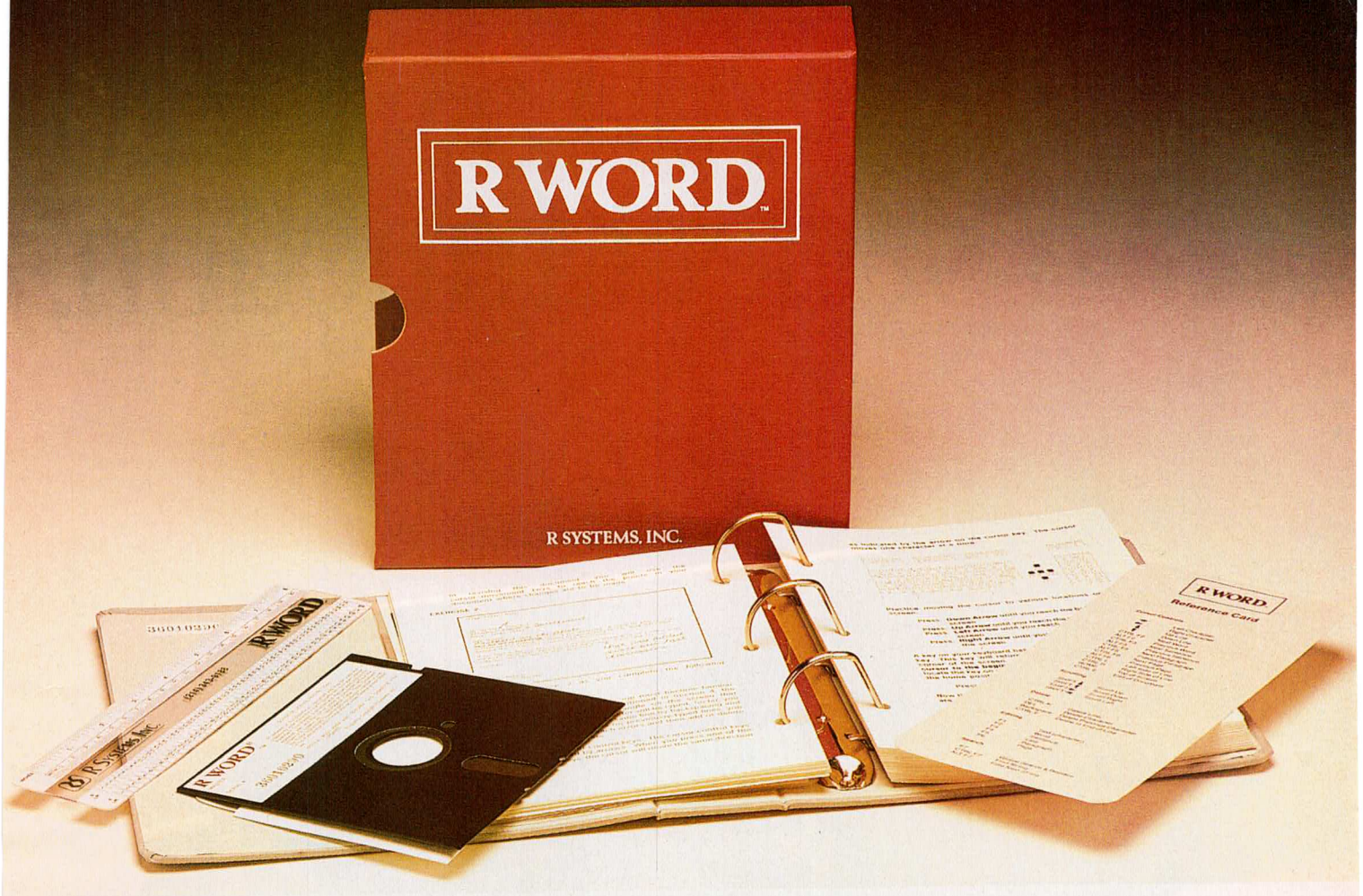
For these reasons, then, we have devoted this month's issue to the Unix system in the office, specifically focusing on the Unix system's role as the integrator of today's disparate office entities. We lead off with our cover story, "Beyond Personal Computers: The Unix System Integrates the Office," by Ken Gilbert and Pat Branaman. Next up is Erwin Morton, whose article, "The Interface: Will the Unix System Be Friendlier Than PCs?" discusses trends in human interface design in today's growing array of Unix system-based office applications software. Finally, Vanessa Schnatmeier tells what's available in the way of products in "Multi-Function Office Automation Systems: An Overview."

One of the Unix system's primary markets will be in small business and departmental computing applications, where machines using the Xenix 286 architecture, especially the IBM PC AT, may dominate. For a look at how to manage those systems, read Mohandas Nair's feature article, "Running With Xenix: Small Systems Administration." And if you're a manager who has just decided to purchase one of those Unix systems and is encountering all kinds of resistance from your staff, you will want to look at Stanley Shein's "Unix—Is There Anything Left To Argue About?"

If you had any doubts that the Unix system wasn't right for the office environment, then I suggest you take a look at this month's reviews. Bruce Mackinlay reviews Hewlett-Packard Co.'s new Integral Personal Computer, which combines the friendliness of the Mac with the power of the Unix system in a transportable package.

Finally, as promised, Bill Tuthill kicks off his new column, "The Unix System Starter Kit," this month. It is intended for those who are moving up to a Unix system computer for the first time, as well as for those of use who've been playing with one for a while but need a little help getting the maximum out of it.

Philip J. Gill
Editor-In-Chief



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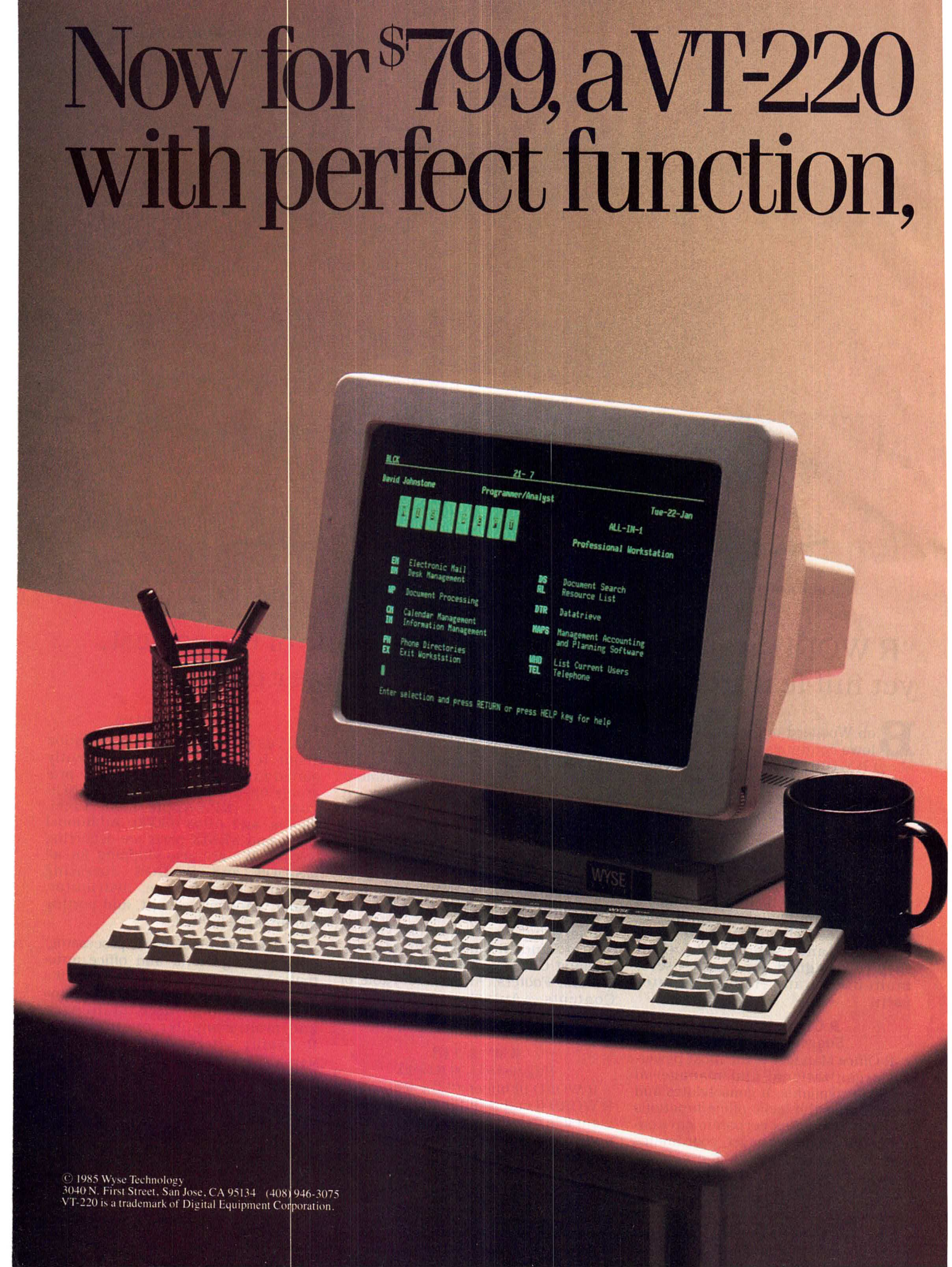

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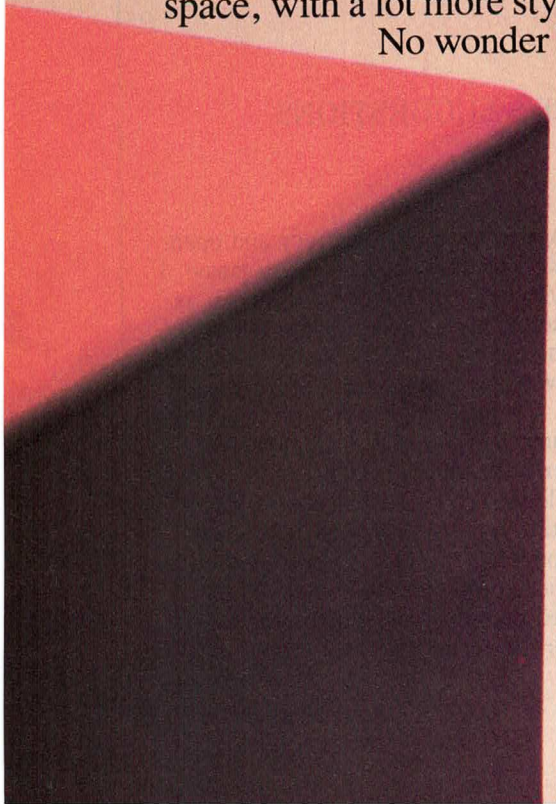

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mail

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

WRITER'S WORKBENCH

Dear Editor:

Regarding your article on the Unix Writer's Workbench software (UNIX/WORLD, Vol. 1, No. 4), I would like to point out that the Writer's Workbench system *is* indeed a commercially available product and has been since July 1983.

Information about the Writer's Workbench system and how to order it is available from AT&T Technologies, Software Sales and Marketing, P.O. Box 25000, Greensboro, NC 27420; 800/828-UNIX.

Yours very truly,

Eileen M. Stansky
AT&T Bell Laboratories
Summit, N.J.

INGRES CLARIFIED

Dear Editor:

An article in UNIX/WORLD entitled "The Latest from DEC: Ultrix 32" (Vol. 1, No. 5) does great service to DEC's new Unix system software product. Unfortunately, however, the author of this article has not thoroughly done his homework.

Your review of those features from Berkeley 4.2 that have been retained, and those that have been omitted, states misleadingly that "regrettably, Ingres did not make it into Ultrix." I wish to clarify here that this statement refers to University Ingres, a research prototype that was developed at UC Berkeley in the early 1970s as one of the first implementations of the relational database model. As a government-funded project (National Science Foundation), University Ingres has been a product for public domain and is delivered as part of the Berkeley 4.2 Unix operating system.

This is *not* to be confused with Ingres, the relational database management and applications development system offered by Relational Technology Inc. (RTI). RTI Ingres was built upon the foundations of University Ingres but embodies an additional 100 man-years of research and development, and approximately 200,000 additional lines of code.

In sum, while University Ingres may, in fact, have been left out of Ultrix 32, RTI Ingres will most certainly be made available on Ultrix, as it enjoys its widest use in the DEC/VAX family and has gained increasing recognition as the RDBMS standard for the Unix system.

Sincerely,

Laura A. Greenfield
Manager, Marketing Communications
Relational Technology Inc.
2855 Telegraph Ave.
Berkeley, CA 94705

Editor's Reply: We appreciate the clarification of the differences between University Ingres and RTI Ingres. They are indeed two separate entities and no reader should assume that we implied in any way that RTI Ingres would not be available under Ultrix 32. I can also assure you that no such slight was meant in the first place.
—Philip J. Gill

A READER'S SUGGESTIONS

Dear Editor:

I am very impressed by the accuracy and openness that I have seen so far in your magazine. I am a Unix system programmer (also known as "wizard"), though my attitude toward the system is not one of religion but rather of foresight. I also would not mind one bit being paid $50 per idea. Therefore, I submit the following bits of rambling, which you may (and should) make less verbose and much clearer.

I would like to propose that *Wizard's Grabbag* be moved to a more prominent area than the last few pages. I would also like to volunteer my services on a selective basis to deal with submitted problems and questions. It would be nice to see the Grabbag evolve into

Continued on page 14

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Continued from page 12

something approaching the Unix Wizards mailing list that lives on the ARPANET, but oriented more toward those of us that must work on systems other than Version 7, 4.x, System III, or System V.

Also (and this is a biggie), it would be great to be able to see *all* the entries for the Grabbag, not just those "worth printing." Those who have a problem big enough to *them* to warrant a letter to the column deserve a response, and those of us who must save face on occasion might just solve some shelved problem due to the correspondence.

I truly appreciate the note in the heading of "mail": "This space is yours....Take a stand." Hopefully, this will be extended to the Grabbag as well. Yes, there will be those who look at the column and say "grumble gibberish mumble mumble" and walk away. But some, like myself, will glory in the fact that others are having and solving the same problems.

I have noticed that most Grabbag entries are shell scripts, and this disappoints me somewhat. This could be alleviated if Grabbag became like the "Unix Wizards" mailing list. I would also like to see descriptions of new utilities that allow even more neat shell scripts to do even more neat things.

Thank you,

Paul B. Reiber Jr.
Software Engineer/Systems Manager
Advanced Product Development Department
American Robot Corp.
121 Industry Drive
Pittsburgh, PA 15275

Editor's Reply: Thank you for your suggestions regarding the Grabbag column. Because UNIX/WORLD is not a "techie" magazine, Grabbag's present location serves our readers best. The majority of contributions to the Grabbag are published—to date not many readers have contributed to this column. Besides shell scripts, we welcome code using any common language as long as it serves a useful purpose. Tips and techniques for Unix system administration are also appropriate.—Rebecca Thomas

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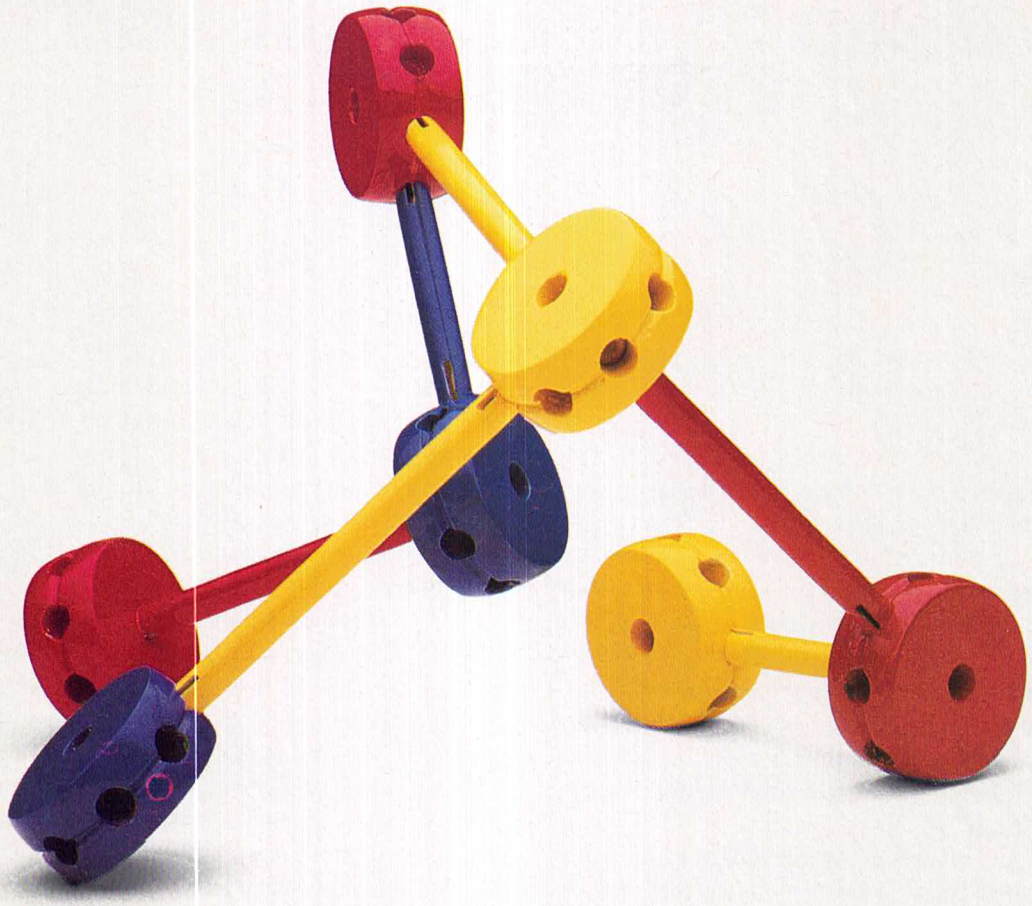

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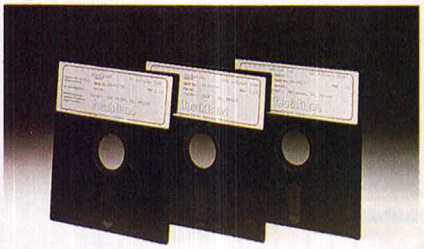

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AT&T-IS WINS IN MAJOR AT&T REORGANIZATION

BY OMRI SERLIN

The dust has settled at AT&T, at least for now. Following a major internal restructuring at AT&T, it is clear that AT&T Information Systems (AT&T-IS) scored a major victory in its battle to gain control of equipment design and manufacturing functions, in addition to its current service and marketing responsibilities. AT&T-IS also absorbed Jack Scanlon's Computer Systems Division and will now become the sole source of AT&T computers to the commercial marketplace.

The surprise announcement came from Jim Olson, chairman of AT&T Technologies. He indicated that three line-of-business (LOB) units will be established within AT&T-IS, each of which will have its own development, manufacturing, and marketing resources geared to serve customers in its particular segment. The three LOBs—designated Large Business Systems, Consumer and General Business Systems, and Computer Systems—will be jointly supported by a single Services organization.

All four will report directly to Chuck Marshall, AT&T-IS president. This reorganization completely replaces the present AT&T-IS structure. In particular, the Marketing and Sales Division and the Product Management and Development Division will be disbanded and their personnel distributed among the four new entries.

Bob Casale, who previously headed Marketing and Sales, has already been sidetracked to a planning job. Frank Vigilante, who was previously in charge of Product Management, will "manage the transition of development resources to the new organization structure" and will continue "to direct enhanced network services and AT&T-IS product architecture planning," AT&T said. ("Enhanced network services" refers to Net 1000, a value-added packet-switched network that so far has proved to be a major flop.) The net effect is that Vigilante, too, has been shuffled aside to planning functions.

THE NEW ORGANIZATION

Named to head the Large Business unit is Dick Holbrook, only recently AT&T-IS vice president of market operations (he replaces Bob Casale). This LOB will serve business customers with 80 stations or more. Key products controlled by this unit will be the System 85 and System 75 large PABXs; however, its sales force will be authorized to sell the entire range of AT&T-IS products to its defined large-business customer base. The unit will take over personnel from the AT&T-IS Product Management and Development Division and from the Information Systems Laboratories—AT&T-IS' "private Bell Labs." Eventually, this LOB will have "control over the factories that manufacture its products," AT&T said.

Vic Pelson has been named to head the new AT&T-IS LOB. He had been president of AT&T Consumer Products, which previously was an independent operation under AT&T Technologies equal in organizational status to AT&T-IS.

The Consumer and General Business LOB will be the largest of the three new units, AT&T said. Its mission is to serve business customers with fewer than 80 stations, as well as residential customers. These two segments will have corresponding organizations within this LOB unit. The unit's key products will be the Merlin key system/small PBX, various telephone instruments, etc. However, its sales force will be authorized to sell all AT&T-IS products to its defined small-business and residential customer segment.

The General Business part of the unit will immediately take over personnel from Vigilante's PM&D Division, including some from the IS Labs; the General Business Systems sales force, now under the AT&T-IS Marketing and Sales organization; the 79 business service and sales centers, now part of AT&T-IS Service Division; and, ultimately, the factories that manufacture its products.

The Consumer and Residential part will immediately take over organizations and personnel from AT&T Consumer Products Laboratories in Holmdel, N.J., and Indianapolis, Ind.; the Customer Service Center in St. Louis; and all of the Consumer Sales and Service (CS&S) organization, including the 900-plus Phone Center retail outlets. CS&S will also manage telephone equipment leased to small business and residential customers. In addition, this part of the LOB will wholesale small-business and consumer products to retailers and will absorb the people developing videotex and similar interactive information services.

Jim Edwards, now vice president of strategic, business, and market planning in AT&T Technologies, has been named to head the Computer Systems LOB. Computer Systems (CS) will handle all AT&T computers, software, workstations, and data communications products. The new unit will encompass Jack Scanlon's Computer Systems Division, based in Lisle, Ill., and now part of AT&T Technology Systems. In addition, it will absorb the marketing personnel now engaged in promoting the Olivetti-made AT&T PC 6300 desktop. CS will take over the computer development organizations from AT&T Bell Labs, the Teletype Corp., as well as people from Vigilante's PM&D Division, including IS Labs.

This LOB will have a direct sales force selling to specialty retailers, OEMs, and value-added resellers (VARs). The unit will *not* have an end-user sales force, but it will supply field specialists to assist the marketing branches of the other two LOBs in their computer sales efforts.

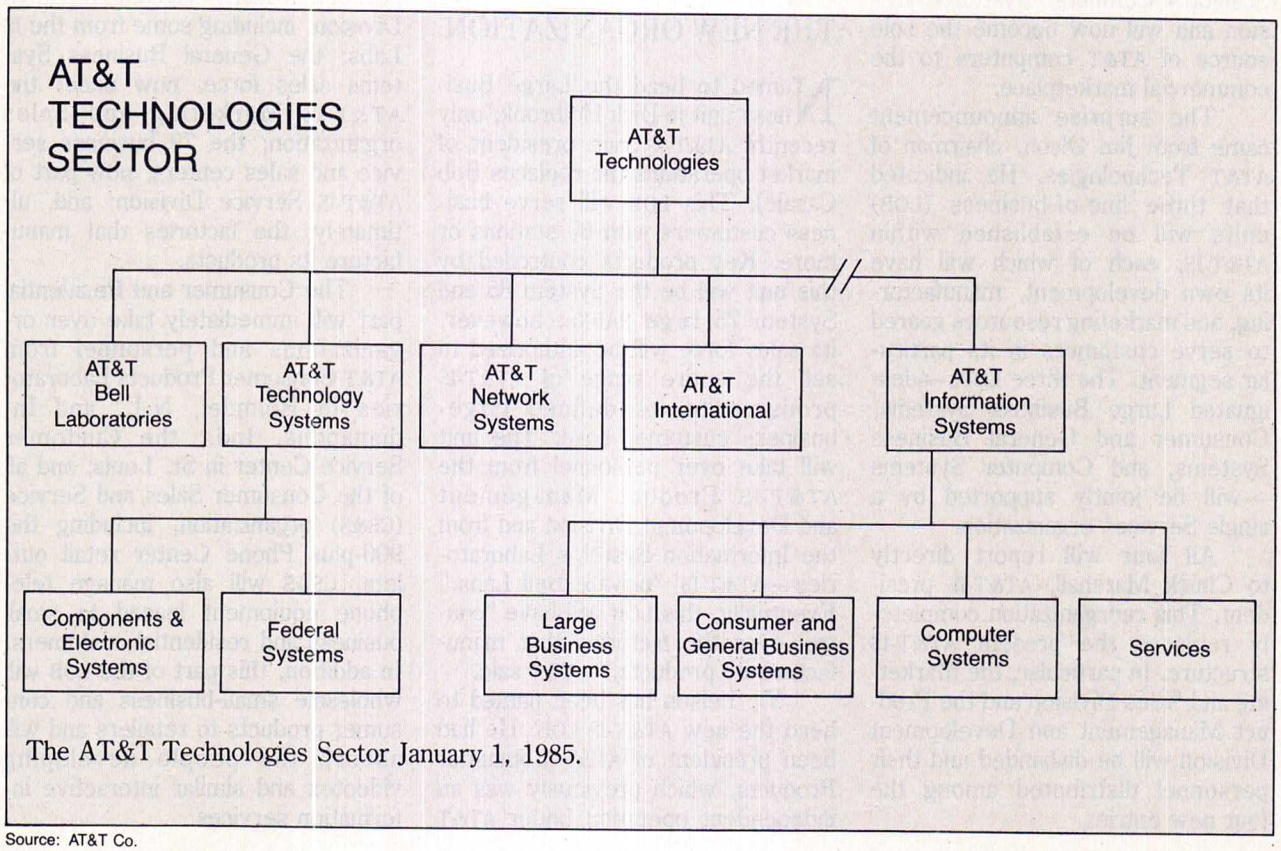
The Services organization will be headed by Bruce Schwartz, who directs the current AT&T-IS Services Division. Joining the 60,000 AT&T-IS Services employees will be people from material logistics and selected services functions now in other AT&T Technologies units. These include, especially, the service center, warehousing, and distribution operations now in the Consumer Products Distribution and Repair Division.

THE IMPLICATIONS

AT&T-IS has succeeded in its effort to gain control of design and manufacturing functions. Previously, its role was essentially limited to marketing and service. It is now the largest, most powerful, and most populated entity within AT&T Technologies, dwarfing such units as AT&T International, Network Systems, Technology Systems, and Bell Labs, all of which are nominally on the same reporting level as AT&T-IS.

With this move, AT&T is giving up all pretense of attempting to abide by the FCC's Computer Inquiry II decision, which required AT&T to form fully separate subsidiaries to deal with nonregulated activities.

Continued on page 24



The AT&T Technologies Sector January 1, 1985.

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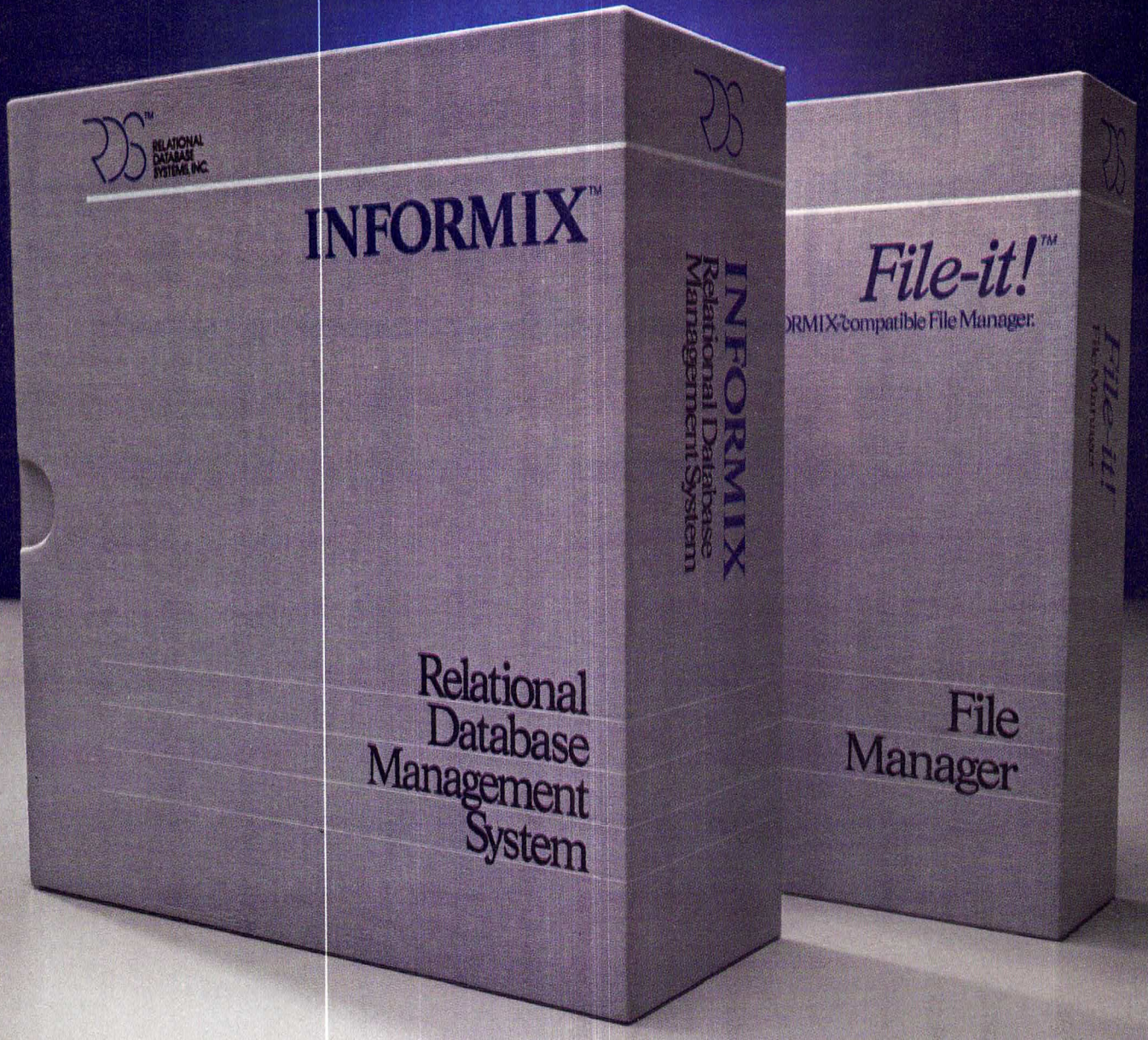

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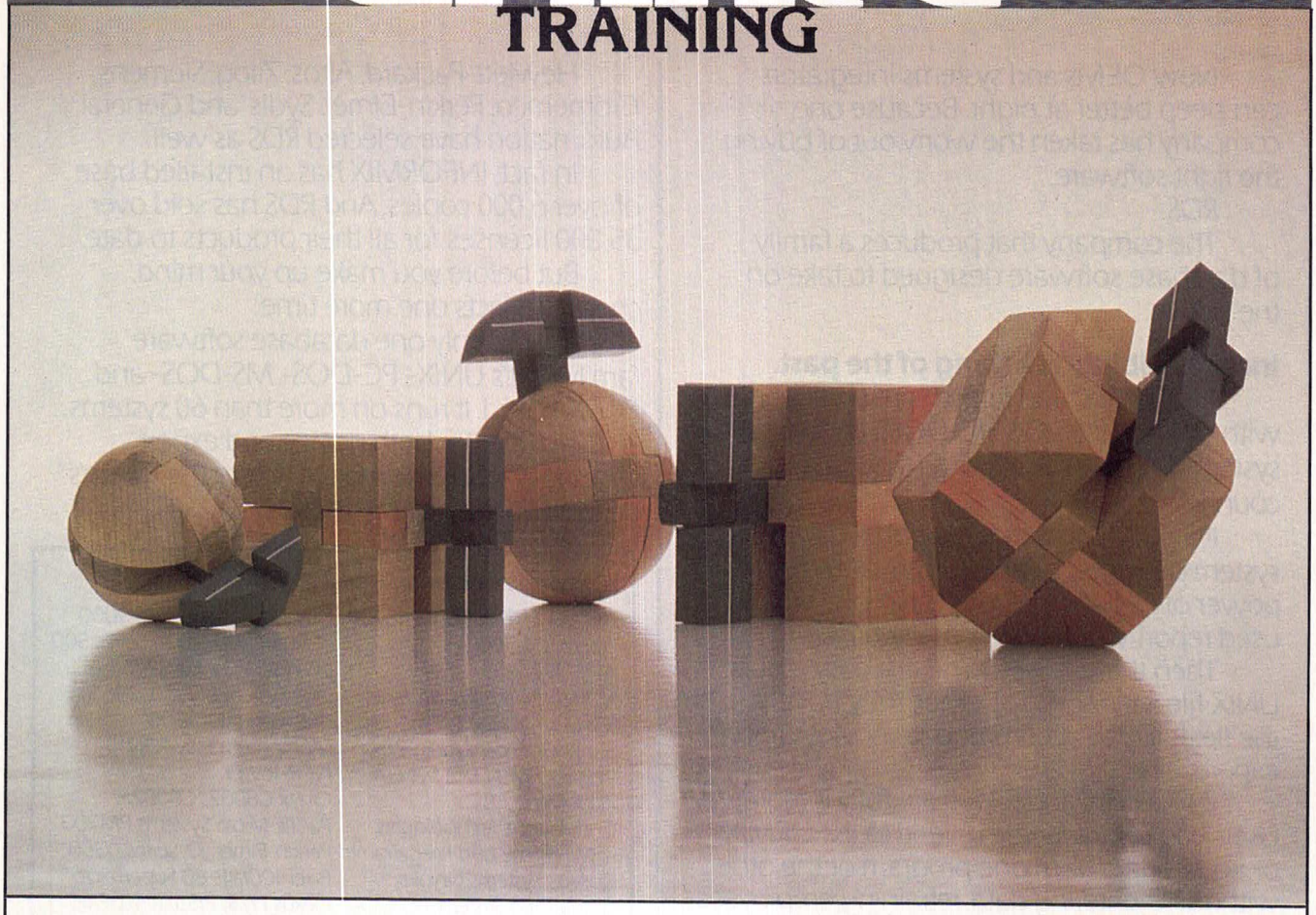

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Continued from page 18

AT&T has long felt—with a good deal of justification—that CI-II was obsoleted by the 1982 Consent Decree.

Under that decision, AT&T divested its Bell Operating Companies (BOCs) in exchange for tacit (but not explicit) acquiescence by the Justice Department to AT&T's direct entry into competitive, nonregulated activities. It isn't clear yet whether AT&T got an unofficial "green light" from the FCC or whether AT&T is merely engaged in establishing the fact first, leaving the questions for later (a favorite practice in the past).

Probably the most intriguing aspect of the reorganization is the absorption of Jack Scanlon's CSD into AT&T-IS. The move can hardly be justified on the LOB principle. The new CS organization in AT&T-IS has no defined customer base, and its only marketing activities not controlled by the other two LOB units will be limited to supporting retailers, VARs, and OEMs.

This author believes that the takeover of CSD represents the culmination of a long internal confrontation between the market-oriented AT&T-IS and the technology-driven CSD. CSD under Jack Scanlon has been waging an expensive campaign to establish the Unix system as a universal standard and to market Unix system-running machines developed by Bell Labs, such as the 3B2, 3B5, and 3B20s. CSD was dealt a major blow when AT&T-IS won corporate approval to offer the PC 6300 desktop—a machine that is IBM-compatible, that runs MS-DOS, that is made by Olivetti, and that has no Unix system support of any kind.

AT&T-IS' view is that it must be allowed to sell what the market wants, whether or not it conforms to the "pie in the sky" views of CSD's technologists. AT&T-IS does not particularly care who made the product, as long as it moves and generates revenues and profits. Early indications are that the Olivetti PC is far from being a "winner" against the IBM PC and that it has been effectively leapfrogged by the IBM PC/AT. Nevertheless, Chuck Marshall evidently carried the day in this dispute, with the result that Scanlon and his division are now reporting to Marshall (via Jim Edwards).

One outcome of this victory will probably be a lessening of AT&T's Unix System V zeal. The campaign to make System V a universal standard has been a significant resource drain, something AT&T can ill afford as it is laying off 11,000 people and cutting back all over. Given AT&T-IS' lukewarm attitude toward the Unix system, its support of MS-DOS, and IBM's refusal to sign up for System V on any of its machines, it is reasonable to expect a noticeable moderation in the AT&T advertising emphasis on System V as a standard.

Another outcome is that AT&T can now be expected to speak with one voice regarding its computer directions, which was undoubtedly one of the arguments Chuck Marshall used in winning his case.

By splitting the marketing focus into small versus large businesses, and by allowing each marketing group to sell the entire range of products to its defined customer base, AT&T follows a precedent IBM set in 1981. The Armonk giant melded all product-oriented marketing divisions into the Information Systems Group, under which the National Accounts Division concentrates on big businesses, leaving small accounts to the National Marketing Division. However, IBM left design and production under the separate IS&TG and IS&CG groups, roughly for large and small systems, respectively.

SHORT NOTES

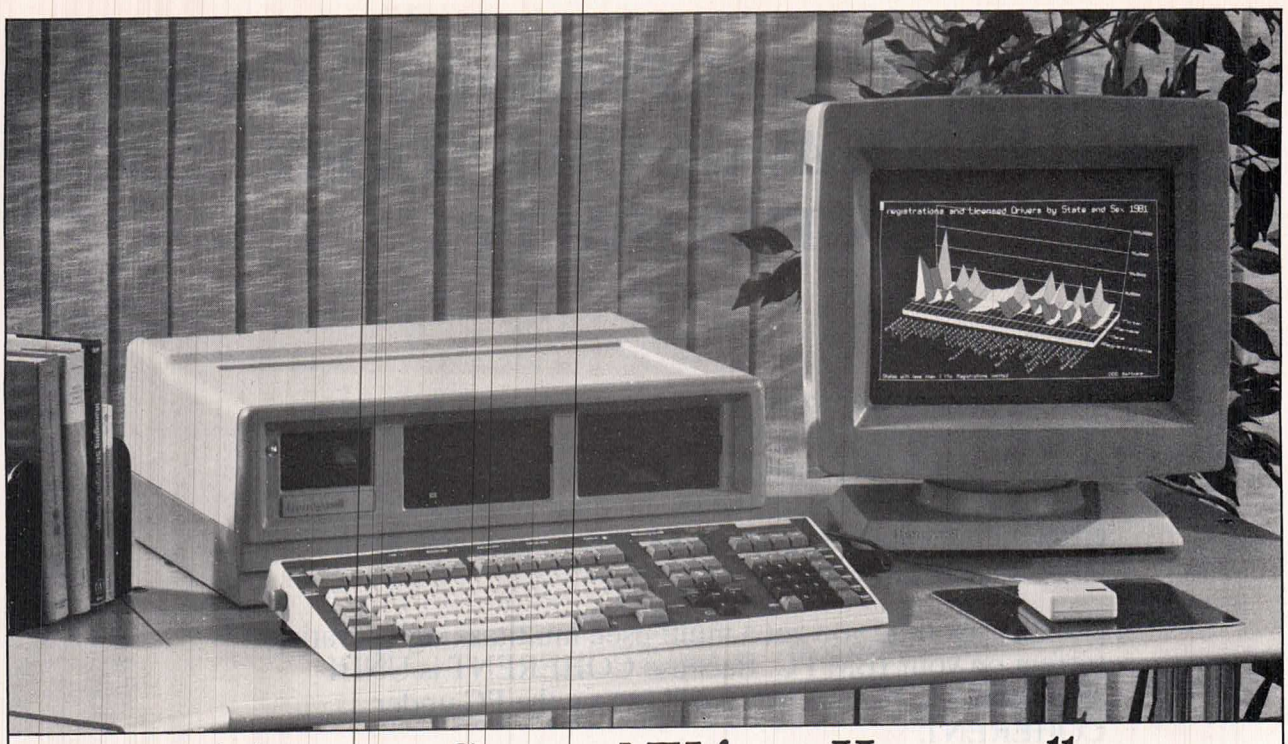
Convergent Technologies (Santa Clara, Calif.) earned $2.7 million on revenues of $105.7 million in the quarter ended September 30. Earnings were down relative to year-ago figures ($3.2 million) and the previous quarter ($4.1 million). The company projected lower growth for the fourth quarter as well. COO Eliot "Ben" Wegbreit officially became president, while Allen Michaels retains the post of chairman.

Meanwhile, the company lost Steve Blank, vice president of marketing of the Data Systems Division (responsible for the MegaFrame and MiniFrame lines); he is now with MIPS Computer, a RISC startup planning to offer a Unix system port. Owen Brown (previously vice president and general manager of the WorkSlate Division) left to become president of Parallel Computers, a Santa Cruz, Calif.-based supplier of 68K-based, 4.2BSD-running fault-tolerant systems.

For the nine months, CT lost $1.9 million (including a $12 million loss from discontinued operations) on revenues of $246.3 million.

DEC (Maynard, Mass.) has announced its high-end VAX 8600 system, previously code-named Venus. The company has introduced a $20,000-workstation based on the Micro-VAX I. Early this year DEC is expected to announce the Micro-VAX II, based on the one-chip Micro-VAX 32 MPU. □

Omri Serlin heads ITOM International Co., a Los Altos, Calif.-based market research firm. He is the editor/publisher of Supermicro *and* FT Systems, *newsletters that cover developments in the computer industry. He holds bachelor's and master's degrees in electrical engineering.*



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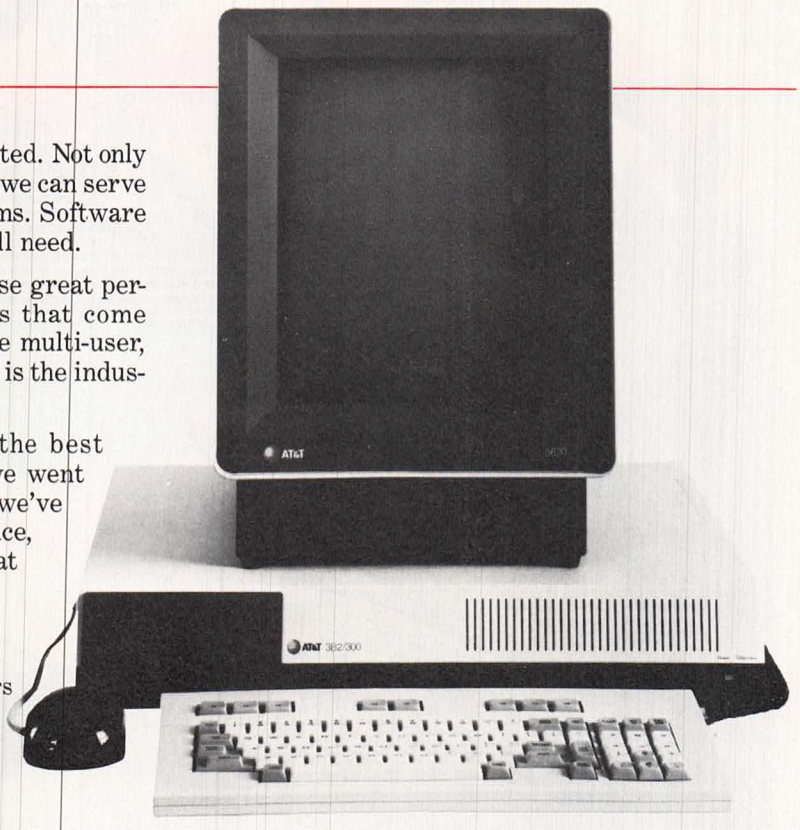

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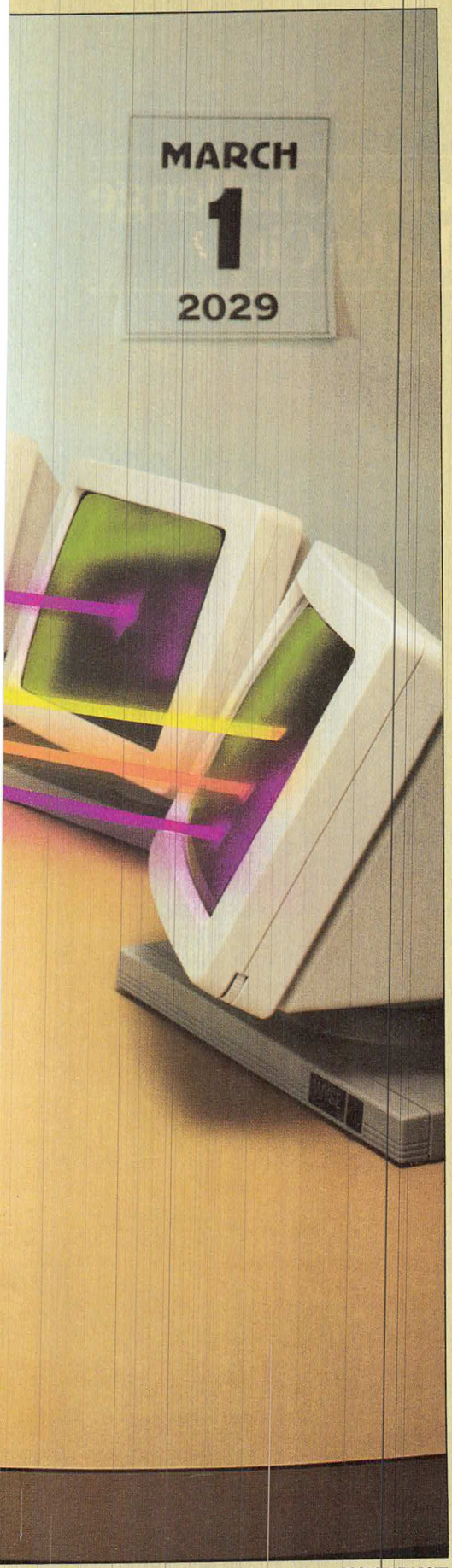

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BEYOND PCs:
THE UNIX SYSTEM INTEGRATES THE OFFICE

BY KEN GILBERT AND BARBARA BRANAMAN

Office systems have evolved from dedicated word processors for clerical workers, through stand-alone personal computers, and now on to departmental information systems, where multiuser Unix system-based computers will dominate.

Beginning in mid-1981, when IBM introduced its Personal Computer, the definition of what is and what is not an office system has expanded to address *knowledge workers:* executives, managers, professionals, and their administrative staffs.

The dramatic growth of personal computers within the office brought about by the IBM PC has also caused an equally dramatic phenomenon with how knowledge workers want to use them. Increasing the productivity of individuals within the office was the first step. However, now that all these knowledge workers are creating and analyzing information on personal computers, they face two important problems: (1) how to access the necessary information from their corporate databases, and (2) how to communicate the resulting analysis and concluclusions throughout the organization.

One way to solve this problem is to connect the personal computers directly to the corporate mainframe via some form of dial-up connection or local-area network. With this approach, the office applications have to be implemented on the corporate mainframe.

But using the corporate mainframe is too costly a solution. According to IBM, every 1 million instructions per second (MIPS) of additional PC compute power on the desk will require 2 to 5 MIPS of additional mainframe and distributed system compute power throughout the organization to connect the PCs into the mainframe network.

If the corporate mainframe is not a satisfactory alternative, then that brings us back almost full circle to multiuser supermicro and minicomputer systems, many of which run the Unix operating system. These machines will serve as the foundation upon which office knowledge workers and their personal computers will be integrated into an overall office system.

Thus, a new segment of the integrated office systems market emerges: the multiuser, supermicro- or minicomputer-based departmental information system (DIS). This system, which by its very nature must support multiple users and multiple tasks, is a natural for the Unix system.

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created within a department stays within that department.

The DIS is the newly emerging integrating element for the office system. It allows community-of-interest information to be managed without putting an added burden on the corporate computer resources. It effectively interconnects personal computers and terminals and allows them to share expensive printers and on-line storage.

In addition to providing easy access to corporate mainframes and outside services, the DIS allows a wide range of desktop devices to be used, from low-cost terminals to feature-rich personal computers. And many companies provide DIS solutions using a system architecture based on existing minicomputer technology.

This technology has existed for a number of years and has been proved for data-processing use. A large installed base of the more popular minicomputers exists, and with that comes a large number of people trained to program, support, and service them.

However, a significant disadvantage is that these older systems were originally designed for processing large amounts of data, such as back-office accounting and manufacturing applications. Their key strength, in other words, is *computing* information, while the DIS' major task is *moving* information.

The departmental information system is only one key element of an office system, the others being corporate data resources, local-area networks, and various desktop devices.

CORPORATE DATA RESOURCES

Easy access to corporate information is one of the most critical requirements of a manager or professional within an organization.

Office systems have expanded to address knowledge workers —executives, managers, and their staffs.

Without such access, a departmental system would be virtually useless.

Other data resources include such outside information services as Dow Jones and The Source. They can also be used as gateways into wide-area networks to access remote computer systems and data services such as Tymnet and Telenet.

THE LOCAL-AREA NETWORK

Within the confines of an overall office system, a local-area network (LAN) is used primarily to connect desktop workstations with a DIS and with other LANs. Local-area networks are also used to connect departmental systems and to connect the departmental systems to corporate computer systems.

Today, there are two general approaches to local-area network solutions within the office environment: cable-based and PBX-based.

Ethernet is probably the most notable of the cable-based local-area networks in use today. However, IBM's Token Ring network likely will emerge as a widely accepted industry standard over the next three years and will provide a reasonable alternative. But both IBM's and AT&T's alternatives require rewiring existing buildings or wiring new buildings with combinations of twisted pair and fiber optic cable.

An integrated voice and data PBX-based local-area network is a strong contender as an alternative to the LANs from IBM and AT&T. The reasoning here is that every office has to be wired for telephones and that it would cost less to place a digital telephone at every desk than it would to wire for other types of LANs.

Examples of this solution for connecting desktop devices include the Rolm CBX-II and the Intecom IBX. Both are voice/data PBXs that will connect desktop workstations to departmental information systems, to each other, and to corporate and outside data resources. Newer PBX solutions include the Ztel PNX and the CXC Rose.

A third approach is the DIS that also provides an integrated voice and data local-area network. This approach eliminates the incremental costs of wiring by using only one twisted pair, provides all the capabilities needed from a local-area network, and minimizes the risk of choosing the wrong LAN before standards evolve. Examples of this alternative approach to local-area networks are limited at this time, but include the Sydis Voice Station System and DAVID System's switch. These are both departmental information systems that also act as a LAN for other workstations, terminals, and computer systems.

DESKTOP DEVICES

The desktop device, or workstation, is the most visible element of the overall office system to an office worker. Workstations come in many different flavors, ranging in power from the personal computer to the dumb terminal. Choosing a workstation should not be dictated by the departmental system or by the corporate mainframe; it must be based on an individual's specific needs to get his or her job done.

Some office professionals spend most of their time accessing the shared corporate and depart-

mental information, and very little of their time analyzing the information, generating reports, or communicating the accessed information. Such workers would find a minimum-feature terminal, such as a VT-100 or compatible, the most appropriate desktop device to have connected to a departmental information system.

Other office professionals spend most of their time accessing and analyzing shared corporate and departmental information, and very little of their time generating reports or communicating the resulting information. For these workers, a personal computer, such as the IBM PC or an Apple, would be the most appropriate desktop device to have connected to a departmental information system.

Still other office professionals and managers spend most of their time communicating information and decisions that result from analyses others have made. Both voice and text are important for these individuals to communicate effectively. Devices such as a Sydis Voice Workstation would be the most appropriate desktop device to have connected to a departmental information system.

A user of a terminal employs the departmental system and the corporate mainframe in the same way that the personal computer user does. However, the terminal user also needs the departmental system to support such applications as word processing, spreadsheet, business graphics, and personal database management.

Other types of desktop workstations include voice/data terminals, voice/data personal computers, word processors, and others.

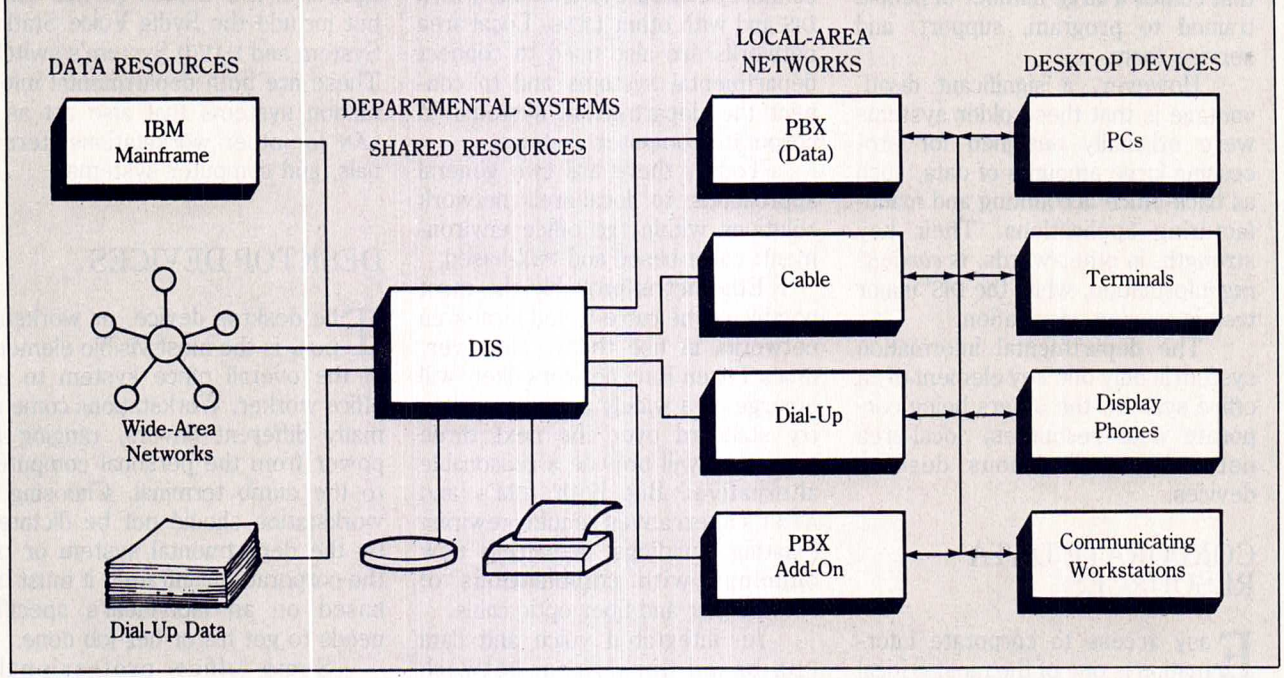
OFFICE SYSTEM REQUIREMENTS

Acceptable performance is the most important requirement placed on the architecture of a departmental information system. There are two sides to the performance issue. First is the user response time.

Acceptable response time can be on a sliding scale, according to system users, with the responses to perceived simple functions needing to happen within one second. Users quickly learn to accept longer responses to those functions they perceive to be more difficult, such as searching a large database or accessing a large document.

The second performance issue is based on what happens to the response time when additional users

FIGURE 1: ELEMENTS OF AN OFFICE SYSTEM (PIECES)



Unix system-based departmental information systems (DISs) will form the center of office information systems that connect IBM mainframes and other database sources with desktop workstations.

are added to the system. For a given architecture, the system's response time begins to degrade rapidly when the number of users exceeds a certain point. For example, if a system's hardware and software are designed for optimally supporting 50 users during peak traffic hours, more processing power must be added to the system when on a regular basis more than 50 users need to access the system at such times.

MODULAR GROWTH

Office systems are typically installed initially to support a small community of interest. Once the system begins to win wide acceptance, the community of interest will grow. As this growth occurs and as more users are added to the DIS, performance will begin to suffer.

The right departmental system must support this growth in an orderly fashion. The system should be designed to start with a small number of users, say 16, and then grow incrementally in processor power, memory, on-line storage, and ports until it can support between 100 and 200 users.

COMMUNICATIONS AND NETWORKING PROTOCOLS

The communications and networking requirements of a departmental information system can be divided into three logical areas: remote user access to the DIS, access to corporate and external data resources, and communication with users on other systems.

Accessing the corporate mainframe, typically an IBM mainframe, means emulating one of the IBM terminals (such as the IBM 3278 Display Terminal), using either the Bisynchronous protocol or the SNA/SDLC protocol. Accessing an outside service, which can be any type of computer, means emulating one of the more popular ASCII terminals (such as the DEC VT-100) using the ANSI X3.64 protocol.

The Unix system is a natural for this new segment of the integrated office systems market.

Networked departmental systems must also support equipment from different vendors. One group could be using a Wang system, another group using an IBM system, and still a third group using a Sydis system. Users on all three systems need to be able to create a document on one system, have it revised on another system, and have it reviewed by users on all the systems. Both IBM and Wang have taken the lead in this area by publishing their document content and document interchange architectures. However, because of IBM's dominance of the industry at large, the IBM alternatives (DCA and DIA) will become the de facto industry standard.

OPERATING SYSTEMS

The key issue for operating systems today is standards. And the only standard operating system that can run on different vendors' hardware and on different system architectures is the Unix system.

A standard operating system is an important requirement because it guarantees that an application program written to operate on one computer system will run on other computers with a minimum conversion effort. As with the Unix system, there can be different dialects of the same operating system (for example, Version 7, System III, System V, 4.2BSD, and Xenix) running on different hardware architectures (the DEC VAX Series, the AT&T 3B Series, and the Motorola 68000 family). But an application written for one machine using one dialect can be easily ported to another machine with a different dialect. Typically, little or no modification will be necessary.

The Unix system itself is written in C, a language designed to be portable, and one that can run on just about any computer manufactured. Only about 5 percent of the code in the Unix operating system program must be rewritten for each new computer implementation. This compares with a figure of almost 100 percent of the code for operating systems like CP/M and MS-DOS.

The market demands that system software be able to access the largest possible software base. All indications are that future versions of MS-DOS will be written in C and that they will eventually include most or all of the functions usually associated with the Unix system. These indications imply that, although MS-DOS will not actually contain Bell Labs' Unix system code, it will at some point in the near future run both the Unix system and MS-DOS programs. Thus, there will be a very broad spectrum of applications software from both system vendors and third-party software developers.

Most suppliers of integrated office systems evolving out of the minicomputer market (such as Wang, Digital Equipment, Data General, Hewlett-Packard, and IBM) use proprietary operating systems. This requires their customers to learn, develop on, and support a nonstandard operating system. The problem is compounded if many different vendors' systems are installed within one company.

A company often needs to have customized applications developed under contract by independent third-party software developers. Both the cost of the development and the time it takes to develop the applications will be lessened if the operating system is standard and already known by the developers. Thus, a standard operating system is very important to the long-term viability of departmental information system suppliers. They will not stay competitive in the market if they try to develop by themselves all of the software their customers need.

Workstations come in many different flavors, ranging in power from the personal computer to the dumb terminal.

Other operating system requirements for the office environment include the ability to develop applications on the system by its users, to support different data types (text, voice, graphics, image, and data), to support multiple users each running multiple concurrent applications, to support the interrupt-driven nature of office workers, and to support background operations such as printing.

OFFICE APPLICATIONS

Most office systems provide the needed applications to enhance personal and organizational productivity. These include word processing, spreadsheet, business graphics, database, electronic mail, integrated filing, and telephone messages.

Integrating voice into a departmental information system is specifically designed to increase the ease with which people within an organization can communicate with each other. Voice applications include voice- and text-messaging, voice annotation of word-processing documents, voice annotation of mail envelopes, dictation and transcription, and an on-line telephone and mail directory.

Future growth areas for office applications will come from integrated image and integrated teleconferencing applications.

USER INTERFACE

The ease with which knowledge workers (who are nonprofessional programmers) can use a departmental information system is key to the office system's wide acceptance and success. The user interface must be easy to learn, easy to use, consistent, customizable, supportive of the discovery process, and easy to integrate into other applications.

Most of the latest user interfaces use multiple windows to allow multiple applications to be accessed concurrently. They also use graphic icons to represent the more familiar office objects, such as scratchpad, rolodex, file cabinet, in and out baskets, calendar, waste basket, word-processing documents, spreadsheets, graphs, databases, voice messages, and telephone slips.

These newer user interfaces do not require users to be proficient at using a keyboard. The use of integrated voice, dynamic function keys that are labeled on the screen, and a fully integrated contextual help facility eliminate the need for a keyboard to always be present in order to use the system. They also eliminate the need for a mouse to always be present to use the system. However, just as with the keyboard, some users prefer to use a mouse, and some applications actually work better with a mouse.

Examples of the advanced user interfaces are found on the Xerox Star and Apple Lisa workstations, a variety of machine-independent operating environments such as VisiOn, DesQ, and TopView, the Apple Macintosh personal computer, and the Sydis VoiceStation 1 workstation.

TOWARD THE FUTURE OFFICE

Although departmental information systems have not yet become widely accepted, knowledge workers are beginning to use them. This has been made possible because of the companies that have pioneered new ground in the areas of integration, user interface, and voice technology. The number of installed DISs will undoubtedly increase as users begin to realize the productivity improvements that result from their use.

Thus, we've seen how office systems have evolved from their early days as dedicated word processors. And we've seen how office systems have expanded to meet the needs of executives, managers, and their administrative staffs. The PC revolution showed that these knowledge workers would use a computer, but the problem arose of how to link the personal computers as they proliferated in the office. It is this need that has given rise to the concept of the departmental information system—an excellent market opportunity for Unix system users and vendors. □

Ken Gilbert is director of product marketing at Sydis Inc., San Jose, Calif. Barbara Branaman is product manager for the same firm.

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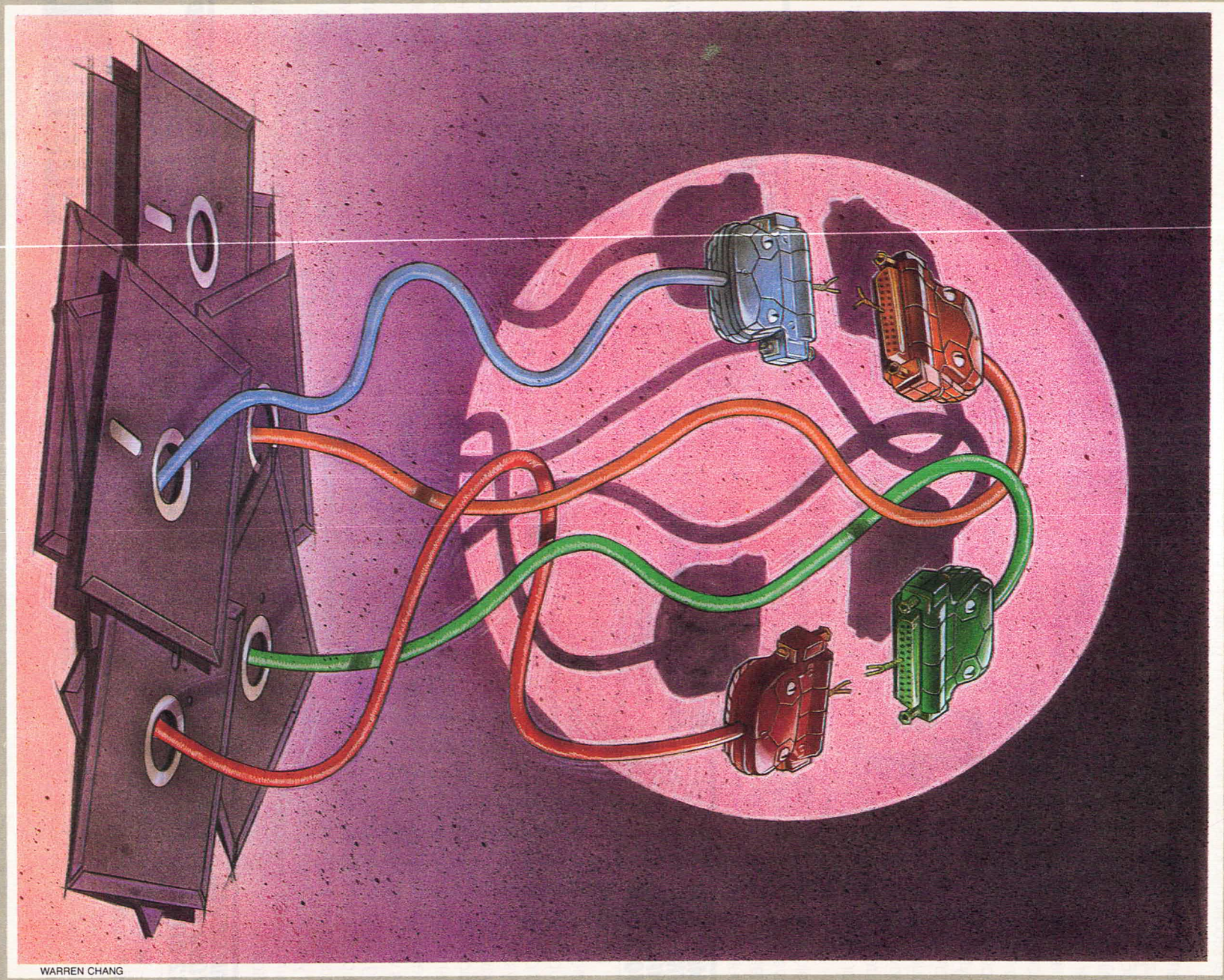

WARREN CHANG

THE INTERFACE:

WILL UNIX BE FRIENDLIER THAN PCs?

BY ERWIN MORTON

No one who uses the Unix system should doubt that multiuser micros represent the future for office technology. The personal computer may have been the first launch, particularly for small businesses. But those in almost any office of any size soon learn that the isolation of a desktop stand-alone micro is a major liability.

Beyond the emergence of multiuser micros, however, there is another trend that may, in the long run, have more far-reaching implications. The real direction of office automation is in making the relationship between human and hardware a comfortable, natural process—and that, indeed, is the goal of an effective user interface.

This article looks at how these two trends—multiuser micros that tie people together and well-designed interfaces to integrate those people with computers—will come together in the months and years ahead.

Interface design is a challenge under any circumstances. But in a multiuser Unix system environment, the problem is compounded dramatically because a single set of tools must serve people having different skills, tasks, and preferences. The interface for a word-processing package, for example, should be comfortable for the power typist who spends all day at the keyboard, for the secretary formatting business letters and reports, and for the manager using the system only 15 minutes a week.

Giving each of these people a different package has the same disadvantages as are found in the isolated environment of the stand-alone personal computer. Multiuser systems have the potential of tying an office staff together, but only if true multiuser application software is in use.

A TALL ORDER

Designing an interface that can serve everyone in an office equally well is a tall order, analogous to creating a single pair of shoes that can be worn by every member of the family—and used for everything from ballet to skiing.

In learning to use a computer program, you should be able to get started quickly, with just a smattering of knowledge, and expand your learning incrementally at your own pace. The more you learn about the system, the easier subsequent learning should become.

At the same time, lest we forget, software products are the most complex tools ever put into the hands of ordinary mortals. By any reasonable measure of internal complexity, an office system is more akin to an oil refinery than to a typewriter. We don't try to build refineries that can be run by laymen; we train people for the job.

By the same token, it may be unreasonable to expect to pick up a software package, take it for a test drive without any lessons, and be negotiating sharp curves at 90 miles per hour. But that is what software advertising and brochures have led us to expect.

Flexibility and simplicity are the key issues for interfaces under the Unix system, but what does this say about some of the most talked-about devices and techniques, such as pointing devices, more capable display screens, windowing, and voice?

I believe that much of what is entering the marketplace is designed to impress people at trade shows, not to serve people in the office. An interface should not be a place for pyrotechnics; it is important to separate what is useful from what is just gimmickry.

IMPORTANT GOALS

And what is really useful? A few important goals stand out. As much as possible, the interface should allow you to directly manipulate and modify your data (a good word processor is the obvious example). Direct manipulation is much faster, easier, and less error-prone than preparing input for a program that operates behind the scenes (`nroff`, for example).

The interface should be predictable and consistent across different applications and different types of data. It should be concurrent: You should be able to work in several domains at once and not have to finish (or exit) one task before beginning another.

Aesthetic presentation counts. This is what the Macintosh is all about. Well laid-out screen presentations can help avoid confusion, distraction, and unnecessary trips to the reference manual.

Finally, the interface should execute at an appropriate speed. When the system is too slow, it is very difficult to concentrate on what you are doing. Even one-second delays at inappropriate times can throw you off balance or cause you to lose your train of thought.

In the following observations about specific interface techniques, I will concentrate on these considerations and largely ignore the economic ones:

POINTING DEVICES

Analog devices for cursor movement have been around for a long time. (I recall playing Space War on a PDP-1 minicomputer with joysticks more than 20 years ago.) Today, pointing devices are used more on home computers than on office systems for selecting, moving, and modifying items on the screen. There are many varieties —mice (with one, two, or three buttons), trackballs, joysticks, touch screens, and light pens, among others. Of all these devices, the mouse is most in vogue today.

A mouse can make the interaction with a computer screen more natural, or it may only make it more cumbersome. The device makes the most sense in a graphics application, where a keyboard is not heavily involved. But for most office applications, where the keyboard is still required for data entry, the mouse loses much of its advantage. Moving your hand to and from the keyboard requires time and attention, and the mouse and keyboard together take up a lot of desk space.

Mice are difficult for some people because of hand/eye coordination problems. The plane in which the mouse moves is generally perpendicular to the screen, and the mind must learn to make this adjustment. Also, many mechanical mice are susceptible to malfunction if dirt (such as bits of eraser) is permitted within several feet of them.

The touch pad has some advantages over the mouse. Dirt and desk space are not problems, and the touch pad can be located on the keyboard, where hand movement is less difficult. Of course, mice are cuter.

Many believe they can test drive a software package without any lessons and negotiate sharp curves at 90 m.p.h.

The mouse's cousin, the light pen, would appear to be a better solution if only because the user can contact the screen directly. The light pen does not take up valuable

Designing an interface for everyone in an office is analogous to creating a single pair of shoes for a whole family.

desk space, and there is no hand/eye problem. However, arm muscle fatigue is so extreme that at least one manufacturer of systems employing this interface felt compelled to attach an armrest to the screen.

The touch screen is to the light pen as the touch pad is to the mouse. The touch screen is less precise as a pointing device and requires frequent window-washing.

These interfaces are all delightful to use in any application that doesn't require constant switching between the pointing device and the keyboard. But hand, arm, and eye fatigue, plus interruption of the user's train of thought, will continue to be problems in any such application. However, when coupled with voice recognition (see below), these devices may really come into their own because the hand can then be kept on the pointing device.

In the interim, it is a mistake to try to force people to use the mouse (by building a keyboard without arrow keys, for example) in inappropriate situations. Ideally, each user should be able to take advantage of whatever interfaces are available.

The bottom line here is not that hardware shouldn't be more capable, but that it should at least offer a choice. When Apple chose not to provide arrow keys on the Macintosh in favor of the mouse, they were, in effect, saying that they knew more about your needs than you do.

DISPLAY SCREENS AND WINDOWING

Bit-mapped screens and color graphics help improve aesthetics. Bit-mapped displays permit different type styles and sizes (as well as graphs and drawings) to appear together on the screen. This technology is advancing, and the costs are dropping rapidly.

As for color graphics, the range of capabilities in hardware is enormous. Although the beautiful effects possible in the best color monitors are unnecessary for dealing with the day-to-day requirements of office life, this technology may come into prominence if it becomes inexpensive enough. In any case, moderation is important. Used appropriately, color can be very effective at highlighting important points. But overused colors that present the user with a rainbow of brilliant colors are merely distracting, clownish, and a cause of eyestrain.

With windowing, the goal is concurrency—the ability to display more than one application at a time. But the fancy windowing that catches the eye at trade shows is not terribly relevant to getting work done in the office. Most screens are not large enough to display more than two or three windows and still show enough content to be useful. How useful is a 2-by-3-cell spreadsheet or a paragraph with its right side cut off?

The functions most useful for windowing are the splitting of the screen for comparing two chunks of data, moving the data from one application to another, and running the two processes simultaneously. Simple screen splitting, plus better-designed applications programs, should make the now-fashionable overlapping window interface largely unnecessary.

VOICE

This interface has several components, including voice store-and-forward (electronic voice mail), voice annotation, voice editing, voice recognition, speech recognition, and speech synthesis.

Voice store-and-forward, independent of the other components, is a great leap from the common telephone answering machine and may help stamp out the modern day dilemma of "telephone tag." But it will not be related to the interface problem until components become available.

Voice annotation of documents will be an important part of the new generation of object-based office applications. Independent of the other voice issues, this one permits the keyboard-shy manager to edit documents with only a handset or microphone and a mouse. More importantly, however, it permits effective use of the mouse with text because it eliminates the cumbersome back-and-forth hand movements mentioned above.

Voice editing will become necessary as we begin to use voice documents of significant size. If you attach a one-sentence annotation to a document, you can discard and replace it. But if you have dictated three pages of text, you may want to strike or replace a given sentence before sending it even to a secretary.

Voice recognition, in the sense of identifying the speaker, may become an important security mech-

anism when the necessary hardware components are more common in the office environment.

Speech recognition—the voice-activated typewriter, for example—has been a dream for a long time, and it remains just that. Barring a major breakthrough, the technology is probably still years away. Devices are currently available that can recognize a very few words (*zero* through *nine*, for instance) from many speakers, or a larger (but still carefully selected) command vocabulary from a single speaker.

The primary applications here are not in the office, but rather in environments in which the computer must accept instructions from people who cannot use their hands

Much of what is entering the marketplace is designed to impress people at trade shows, not to serve people in the office.

—for medical, economic, or ergonomic reasons. For example, it may be cost-effective to permit a worker in a warehouse to shout stock numbers to a computer rather than setting down a load, walking over to a keyboard, and typing the data in. It is certainly cost-effective to have a doctor who is viewing through a microscope speak numbers to the system, rather than be crippled by the eyestrain and headaches that result from shifting focus every 30 seconds.

Speech synthesis has applications primarily where the system must get your attention and where video is unavailable. On the warehouse floor or in the doctor's lab, two-way speech communication is valuable. But speech synthesis, when used to make cars or computers more human by appearing to talk, is probably just a fad. Indeed, voice conversation between person and machine is undesirable in certain environments, such as a densely packed office.

BACK TO BASICS

These emerging interfaces will have more of a bearing on Unix system-based office systems as more power—faster processors; bigger, faster memories and disk systems; faster data transmission; and networked workstations—becomes available at lower costs.

But don't forget that, as fancy workstations become more affordable, ordinary ASCII terminals are growing cheaper still. There are far more of these terminals around than there are workstations, and this will remain true for a long time. Software interface improvements for these devices may affect more people over the next five years than any of the hardware improvements we've discussed.

Consider also the problems encountered by independent software vendors in trying to support a variety of terminals or a mixture of terminals and workstations, all connected up to one multiuser box or to a network. Clearly, for both product developer and end-user, device-independence is an important goal, as it represents insulation from changes in fashion, cost, and vendor whim.

Device-independent output is important in the development of "what you see is what you get" software. It is not a trivial task to get the screen to approximate what you will see on paper. This is especially true in a multiuser environment, where terminals and printers may be mixed and matched at will, and when the target hard-copy device is selected only at print time.

THE BOTTOM LINE: FLEXIBILITY

As interfaces evolve for the Unix system environment, the primary concern will be flexibility. As systems designers, we cannot tell for sure what your work habits and preferences are, and we certainly shouldn't try to dictate what they should be.

The fact is that different people work best in different modes. Some think visually and prefer the written word; others prefer to hear it spoken. Some people relate best to text, others to numbers, still others to pictures and symbols.

The strength of Unix system machines in the office environment is in coordinating individual efforts. The goal of the human/machine interface—that dividing line between person and machine—is in leveraging individual talents and enabling people to work in the most effective way possible. That is both the promise and the challenge. □

Erwin Morton is president of Santa Clara-based Syntactics Corp., which developed and markets the CrystalWriter word-processor system and the CrystalFocus document-management system for the Unix system. Mr. Morton holds a A.B. from Harvard and an M.A. from UC Berkeley; both degrees are in astrophysics.

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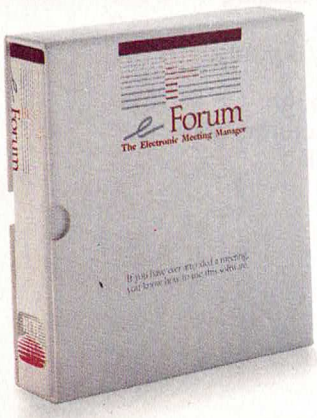
1. A public meeting place for open discussion. 2. A medium (as a newspaper) of open discussion or expression of ideas. 3. A public meeting or lecture involving audience discussion. 4. A program involving discussion of a problem by several authorities.



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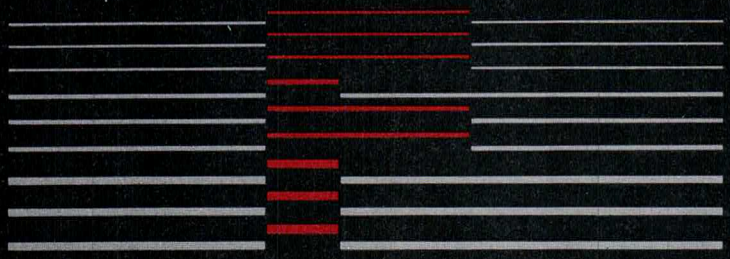

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MULTIFU OFFICE AN OVE

The integrated OA market will be opening up along with every other sector of the market for Unix system-based products.

The fully integrated office automation system—where absolutely everything ties into absolutely everything else and can be retrieved, viewed, annotated, retyped, and mailed at the push of a button—has yet to appear in any market, much less the still-adolescent Unix system market.

Even though this Super-software still hasn't arrived from the planet Decrypton, true integrated office automation packages are indeed showing up in the Unix system field. In fact, with few, if any, exceptions, the Unix system is the operating system of choice for all next-generation office automation systems.

Thanks to the personal computer, the entire nature of the office is changing. The computer is transforming the file folder from something static and shoved into a drawer, to something that flows from place to place and that many people can examine easily and simultaneously.

Dr. John Carlisle, president of Office of the Future Inc., compared the development of the office automation (OA) market to the sexual development and awakening of teenagers: Back before 1976 "we were in the junior-high-school sex phase of office automation," he says, "where everybody was talking about it but nobody was really doing much. It was locker-room, Yankee Group, Business Week communication." From 1976 to 1980, he says, there was a lot of experimentation and pilot projects, but no serious commitment. Now, in the 1980s, many firms have made serious, irrevocable commitments to office automation.

WHAT IS INTEGRATION?

As the software evolves, so does the definition of an integrated software package. Until recently an "integrated" package was one that contained a few programs that could loosely trade data; their interaction was limited and complicated for the user. Patricia Seybold, editor of *The Seybold Report on Professional Computing,* pointed out that until now most integrated packages have been barely satisfactory and difficult to work with.

"What is needed," Seybold said, "is a software environment that allows users to flip quickly back and forth among a number of different tasks. It will also enable users to mix and match different types of files—text, data, graphics, voice." In fact, this is the way the market is moving. More than one Unix system vendor claims to be there already, at the "second generation of integration."

Being so new, the integrated OA market is ripe with vendors who will tell you that *they* are the only ones who sell a product that is *really* integrated, or that is really available right now, or that is really user-friendly and not user-surly. There are even some vendors who will tell you that it's no good to be "too integrated" because you lose your

NCTION SYSTEMS: RVIEW

BY VANESSA SCHNATMEIER

flexibility or become tied to a terminal. OA vendors live in the hope that their integrated OA package will eventually drive the Unix system market the way Lotus 1-2-3 drove the IBM PC market and VisiCalc drove the Apple market.

SERVING THE CHANGING OFFICE

The Unix system is excellent for office software, according to Verlaine Crawford, vice president of marketing and sales for Syntactics, Santa Clara, Calif. When properly utilized, the filing structure of the Unix system closely mirrors the file structure in an office, she said, "like a secretary's method of filing accounts with subcategories of inventory, correspondence, and salesperson."

The Unix system's strengths as a multiuser, multitasking system with powerful workstation capabilities put it right on the track to what many predict will be the winning combination in the office: single and multiuser microcomputers networked to a database running under the Unix system.

Of course, the Unix system also has some flaws as far as office automation is concerned; ironically, some consider the aforementioned file system a hindrance because many implementations are relatively slow and clumsy. Others also cite its user interface as one only a hard-core C programmer could love, but the new crop of integrated office software now coming to market should make them change their minds. Many of those products (see the accompanying chart) incorporate the latest advances in interface technology, such as those popularized in the Apple Macintosh and similar products.

What will be the winning combination in the office?—single and multiuser micros networked to a Unix system-based database.

SOFTWARE'S CLAIMS TO FAME

The integrated OA packages being touted incorporate a variety of features, some of them *de rigueur,* such as advanced word processing, an electronic spreadsheet, a spelling checker, electronic mail, and database management. Other features that are more exotic, such as voice annotation of text, may prove to be the selling point for your company.

A few companies, such as Syntactics and Applix, for example, claim that their integrated OA product incorporates "object-based design," which in effect means the software can treat paragraphs, block quotes, or words as discrete objects even though they are all part of a single, compound document. The software can then shuffle the objects around like a deck of cards, without requiring the user to resort to complicated commands.

Another barely explored field is voice technology. Of the firms we contacted, so far only Sydis, of San Jose, Calif., has commercially implemented voice mail in the Unix sys-

COMPANY	PRODUCT	WORD PROCESSING	SPELLING CHECKER	LIST PROCESSING	SPREADSHEET PROCESSING	DBMS	BUSINESS GRAPHICS
Applix Inc. 112 Turnpike Rd. Westboro, MA 01581 617/870-0300	Alis	Yes	Yes	Yes	Yes	Yes	Yes
Computer Consoles Inc. 11490 Commerce Park Dr. Reston, VA 22091 703/648-3400	Office Power	Yes	Yes	Yes	Yes	Yes	Yes
Fortune Systems Corp. 101 Twin Dolphin Dr. Redwood City, CA 94065 415/595-7283	Fortune 32:16 (HW/SW)	Yes	Yes	Yes	Yes	Yes	Yes
Handle Technologies Inc. P.O. Box 1913 850 North Lake Blvd. Tahoe City, CA 95730 916/583-7283	Handle Office Automation	Yes	Yes	Yes	Yes	Yes	Yes
Horizon Software Systems Inc. #4 China Basin Bldg. 185 Berry St., Suite 4820 San Francisco, CA 94107 415/543-1199	Latitude	Yes	Yes	Yes	Yes	Yes	
Lantech Systems Inc. 9635 Wendell Rd. Dallas, TX 75243 214/340-4932	Integrated/ Office System	Yes	Yes	Yes	Yes		
Onyx Systems Inc. 25 East Trimble Rd. San Jose, CA 95131 408/946-6330	Onyx Office	Yes	Yes	Yes	Yes	Yes	
Quadratron Systems Inc. 15760 Ventura Blvd. Suite 1032 Encino, CA 91436 818/789-8588	Q-Office+	Yes	Yes	Yes	Yes	Yes	Yes
Sydis Inc. 410 East Plumeria Dr. San Jose, CA 95134 408/945-1100	The Information Manager	Yes	Yes	Yes	Yes	Yes	Yes
Syntactics 3333 Bowers Ave. Suite 145 Santa Clara, CA 95054 408/727-6400	Crystal Series	Yes	Yes	Yes		Yes	
Uniplex Integration Systems One Galleria Tower, No. 500 13355 Noel Rd. Dallas, TX 75240 214/851-4213	Uniplex II	Yes	Yes	Yes	Yes	Yes	Yes

SPECIAL FEATURES

Applix Inc.: calendar management, meeting scheduling, drawing. **Computer Consoles Inc.:** user-defined application program, telephone messaging, calendar management, resource management. **Fortune Systems:** calendaring, scheduling, user-definable menus. **Lantech Systems:** "desktop programs," including calculator, rolodex, calendar/reminder, notepad, `vi` editor, Bell editor, EMACS editor, Lattice C compiler. **Onyx Systems:** calendaring, personal file, telephone directory, calculator.

COMMUNICATIONS	DISTRIBUTED WINDOWING	MOUSE SUPPORT	ELECTRONIC MAIL	MACHINES ON WHICH SYSTEM RUNS	PRICE RANGES	UNIX VERSIONS	AVAILABILITY
Yes	Yes	Yes	Yes	Sun, Convergent MegaFrame	$1350—workstation $ 900—dumb terminal	Berkeley 4.2, Version 7, Systems III, V	OEMS
Yes			Yes	CCI PowerSeries	average price per user: approx. $6000	PerPos (compatible with Systems V, 4.2)	direct sales
Yes	Yes		Yes	Fortune 32:16	$5995–$30,000	For:Pro Version 7,	OEMS, direct sales
Yes	Yes	Yes	Yes	AT&T 3B series Durango Poppy, CT MiniFrame	$1395	Systems III, V, Xenix	OEMS, VARS
Yes	Yes	Yes	Yes	most machines running Unix or look-alikes	$695–$4995	Versions 6, 7, Systems III, V, Berkeley 4.1, 4.2, Xenix, Ultrix, PC/IX, and other	OEMS, direct sales
Yes	Yes			VAX, PDP-11, Plexus	varies, average price for modules approx. $500	uNETix, various Unix versions, VMS	OEMS, direct sales
	Yes		Yes	6810 Series, 5012 Series	varies for 6810; approx. $2000 for 5012	System V	OEMS, VARS
	Yes	Yes	Yes	most machines running Unix	$1520–$9200	Systems III, V, Xenix, Berkeley 4.1	OEMS
Yes	Yes	Yes	Yes	GTE, Compath, Italtel	$75,000 for 16-user system	Xenix, Berkeley 4.2	VARS, OEMS
Yes	Yes		Yes	AT&T 3B Series, VAX, Conversent, Plexus, most machines running Unix	$2000–$10,000	Systems III, V, Berkeley 4.1, 4.2, PC/IX, Ultrix, Xenix	VARS OEMS,
Yes	Yes		Yes	most machines running Unix	$495 – $2000	Systems III, V,	OEMS

Quadratron Systems: (not in Q-Office+, but compatible) planner, database manager, graphics, charts, source code editor. **Sydis Inc.:** records processing, rolodex, scheduling, "on-line file cabinet," calculator, voice messaging, built-in telephone, voice annotation of text, transcription, and dictation. **Syntactics:** forms generation and management, open integration architecture, outline processor, document retrieval by key word.

tem integrated OA market. Sydis' voice mail reportedly includes not only voice messaging and voice dictation (with a transcription capability in the word processor), but also voice annotation of text —appending voice comments to a text on screen.

John Butler, vice president of marketing and co-founder of Applix Inc., the Westboro, Mass.-based developers of the *wunderkind* Alis OA package, pointed out that the Unix system is being increasingly used for business graphics applications in office automation.

Users should be able to mix and match different types of files—text, data, graphics, voice.

Do you want to integrate still more packages into your OA setup? This ability may only be a special feature now, but soon it will be a standard. The Integrated/Office (I/O) Series from Dallas-based Lantech Systems includes a program called IF (Integration Facility). Lantech says that with IF, an "integration generator," someone with minimal computer skills can readily integrate unrelated packages into the system and run them in con-

APPLIX PREVIEW: ALIS

Applix Inc.'s soon-to-be-released Alis integrated office system software should at last lay to rest several nagging doubts about the Unix system's viability in commercial business applications. For those few remaining holdouts who still question the Unix system's applicability for the office, a close look at the Alis integrated office system should convince them of the folly of their ways. Those who point to Apple Computer Inc.'s Macintosh in comparison and cry out that the Unix system is unfriendly will discover a new and worthy member of the Star/Lisa/Mac family tree.

And, finally, to those who belittle the Unix system because it lacks the breadth and quality of software available for MS-DOS personal computers, Alis should convince them that Unix system applications software can and will go their MS-DOS one further.

By simple definition, the Alis product is an integrated office automation software package for the Unix system that is aimed primarily at the OEM market. But a simple definition, as is usually the case, won't do, for the Alis system is representative of a new generation of office automation software that is only now beginning to surface.

Functionally, Alis combines the most popular applications of today's integrated software for stand-alone personal computers with the traditional features of word processing and office automation systems and the multitasking and communications capabilities of the Unix system, plus a few new wrinkles all its own. All this comes with a suggested end-user retail price of $1350 per copy for a bit-mapped, display-based workstation, and $900 per terminal for a character terminal-based system.

Alis is currently available on the Sun-2, a network-oriented, 32-bit engineering/scientific workstation from Sun Microsystems. It requires 1 Mbyte of memory and a 10-Mbyte Winchester hard-disk drive. The Sun-2 is the hardware upon which the software was developed, and as of press time it is the only computer on which Applix will admit that Alis runs. Applix president Jit Saxena said Alis was designed for both single-user and multi-user systems but that it is most at home in a networked workstation environment, such as the Sun-2 and its brethren.

USER INTERFACE

The system provides a multi-window user interface for bit-mapped workstations. Window sizes, positions, and overlap are user defined and can be set aside on the desktop for later recall. Users can pick, mark, or move on-screen objects by pointing to them with a pointing device, typically a mouse.

Unlike mouseless systems, which require the use of a keyboard, or some mouse-based systems that demand the use of the mouse for all cursor movement, Alis provides a high degree of redundancy between mouse-based and keyboard-based operations. This redundancy combines the advantages of "point and stroke" mouse operations with a full keyboard-based capability. For example, users can mark and delete text from the keyboard, or they can use the mouse to select the text for deletion.

BASIC CONCEPTS

All Alis information is maintained in logical containers called *objects*. An object is an entry in a relational database that indicates where the object's contents can be found and what kind of object processor is capable of usefully manipulating the data inside that object. Within this architecture, applications and servers are the two major classes of object processors.

Alis supports the integration of arbitrary kinds of editable information (text, data, or graphics, for example) within a single document, a capability Applix has dubbed *Active Integration* (see Photo A).

current windows. Said a Lantech spokesperson, "You can teach IF to call The Source, go down to the stock quotes, look for IBM, grab the quote, write it into a file, then get off the phone."

UNIX AND OA

"Unix *wasn't* good for the office last year, but it is getting there," said Vanessa Abbe of Quadratron (Encino, Calif.). Or rather, the Unix system had very little market penetration until this year. (The same can't be said for Quadratron, we point out, because Quadratron's OA software, particularly its Wang-like word processor, now runs on 50 Unix system-based machines. However, this reflects not so much on the quality of its offerings, but on its having been in the market first.)

The integrated OA market will be opening up along with every other sector of the market for Unix system-based products, as both customers and vendors learn how to get what they want. There is a lot of vaporware out there, but it won't be long until the Unix system is the multiuser system of choice for the automated office of the future. □

Vanessa Schnatmeier, a resident of Oakland, Calif., is a frequent contributor to UNIX/WORLD. She also authored the article on Unix system software availability that appears elsewhere in this issue.

This is transparent to the user, who sees and manipulates all forms of information as a single document.

Alis also permits the integration of new objects or object processors not supplied in the original release from Applix. This openness could be important because it permits new kinds of applications and associated information to be integrated into a document (thus establishing a high degree of viability for the OEM market). In particular, Alis has been designed with a view toward integrating image and voice into documents. In addition, vertical applications, such as accounting or computer-aided design, can be output as part of a document.

Active Integration allows users to combine into a single document different types of information such as text, drawings, business graphics, spreadsheets, and database information and to still edit them within the context of the compound document. This means that users can point at different areas of a compound document (text, spreadsheet, graphics, etc.) and that the appropriate editor/application package is at their disposal.

For instance, if users want to edit a bar graph that is part of a document they are already working on, a window would open up on the right side of the screen in which an editable copy of the graphics would appear, along with the appropriate commands. The users could make all their edits in the side window, then exit and return to the main window, where the revised bar chart would appear.

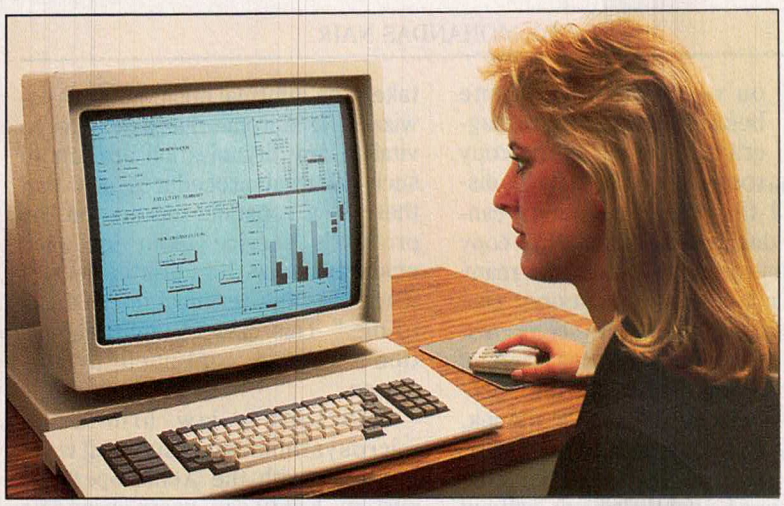


PHOTO A: "Active Integration" allows different kinds of information to be combined in a single document and still remain editable.

Active Integration also allows users to see the different components of an entire compound document as it takes shape, providing a "what you see is what you get" orientation. Also, a document with several types of information in it is still just one document; it has one name for filing, retrieving, mailing, and archiving.

Although atypical in implementation, Alis is an interesting product, one that typifies the design goals of a new generation of Unix system-based office products. For those reasons, Applix merits a closer look as a significant contribution to the state of office systems design, especially those for Unix system-based environments, regardless of its eventual commercial success or failure.

We anxiously await the chance to get our hands on a final working version later this year. □

RUNNING WITH XENIX

SMALL BUSINESS SYSTEM ADMINISTRATION

BY MOHANDAS NAIR

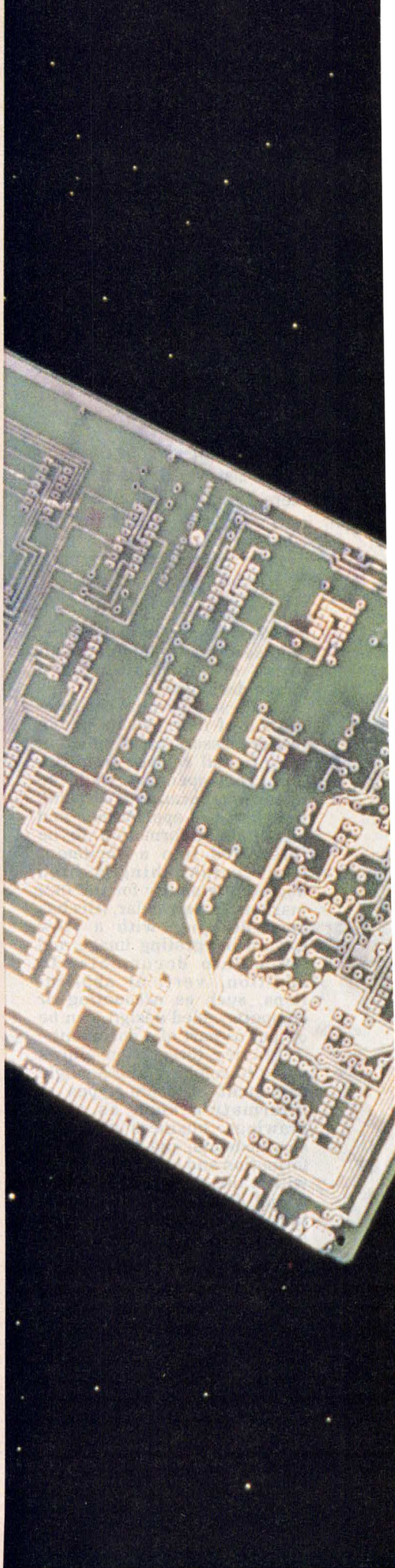
You've seen this scene before: Frustrated managers running out of the copy room after they have discovered that their documents cannot be duplicated because the copy machine ran out of ink. In many other companies, someone else regularly maintains the copy machines to make sure this kind of scene doesn't occur. Formal procedures regulate who refills the ink, orders the supplies, and trains others to use the machine. Machines need administration; without it, they are seen as being unreliable. This can be equally true of microcomputer systems.

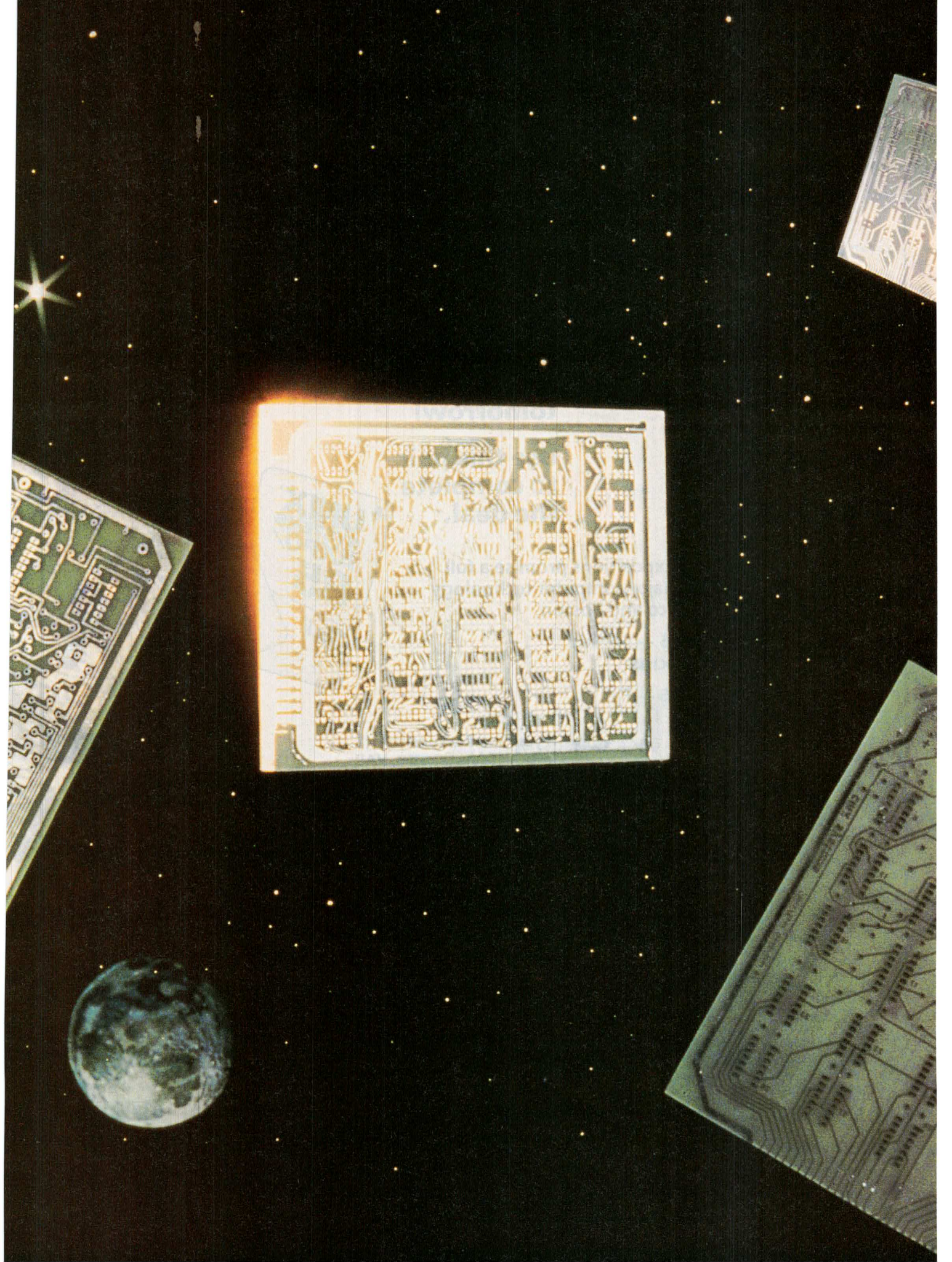
In the last few years, Unix and Xenix system-based microcomputers have penetrated the commercial market. Law offices, dental offices, and other business centers use these high-powered micros to manage their data and even to help employees think. In any major establishment, micros have become such important factors in productivity that daily activity can scarcely continue without them.

But who ensures that they keep running? In small offices, it is usually an intelligent and interested administrative assistant who has taken the informal position of microwizard. It is ironic that machines so vital to any organization are left to such informal procedures and that there is a constant reliance on the product's service team for such emergencies as "the printer doesn't work" or "the terminal doesn't talk to me." This hinders any organization's overall continued performance.

Picture a law firm using microsystems running software packages with the Xenix operating system. Every day, users enter data about clients. One day, a consultant advises the firm to add a serial telephone interface (a modem) so that employees can work from home. However, no one administers the micros in the law firm, and the telephone number is shared by all employees. Soon, the firm finds that client information is being leaked to its competitors. To the company's horror, it also discovers that company information is not secured and that outsiders have been calling its systems. This business disaster could have been avoided with system administration.

Microsystems have been incorrectly associated with personal computers. Intel's System 310-40,





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for example, contains a 40-megabyte disk drive, a 320K-byte floppy drive, and a fast, high-powered processor. These systems run the Xenix 286 operating system, a sophisticated multiuser, multitasking operating system for the commercial environment. The Xenix 286 operating system Release 3 is a derivative of Unix System III. These systems are hardly personal computers, and administrating these high-powered microsystems is far more demanding because they offer greater functionality.

WHAT IS MICROSYSTEM ADMINISTRATION?

Microsystem administration is an offshoot of system administration for mainframes and minicomputers. In major commercial banks, for example, large computers have maintained critical data that have to be backed up, retrieved, and associated with new data; this is part of the administrative process. Banks today use micros that, although small, also perform similar functions. However, many banks do not manage these micros with the same thoroughness—at least until the first security break or the first system crash! Then begin the questions and the administration efforts.

Hence, microsystem administration demands the attention and the manpower of a dedicated and informed administrator. Depending on the size of the microsystem environment, an organization may find that a half-time administrator could suffice.

System administration has been a relatively undocumented function. Many microcomputer manuals represent maintenance with descriptions of utilities like `backup`, `restor`, `dump`, and `tar` (see the *Terminology Board* for brief descriptions of these and other utilities). Although these utilities are essential, they do not help the administrator understand all the responsibilities of the job. Feeble representation in the manuals will, of course, render equally feeble results. However, professional system administration demands both a more formal approach and the conscientious carrying out of duties.

A LACK OF GLAMOUR

We can separate the main functions of system administration into two parts: the routine and the creative. Routine system administration duties, usually deemphasized because they seem to lack glamour, actually form the backbone of system administration. From the routine duties, the administrator can move ahead to more creative tasks. When a department or office views systems seriously, it begins to realize that the main issues are important. Systems do break down, memory boards do burn out, and people do walk away with terminals and modems.

By the same token, inventory control, capital equipment administration, inventory management, and capital equipment depreciation are real issues. Consider software licensing issues and maintenance contracts. Who keeps them, and who ensures their enforcement?

Let's go back to the example of the law office we discussed earlier. Picture the office with five microcomputer systems. The firm has a room to hold these systems and is very happy with their utilization. When a terminal locks up, the user walks into that room and hits the reset buttons, hoping to bring life to the terminal. Clearly, this would destroy any work other users are performing, but it does happen!

TERMINOLOGY BOARD: WHAT THE TERMS MEAN

backup:—Saving files onto other media, such as tape or diskette.

cu:—"Call Unix" utility; used by one system to log-in remotely on another system via serial lines.

dump level 0:—Utility that copies file systems onto backup media; with a level 0 dump, all files in the system are backed up.

/etc/rc:—A program (*rc*) living in the *etc* directory is invoked when the system goes into multiuser mode from single-user mode; this file invokes other programs to prepare the system for many users.

fsck:—Used in system administration, *fsck* is short for "file system check"; it monitors the integrity of the file system.

login name:—Name by which the Xenix operating systems identifies a user.

pwadmin:—A Xenix 286 operating system utility that permits password administration; it ensures that all passwords are changed within specified time intervals.

restor:—The reverse function to *backup*.

superuser:—Synonymous with "root" (a privileged user on the system with access to all files), it is typically used by the system administrator.

sysadmin:—A Xenix 286 operating system utility for file system backups and for restoring files from backup disks; it can do a daily incremental backup (backing up only files that have been changed since the previous backup) or a full backup (level 0 dump); it can also provide a listing of the files backed up.

tar:—The Tape ARchiving utility saves and restores multiple files on a single file (usually a magnetic tape or diskette, but it can be any file).

troff/nroff:—Text formatting and typesetting utilities.

uucico:—The program invoked on systems to perform *uucp* protocols.

uucp:—Unix-to-Unix CoPy; serial communication, file transfer, and mail between two or more systems.

Healthy computer room administration is a result of the following: (1) maintaining lock combination settings on doors and being careful with the combination's distribution; (2) room organization—storage space, equipment control, and cleanliness; (3) facilities planning—communication lines, modems, and temperature and humidity control; (4) protection against fires, floods, and other natural disasters; (5) printer/plotter operations; and (6) ordering and tracking computer supplies.

System administration methodology must begin with rudimentary techniques that ensure the successful continuance of the computer system's support. In other words, before anything else, we have to keep the system alive.

The computer operations responsibilities of a system administrator include the following: (1) back up all disks at regular intervals; (2) perform crash recovery, when necessary; (3) run diagnostics routines when hardware fails; (4) install communications connections (networks and modems); (5) keep up with preventative maintenance (cleaning the printer, running diagnostics); (6) maintain a trouble log, register users' complaints; (7) plan downtime for maintenance, backups, etc.; (8) restore users' files; and (9) manage archive library of software, hardware, and documentation.

SYSTEM ADMINISTRATION TOOLS

System administration tools are available to us with the Xenix operating system. Any beginner's text on the Xenix/Unix operating system supplies techniques to perform the following: (1) add/delete user accounts; (2) maintain access permissions to user and group; (3) maintain password file; and (4) measure disk usage.

System support is not mundane—administrators can go beyond routine tasks and make creative contributions.

Many shell scripts, utilities, and C programs come well described in most manuals and magazines. However, the responsibilities of system support encompass an even wider circle of activities.

System administrators are technical experts on the operating system and its capabilities. They install new software releases, perform emergency fixes to software and hardware, install new drivers for new peripherals, communicate with all users via electronic mail, and maintain file systems.

Administrators locate files, monitor their usage, and perform analysis of disk use or free space. They measure system activity to ensure fair use of system resources —for example, by catching those who hog telephone lines or system resources. Administrators understand the systems well enough to optimize their capabilities, whether by increasing I/O buffers and reducing the number of available processes or by reorganizing the file systems.

The system administrator is also responsible to users and must ensure their privacy. This means the administrator must take security measures, especially with systems that link to other systems. Systems with modems are always security hazards. The administrator keeps strict control on who knows the telephone number to the systems, ensures that every log-in name contains a password, and sees that everyone logs out after using the system.

The administrator should also ensure that passwords are changed regularly and that users avoid using simple passwords. The Xenix 286 operating system insists that users have passwords when they are entered into the system. By using the `pwadmin` utility (see the *Terminology Board*), administrators can make sure that all passwords are changed regularly. Administrators can also write a small shell script/C program to log off any inactive user if no keyboard activity is detected within a certain time.

De-encryption programs that read password files roam free in many Unix and Xenix operating systems. It does not take long to write a shell script that emulates a standard log-in message on any terminal. When the user types the password, the program could easily record the password into a data file and log itself out after outputting the message "incorrect password." This would lead the user to believe that the password had been typed incorrectly. Because the true log-in prompt appears the second time, the user will never know the difference. System administrators can reduce such transgressions.

The role of system support is hardly mundane when administrators can go beyond routine tasks and make creative contributions. For example, administrators can identify needs and develop tools to feed these needs. They can develop tips, software tools, and training sessions for both novice and sophisticated users.

With the Unix/Xenix operating system, most establishments have access to a network. Many networks circulate utilities that form tremendous work-saving tools. These include programs or shell scripts that measure system activity and programs that log out idle users. Thus, the administrator, by devel-

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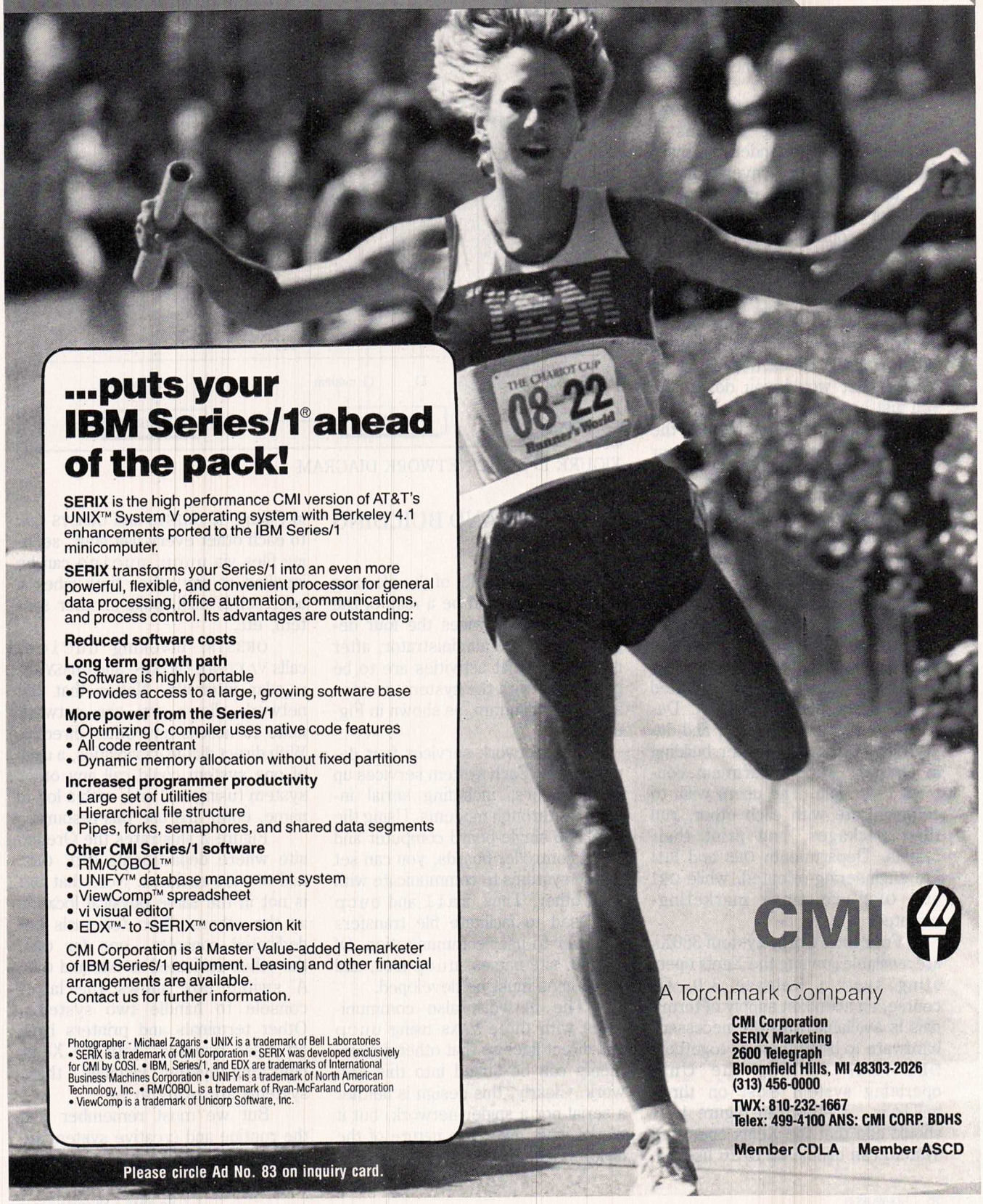

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oping tools and providing assistance seldom found in vendor manuals or related texts, can fill the gaps that usually cripple users.

The following example shows that administrating systems is challenging and dependent on many factors. This section covers some of the hurdles seldom mentioned in books or manuals that an administrator will encounter.

A SAMPLE PROCESS

If you were given a couple of microsystems and were told to add terminals on each desk in an office, what would you do? Could you just hook the systems up, boot them and administer aid to the needy user? Or would you try your best and fall flat on your face? Or another predicament could befall you. Say you were asked to maintain an existing network of microsystems. What would you look for? What can you expect?

Here's a snapshot of the situation. Let us assume that you need to service four departments. They are named OR1, OR2, OR3, and PH4. Departments OR2 and OR3 are situated in the same office in Oregon. Department PH4 is in Phoenix, and department OR1 is in another building in Oregon. Each department contains 11 people. The users wish to communicate with each other, run their packages, and print their results. Departments OR3 and PH4 are engineering-oriented, while OR1 and OR2 are more marketing-oriented.

Four Intel Corp. System 380Xs are available running the Xenix operating system Release 3.0. Of course, an abundant supply of terminals is available with the necessary hardware to bring them all together. DEC VAXs running the Unix operating system exist on three buildings, as shown in Figure 1. (I should add that the Xenix operating system can handle up to 16 users.)

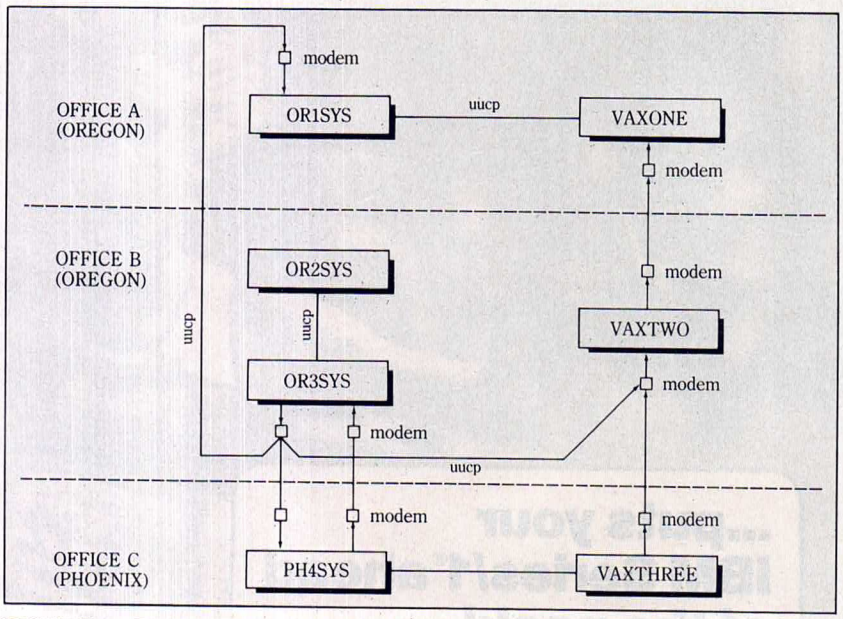

FIGURE 1: BASIC NETWORK DIAGRAM

PLANNING AND BUILDING A NETWORK

One of the results of the planning process should be a map of the network that services the four departments. The administrator, after measuring what activities are to be performed with the system, creates a network diagram, as shown in Figure 1.

The network services four departments. Each system services up to 16 users, including serial interfaces through modems. Using the iAPX 286 single-board computer and serial controller boards, you can set up the systems to communicate with each other. Thus, `mail` and `uucp` are used to facilitate file transfers and user-to-user communication. Of course, site names, `uucp` files, and serial lines must be developed.

The network also communicates with three VAXs using `uucp` and direct lines so that other departments can be linked into this network. Clearly, this design is neither a serial nor a spider network, but it works well, given the nature of the dialog between systems. As shown in Figure 1, OR2SYS and OR3SYS talk to each other every half hour, sending files via `uucp`. `uucico` can be invoked at any other time when a user sends mail, polls another system, etc.

OR3SYS, invoking `uucico`, calls VAXTWO, OR1SYS, and PH4SYS at regular intervals. Notice that the network allows any one network node to access any other directly. With direct dial-in capabilities, a user of one system could call any other system (using `cu`) and, with a log-in name, enter and use this resource.

Figure 2 illustrates the Oregon site where departments OR1, OR2, and OR3 are resident. Note that OR1 is not in the same physical location as the others. Two terminals are dedicated consoles—one for OR1, the other dedicated to OR2 and OR3. A switch box allows the latter console to handle two systems. Other terminals and printers hang off these systems. With the Xenix operating system installed, these systems are ready to go.

But we must remember that the routine and creative system administration duties can never be

avoided and that the steps outlined above are only the beginning. Consider the Oregon site and some of the functions necessary to maintain efficiency—computer operations and system support duties.

SYSTEM BACKUP

Daily backups are the best way to go. Of course, the frequency of activity on the systems dictates the frequency of the backup. Abundant backup techniques are available. Of course, we don't have to perform a level *0* dump every day. Every week a level *0* dump could be performed, and every day following, a level *1...n* dump instigated. Hence, the administrator needs only to store files that have been changed.

The Xenix operating system provides a formal maintenance program, the `sysadmin` utility, that locates modified files, copies them, and produces an optional list of files. This utility also performs periodic and regular backups when instigated. The backup responsibility is only completed with a strong archiving system; that is, tapes and disks should be labeled and saved.

MAINTAINING SYSTEM INTEGRITY

The Xenix operating system Release 3.0 provides utilities such as `pwadmin` (password administration) that force users to change their passwords at intervals decided by the superuser (the system administrator). The administrator should ensure that all users have passwords, that dial-in files (log files) are checked, and that call-back modems are used. Utilities to measure free space and disk usage (`du` and `df`, respectively) are also available. The famous `fsck` facility is another valuable tool for maintaining file system integrity.

Apart from password administration, administrators have to see that proper permissions exist on files; in short, they manage file ownership. System administrators also must ensure access security. For example, administrators must make sure that all users log-off after work and that they keep the superuser password a secret.

Surprisingly, checking the mail files in a system can uncover passwords because users send their passwords to each other thinking no one will know. Consequently, security breaks can occur through systems that are linked together. For example, a user may have quit the company, but that account may not have been removed from the system having `uucp` links to yours. Administrators have to ensure that neighbors are as safe as the homes the users live in.

TAILORING YOUR ENVIRONMENT

With the network established, the system administrator can begin to adjust the environment to fit the needs of the users and of the system. In many commercial environments, for example, users might want to create slide presentations on-line. With a respectable printer, macros can be set up on the systems to create professional slides using `troff` or `nroff`.

Furthermore, many offices have sign-in boards and mail slots that, although convenient, are eyesores. A creative system administrator could write simple shell or C program packages that allow the telephone receptionist to use a terminal instead of an intercom. The receptionist sends mail to users and checks to see if they are at their desks.

Logs are always useful, but on-line logs are even better. For example, `/etc/rc` can invoke a C program or script that prompts the superuser for reasons for restart (`/etc/rc` is invoked on multiuser initialization). Therefore, the superuser can record all reasons for reboot or re-initialization as well as the time and date that the event occurs.

We have covered in this article only a small part of the challenges involved in system administration. You may discover areas that we have not addressed, but this is encouraging because even the tasks outlined thus far require and strict observance of established procedures. But the central idea we have presented here is this —companies need administrators, not micro-hacks.

System administration is an attractive balance of chore and challenge; it's a job that demands attention and respect. □

A Singapore native, Mohandas Nair heads an applications marketing group at Intel Corp. Besides holding bachelor's and master's degrees in computer and information science, Mr. Nair is also a semiprofessional musician.

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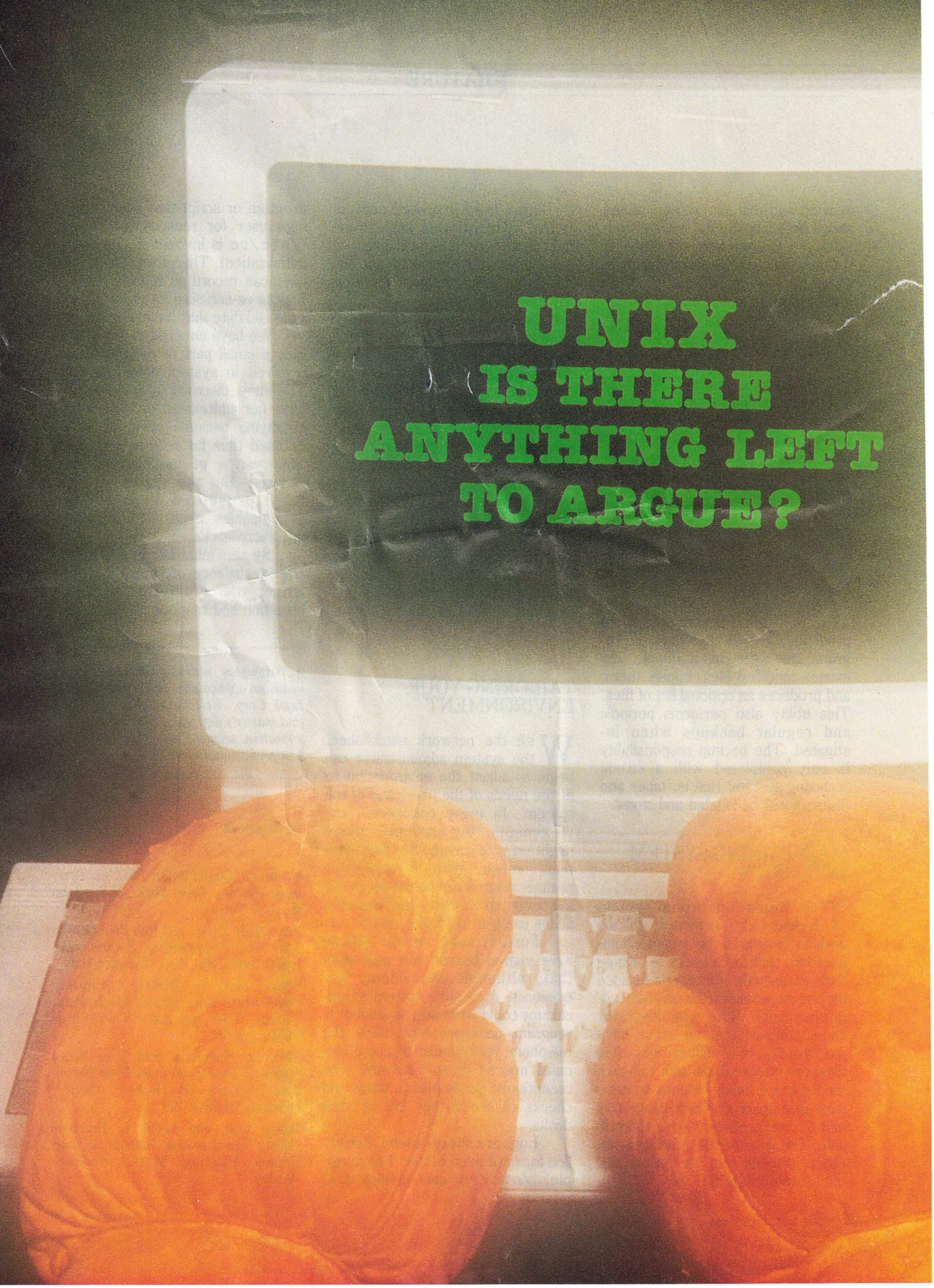
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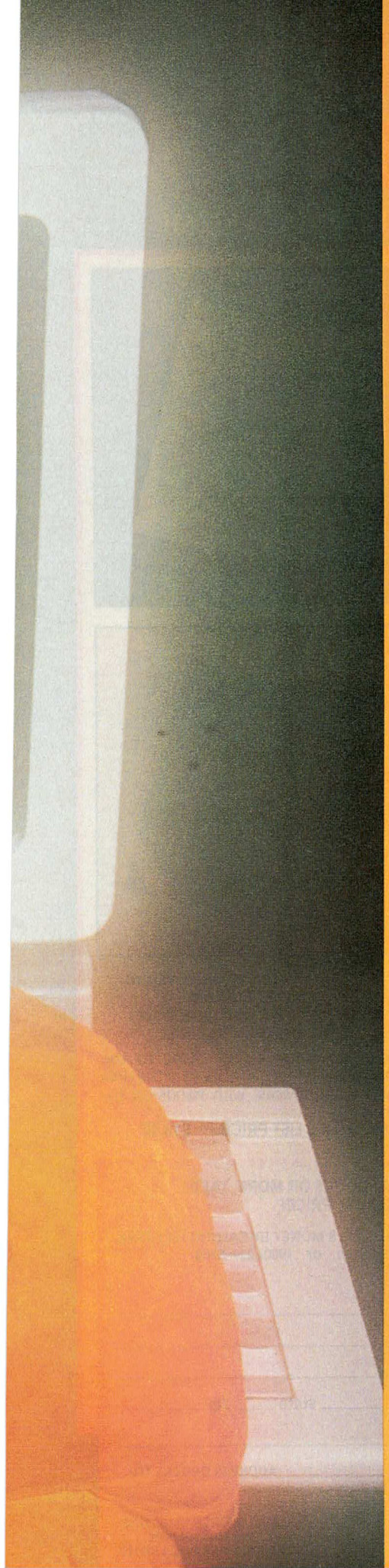

BY STANLEY SHEIN

Despite the fact that every major computer manufacturer (with the possible exception of Wang Labs) has either announced or actually introduced computers employing the Unix system, considerable debate continues about the Unix system's merit (or lack thereof) in business applications. In a sense it calls to mind Mr. Dooley's imperishable observation about a rational man being one who carefully examines all sides of a question and then votes the straight Democratic ticket.

Thus, while an admittedly small but clearly defined group derides the Unix system in commercial applications, those in the industy—including such names as AT&T, Burroughs, Data General, Honeywell, DEC, IBM, NCR, and Sperry (yes, Sperry)—none of whom are exactly babes in the business-computer woods, continue to resolutely stuff the Unix system ballot box.

Nonetheless, prudence suggests that we examine the objections, no matter how shrill or how self-serving they may be. One dissenter let the world know exactly where he stood in an article entitled "Unix—From Now on Consider It Dead." Even discounting the fact that that author works for a company that markets a competing operating system, any manager today who decides what kind of computer his or her company acquires had better be ready to answer all objections or questions, no matter how clear-cut the choice or how cut-and-dried the decision may seem.

THE UNIX SYSTEM'S ADVANTAGES

Let's first take a look at the reasons why the Unix system is seen as such an important development, one that is important philosophically as much as it is technically. Then we can examine the common objections to the Unix system in that light. The reasons why so many people are pro-Unix are very straightforward:

One: Because it is the operating system choice of almost every major computer manufacturer and some one hundred other companies as well, the Unix system seems clearly destined to be *the* standard operating system at least for the rest of the decade.

Two: The portability of the Unix system itself and of the applications that run under it.

Three: With the examples of CP/M and MS-DOS at hand, we all know that establishing an industry-standard operating system inevitably results in the availability of an enormous range of inexpensive, versatile, dependable, off-the-shelf software packages.

Four: The Unix system provides an enormous repertoire of developer-oriented utilities.

Five: It has the capability to integrate data-processing and the omnipresent office functions of word-processing, spreadsheets, and database management.

THE CRITICISMS

Unix isn't user-friendly. The president of a huge and very successful computer company actually expressed this point in his keynote address at a major computer show. But he missed the point. Operating systems aren't meant to be user-friendly; the Unix system is *developer*-friendly.

Amply befriended developers have gone on to produce applications software for Unix systems that are a delight to use—even for office personnel who have never before sat down in front of a terminal.

That president's company, incidentally, is currently advertising that it has sold more Unix system-based computers than anyone else in the industry—apparently forgetting that the Unix system was developed

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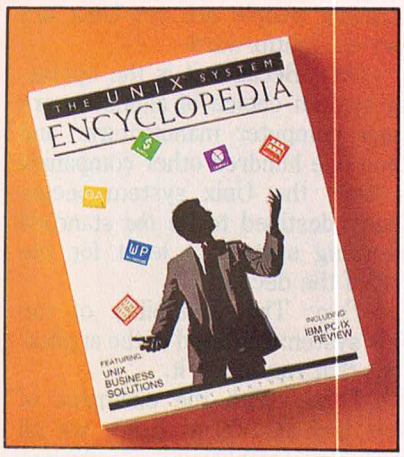

The Unix System Encyclopedia
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The C Programming Language
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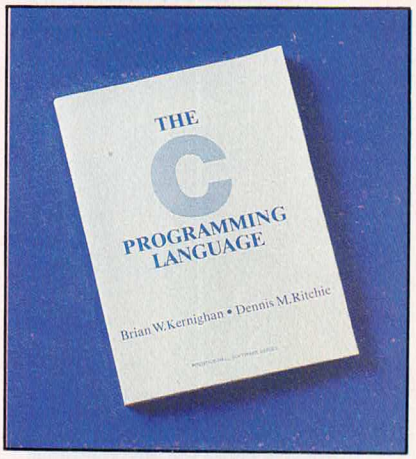

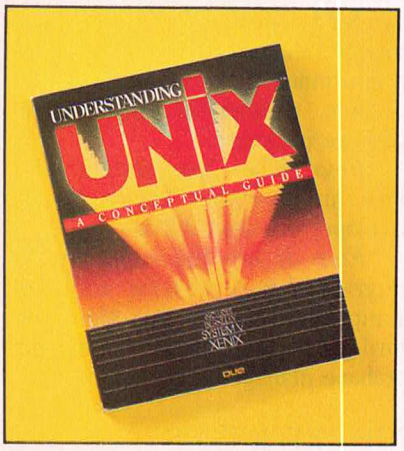

Understanding Unix—A Conceptual Guide
Groff / Weinberg
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An excellent introduction for managers new to the Unix system, the *Conceptual Guide* introduces you to the reasons for implementing the Unix system.
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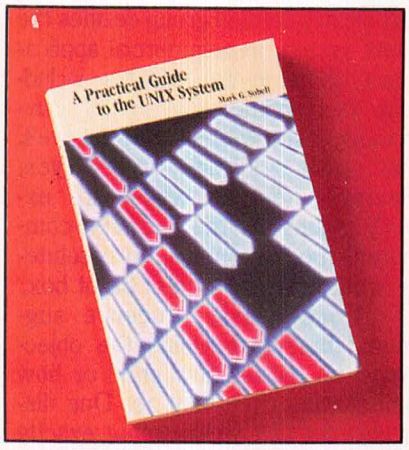

A Practical Guide to the Unix System
Mark Sobell
BENJAMIN CUMMINGS GROUP

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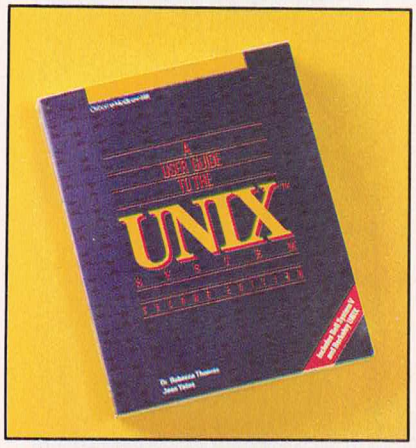

A User Guide to the Unix System Second Edition
Dr. Rebecca Thomas / Jean Yates
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on DEC's PDP series and that it also runs on DEC's VAX line—but anyway we all know what it means.

There is no single standard Unix system. It's quite true that there is an alphabet soup's worth of Unix-derived and Unix-like operating systems around. There are Xenix from Microsoft, Venix from Venturcom, Ultrix from DEC, Berkeley 4.x, System III, System V, Version 7, and more. However, each implementing company has been very careful to do two things.

The first is to produce a quasi-proprietary product with a unique identity and unique benefits that provide obvious marketing advantages. Let's face it, Madison Avenue now runs between Route 128 and Silicon Valley.

The other thing is to make damned sure that the house-brand Unix system doesn't stray so far from the mainstream Unix system that it doesn't continue to offer the aforementioned benefits. Newer Unix systems tend to drop unneeded, unwanted, or even obsolete features, and they tend to incorporate new features. But programs written in compliance with the /usr/group standard can migrate readily from one Unix system version to another.

The additional effort required to translate application programs written in COBOL, BASIC, or FORTRAN, and so on is caused by inconsistencies that exist in languages, not in Unix operating systems. Software written in C, for example, doesn't have such a problem.

Thus, Unify, which is one of the best-selling relational database management systems and which is written in C, runs under Xenix, Venix, System III, System V, etc., without translation, on systems ranging in size from IBM PCs through supermicros, minis, and superminis, and through mainframes by IBM and Amdahl.

The Unix system didn't become the premier multiuser operating system by omitting protection against those multiusers causing multicrashes.

While neither Unix-like operating systems nor Unix-based computers are replicas, a port of application software from one Unix system computer to another kind of Unix system computer may typically take three computer-programmer days. A port to a non-Unix system machine could take three programmer years!

SPEED VERSUS VERSATILITY

The Unix system is slow. People who say this usually are taking proprietary or special-purpose operating systems as their reference points. (Dedicated operating systems can be made to run very fast, indeed.)

But they miss the point. Speed is a trade-off for the many-faceted Unix system versatility. And there are numerous ways to compensate for this trade-off: (1) the Intel 80286 chip, for instance, incorporates memory management right in its architecture; (2) the multiprocessor design of many of the newer Unix system machines speeds things up; (3) new hard-disk drives appearing on the market are designed to provide significantly faster access times; and (4) cache-memory techniques are now commonplace in many hardware specifications.

Because computers designed and built for the Unix system are expected to find a broader market than those that employ a proprietary system, a more powerful (read: *faster*) machine running the Unix system can replace the slower kind for about the same capital outlay. That is the most direct way to address the speed issue. The question the typical commercial user should ask today is not "How fast?" but rather "Is it fast enough for us?"

The Unix system doesn't have record lockout. This is an example of a case in which the developer steps in and makes the things friendly. Lockout is readily provided by (among others) Xenix, Venix, Unisource, and Unify. The Unix system did not get to be the premier multiuser operating system by failing to provide protection against those multiusers causing multicrashes.

When you come right down to it, most of the objections to the Unix system can be seen as the last resort of people who either have a vested interest in minimizing the widespread adoption of the Unix system or who stand to lose something as this inevitable widespread adoption increasingly turns computer hardware into a commodity.

As a commodity, computers will have to be sold to users based on merit and cost effectiveness. The days of a customer base locked into a particular proprietary brand are all over. In that respect the Unix system may turn out to be a more important industry deregulator than Ronald Reagan and Margaret Thatcher combined!

You see, it's like Mr. Dooley said. □

Stanley Shein is the founder and president of Absolut Software, a Boston-based software development firm. He has written numerous articles for professional and trade publications and has also authored a book on management techniques.

APPLICATIONS SOFTWARE? WHAT APPLICATIONS SOFTWARE?

Just why isn't there more software for Unix system machines?

BY VANESSA SCHNATMEIER

"We have the machines, now give us the software." The cry goes up from a thousand throats of prospective Unix system users who bought an Altos, a Plexus, a Tandy, or a Zilog. It's almost a given in many, though not all, Unix system-speaking circles that there isn't enough software out there. Machines galore, but little to run on them, it is said.

Is this true? Yes, in large part, but perhaps not for the reasons you think, and there are many reasons. There is a ware there, to paraphrase Gertrude Stein, but only if you have the right machines. There will be *more* ware, too. But you may have to wait for it, and it may depend on how well AT&T can determine the direction IBM will take.

Let's walk through the rogues' gallery of reasons Unix system-based applications haven't appeared in their expected numbers.

David Preston, director of marketing for The Wollongong Group, Palo Alto, Calif., says there's not as much software out as people had expected but that the lack comes from an overestimation of market growth.

Hardware and software companies are circling the Unix system like a pride of hungry lions, waiting to make a killing.

We've been spoiled by the phenomenal success of the microcomputer industry, says Preston. As a result, hardware and software companies are circling the Unix system like a pride of hungry lions, waiting to make a killing. In fact, Preston suggests, many people are jumping the gun in their expectations for the Unix system and Unix system-based applications.

"It's not the torrent that people expected; it's the trickle before the torrent," he says. The situation was very similar in the microcomputer industry not so many years ago. We tend to forget that "Unix" was, until recently, only a buzzword in academic circles and that it is still finding its feet commercially.

The amount of software available depends on which source you read. David Fiedler, editor of *Unique*, an industry newsletter, says there are from 300 to 700 applications available for one version of the Unix system or another, "depending on what you consider an application." A recent list of applications compiled by /usr/group and published in *Computerworld*(Sept. 26, 1984) tallies a total of 728 applications "available on some version of the Unix operating system." (See Figure 1.)

Compilers comprise 106 of these applications, with 92 in system software, 83 vertical applications, 66 database managers, 66 training and education packages, 54 consulting packages, and 52 general accounting packages, as well as a host of others for graphics, financial analysis, spreadsheets, word processing, manufacturing, and industrial control. Notice that these last areas are where we find a lot of microcomputer software—the types of software bought by the non-experts, the common business user. In these areas, there *is* a lack.

An application of the type you

want may be available, but you may not be able to use it. "Just because it's on Unix doesn't mean it will run on my machine," says Fiedler. "Say you're looking for a legal application package that runs on your machine. You may find out that there are only one or two companies in the entire universe that make legal application programs, and neither one of them makes it for your machine. So, as far as you're concerned, there are no legal applications."

THE BOGEY-WORD: STANDARDIZATION

A major reason for this dearth of usable applications is that Unix bogey-word—*standardization*. The generally accepted wisdom says the software market hasn't jelled because there is no real Unix system standard.

> **'Unix' until recently was only a buzzword in academic circles; it is still finding its feet commercially.**

"One lesson most of the fledgling micro industry had already learned was that to be truly successful, the market had to be built on widely accepted system software standards," said Mark Ursino, president of Technology Services Corp., Bellevue, Wash. In this multisystem market, with Xenix, Venix, AT&T's Systems III and V, Berkeley 4.1 and 4.2BSD, UniPlus+, and PC/IX all having their adherents, there clearly is no "standard" system, despite all of AT&T's wishing to make it so.

Says Fiedler, "Companies may write an application, but they're not going to port it to the literally hundreds of machines that are out there. The best supported Unix machine might have 50 percent of the programs available for it. This leaves a lot of people out in the cold." In effect, the characteristics that made the Unix system so widely ported have also helped kill its own market. Without a standard, you can't port everything to 150 machines.

Another point: The Unix system possesses unique capabilities that haven't been taken advantage of by most applications. Bob Beasley of BroVenture, the venture capital arm of the Donaldson Brown family, believes that the simple generic applications, such as spreadsheets or database managers, have been done now. Not enough software exists that works with, for instance, the Unix text-processing facilities. "We need applications that make the organization work better," he said. "That's what makes a multiuser system perhaps better than a network solution. The ultimate goal is to communicate and reduce information float."

What software there is may not, umm, be of the best because of the imperatives forcing software companies to the market. Maxwell Steinhardt, vice president of information systems for the market research firm Strategic Inc., says there is a lot of "experimental software floating around that hasn't been fully tested." New releases may solve the problem, but by then

Category	*Count*
Application generators	15
Business graphics	6
Communications	67
Computer graphics	5
Consulting	54
Database management	66
Engineering graphics	12
Financial analysis	7
General accounting	52
Industrial control	3
Office automation	3
Manufacturing	5
Point-of-sale	3
Publications	22
Spreadsheet	12
System software	92
Training and education	66
Typesetting	20
Word processing	26
Languages/compilers	106
Other (vertical applications)	83
Integrated "personal" applications	3

SOURCE: *Computerworld;* Sept. 26, 1984

FIGURE 1: TALLY OF APPLICATIONS AVAILABLE ON SOME VERSION OF THE UNIX OPERATING SYSTEM

the buyers may have hardened their hearts. Documentation is rarely sufficient for end-users to work with readily and quickly, he says. Most of this comes about because money-starved software companies rush a package to the shelf before all the bugs are out.

FINANCIAL AFFAIRS

This brings us to the generally poor state of financial affairs under which most Unix system software companies labor. Michael Dubrall, formerly of Yates Ventures and now with NCR Corp., pointed out that hardware companies can't sell their products unless they can find the software; but, meanwhile, desperately under-capitalized software companies are aching for funds to bring out their products. Dubrall suggested that hardware and software companies try to achieve a marriage of true minds with but a single thought: to get the software out of the development houses and onto the machines that run them.

Distributing software is expensive and complex. One of the big risks involved in producing software is the cost of getting it to market. The major costs for a software house used to come in the development end—the months or years it took to shepherd a project to completion while paying several talented software artists to practice their craft.

Nowadays, however, you can develop Unix system-based software with a high prospect of success. But the money involved in promoting it (in the hundreds of thousands or millions of dollars)—as well as the necessity of having a good installed base of machines that run your exact version of the Unix system—can prove prohibitive.

Money-starved software companies are rushing packages to the shelf before all the bugs are out.

Eventually, said Steinhardt, the advent of a Unix system standard, de facto or de jure, will drive some companies into developing a major marketing program.

Ursino pointed out that a few companies have actually trodden this path, notably Microsoft, which produced a version of the Unix system for the retail market to help it better service its OEM customers. Now, the Santa Cruz Operation distributes Xenix for the Lisa and the IBM PC; UniSoft sells UniPlus+ for the Lisa; and Venturcom distributes Venix for DECmicros and the IBM PC. Retail chains that specialize in business solutions, such as the Control Data Business Centers and the MicroAge computer stores, have also had a modicum of success in marketing the Unix system retail rather than through consultants or manufacturers' representatives.

IBM'S ROLE

IBM is everywhere, it seems to this writer. "At this point, everything depends on IBM," said Steinhardt. If IBM releases Unix system products, he said, then the Unix system will be helped immeasurably, and with it the state of Unix system-based software.

Amy D. Wohl, of Amy D. Wohl and Associates, Bala Cynwyd, Pa., agrees: "What IBM chooses to do about operating systems over the next six months, particularly in the micro and multiuser world, will be critical."

Many companies are waiting to see which way IBM will jump. Steinhardt thinks IBM will attempt to migrate its own software with Unix system-type capabilities to smaller machines, thereby getting a hammerlock on the market. Wollongong's Preston noted that a great deal of the tremendous growth so desired by Unix system developers and users may depend on the success of supermicros capable of running the Unix system.

That's the way it worked with MS-DOS, everyone's touchstone for a "bankable" operating system. A machine that hits it big could bring the Unix system along with it—particularly a smaller machine (such as AT&T's Model 6300 PC) that could proliferate more quickly than a mini or a mainframe. Parenthetically, we point out that the Model 6300 initially is available only with MS-DOS.

Both AT&T and the Unix users' community are playing a software waiting game, hoping that IBM will make the question of software and standards moot.

Until we hear otherwise, our advice is to shop for applications the same way you would for a microcomputer: Look for the applications first; then, if you're in a position to do so, choose your hardware. As the software goes, so will the hardware be inclined. □

Vanessa Schnatmeier is a freelance writer and frequent contributor to UNIX/WORLD. Her work has appeared in several computer-related magazines.

THE HP INTEGRAL

THE UNIX SYSTEM TAKES ON THE MAC

Was that really a sewing machine our reviewer was carrying across HP's parking lot?

BY BRUCE MACKINLAY

I WANT ONE! I can't think of a stronger endorsement for a personal computer than that. I do have to admit that I first thought the HP Integral Personal Computer was a very nice toy (like the Macintosh). But as I used it, I realized that it was more than a toy. This machine combines the functionality of the IBM PC with the advanced interface technology of the Apple Macintosh. It is a true Unix system-based personal computer, and I like it better than either the IBM PC or the Macintosh.

The Integral is a small, transportable computer, and it includes a medium-resolution amber electroluminescent display (512 by 255 dots), one 710K-byte 3-1/2-inch microfloppy, 512K-byte internal memory, 256K-byte ROM, an ink-jet printer, and lots of software. All this takes up four-fifths of a cubic foot, smaller than many printers. At press time, HP had not yet settled on a price, but the basic unit should cost less than $5000.

HP plans to market this machine to software developers, engineers, scientists, and other technical end-users in addition to its current users (specifically as an upgrade path to its Series 80 customers). HP also plans to place its HP Technical BASIC on this machine, a move that will instantly increase the software base by combining the available Unix system software with all the HP-BASIC software.

HP has broken some new ground with this machine. The first thing you notice is the electroluminescent display (ELD). I have seen ELD screens before, but never in a retail computer. The screen is flat and measures 7-1/2 by 3-3/4 inches. By using a flat screen, HP was able to save space and weight, allowing it to place more electronics inside the box. (For example, the Integral is 60 percent smaller than my MS-DOS transportable, *and* it includes the printer.)

However, there are some problems with the ELD screen. For instance, the machine I reviewed had a "streaking" problem. But an HP technician told me (without prompting) that the firm had corrected this problem. In addition, the display was hard to read under bright fluorescent office lights. It also tended to flicker, and it was hard to find the cursor when it was sitting on top of a letter.

This last problem, though, is related to the font, not the display, because the letters are hard to read. You can change the font with a standard system utility, and I suggest that you experiment with the fonts until you find one that is more

PRODUCT OVERVIEW

Model: Integral Personal Computer

Price: $4995

First Delivery: January 1985

CONFIGURATION:

Measurements: 13 inches wide, 7 inches deep, 16 inches high

Weight: 25 pounds

Memory: 800K bytes, minimum memory
512K bytes of user RAM
256K bytes of ROM
32K bytes of display RAM

There can be 1-1/2 Mbytes of RAM installed in the system itself and up to 5-1/2 Mbytes of RAM by using the bus expanders.

PROCESSOR:

CPU: 16/32-bit M68000
16-bit HP graphics processing unit

Cycle Time: 8 MHz

Operating System: ROM-based HP-UX (derived from AT&T's System III)

PACKAGING:

Display: 9-inch electroluminescent display
bit-mapped flat panel amber display
512 by 255 pixels

Keyboard: HP's keyboard
detached
low profile
merged numeric pad

INTEGRATED FEATURES

Built-in ThinkJet printer—150 characters per second

Built-in 3-1/2-inch double-sided disk drive

readable. (It would be nice if you could plug in a CRT display for the office, but if you compare it to the LCD screens, it is still very readable.)

THE PERSONAL APPLICATIONS MANAGER

Included in the read-only memory is the Personal Applications Manager (PAM)—a combination menu and soft function key interface used on other HP personal computers, including The 150 Touchscreen and The Portable. This program, which automatically runs when the system boots, is a special shell that knows a lot about windows and the mouse, and it displays all programs, files, and directories.

You select an item by pointing at it (using the mouse) and then pressing the "select" button. If the item is a file, PAM displays the file in a new window. If the item is a program, PAM runs it in a new window; if the item is a directory (a folder), PAM opens the directory and displays its contents.

You can also move, copy, rename, and delete files, and you can do all the typical Unix system shell functions. But there is one problem with PAM—it doesn't allow wildcards in such commands as `move`, `copy`, and `delete`. To use wild cards, I loaded the Unix system utilities into a `/bin` directory and used the traditional `mv`, `cp`, and `rm` commands via `csh`.

I played quite a bit with the primitive graphics program supplied with the Integral, and it is a good demonstration of the machine's graphics capability. Even though it is limited, you can make nice pictures with it.

The windows are much more than a sales gimmick. I found myself bouncing back and forth between PAM and `csh`—working with `vi` from `csh` and moving files about with PAM. The C compiler requires two disks (more on this later), but with the windows I could edit the source in one window and compile the program in another. The Integral does not use pop-up menus like many other window systems. Instead, it uses a strip of context-sensitive soft function keys across the bottom of the display.

COMPANY OVERVIEW:

CORPORATE:

Company Name: Hewlett-Packard Company
Public/Private: Public
In Business For: 45 years
Headquarters: 3000 Hanover St., Palo Alto, CA 94304

MANAGEMENT:

President and CEO: John Young
General Sales Contact: call 800/FOR-HPPC

FINANCIALS:

	This Year	Last Year
Gross Revenue:	$6.04 billion	$4.71 billion
Net Income:	$547 million	$432 million
Employees:	81,000	

SOFTWARE AVAILABLE AT INTRODUCTION TIME PERIOD

Category	Manufacturer	Name
Personal Computer-Aided Design	ECOM	Structural Engineering (17 packages)
	Land	Surveying
	PAC Soft	Topography (10 packages)
Math/Stat	HP	Calculator
	Software Arts	TK: Solver
Database	Unify	Unify
	RDS	Informix
Project Management	Softrak	Microtrak
Communications	HP	Data Communications
Electronic Spreadsheet	Microsoft	Multiplan
Financial Spreadsheet	Consumer Financial Institute	Turningpoints
Word Processing	HP	Memomaker

4.2BSD

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When it comes to Unix™ systems, "standard" isn't always good enough.

Experts agree that the most powerful and most technically advanced **Unix** system is the Berkeley version. That's why 4.2BSD from Berkeley is the operating system of choice for software development, networking, engineering, CAD/CAM and demanding scientific applications. Other **Unix** systems don't have the features advanced users require.

But 4BSD was developed at a university, so it has never had real-world support. User assistance, bug fixes, updates and enhancements have not been provided.

Now that's changed.
MT XINU, the 4BSD specialist, supplies:

- Fully supported 4.2BSD-based binary licenses (MORE/bsd) for VAX™ computers.
- 4.2BSD source support and source updates for current 4.2BSD source licensees.
- Enhanced 4.2BSD-based source software for new sites, with or without redistribution rights.
- Full support for a wide variety of DEC™ and non-DEC peripherals.
- Assistance for OEM's and hardware manufacturers developing 4.2BSD-based products.

MT XINU personnel have been involved with 4BSD development from the beginning. Now we are producing 4BSD performance enhancements, advanced networking, other **Unix** system extensions, and support for new peripherals and architectures. As a service, we distribute 4BSD bug reports and proposed bug fixes to the community. Our years of experience can speed and improve your 4BSD implementations.

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BENCHMARK MEASUREMENTS

Arithmetic Instruction Times (microseconds per op)

	short	*long*	*float*	*double*
+add	2.3	2	216	174
*multiply	66	84	240	180
/ divide	102	114	336	288

Memory Loop Access Times (microseconds per byte)

	read	*write*	*copy*
Char type	2.3	3.7	3.2
Short type	1.17	1.87	1.64
Long type	834ns	1.36	1.3

Input/Outut Rates (bytes/sec)

	read	*write*	*copy*
Disk	12K	12.3K	5.3K
Pipe			84.6K
TTY 1		0	
TTY 1+2		0	
RAM 1-byte			308.2K
RAM 4-byte			769.5K

Array Subscript References (microseconds)

short[]	long[]
12	12

Function References (microseconds/ref)

0-parameters	1-parameter	2-parameters
funct()	funct(i)	funct(i,i)
18	36	48

Process Forks

(46K bytes)
10 per second

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

getpid() calls:	2 Kcalls/sec or	492 microseconds/call
sbrk(0) calls:	1 Kcalls/sec or	1002 microseconds/call
create/close calls:	11 pairs/sec or	90912 microseconds/call
umask(0) calls:	1.3 Kcalls/sec or	726 microseconds/call

This strip has a one-to-one correspondence with the soft keys on the keyboard. This lets you select a menu item with the mouse or by pressing the appropriate function key. Other systems, although more flexible, force you to move your hand from the keyboard to the mouse when you want to make a menu selection.

The C compiler is very cumbersome. It is stored on two floppy disks—the preprocessor and the translator. To compile a program, you have to withdraw and insert three disks. If you are planning to do any C development, I suggest you purchase a hard disk; they are available in a number of sizes and flavors. (You just plug them into the HP-IB connector in the back.)

THE TUTOR PROGRAM

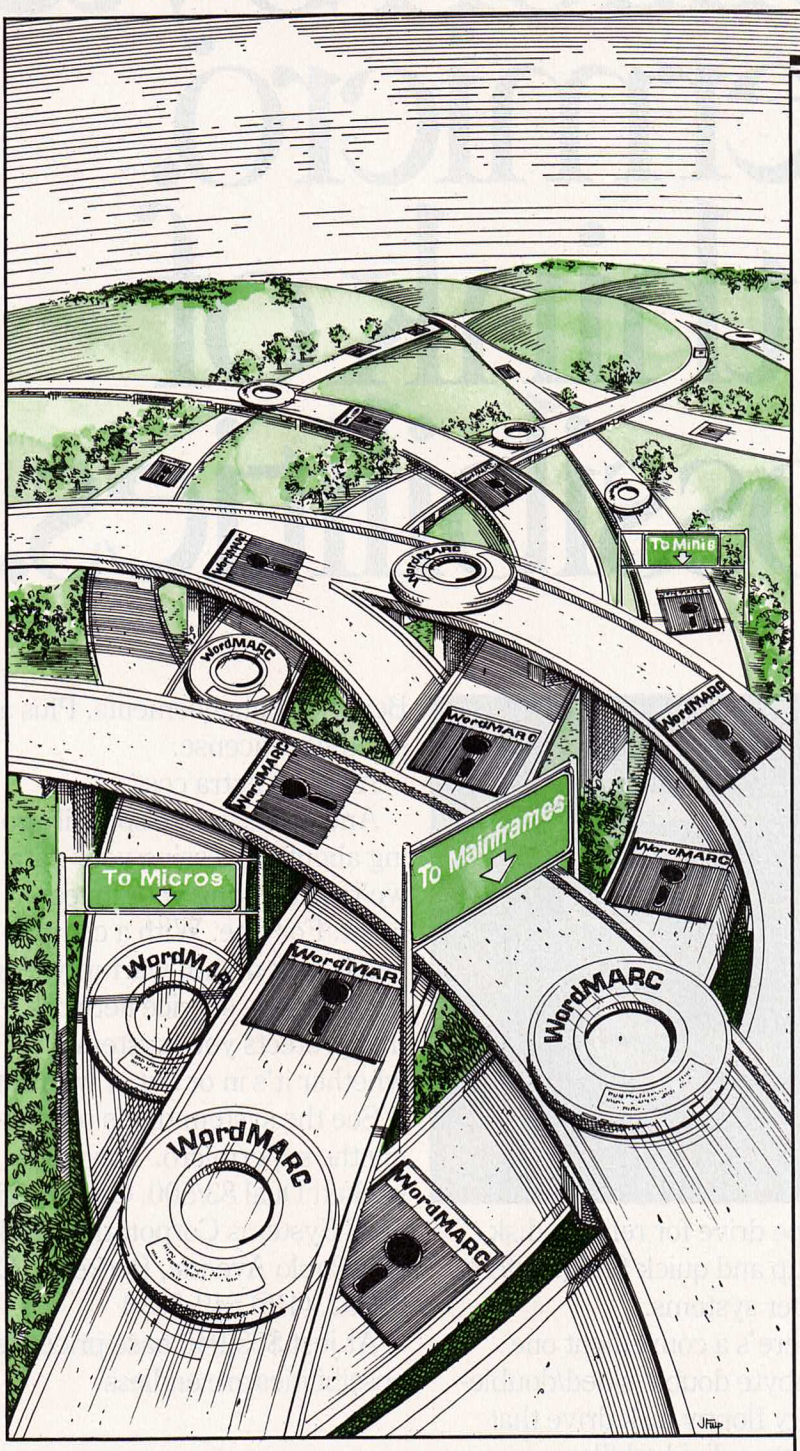
The most interesting program supplied with the Integral is the Tutor program, which novices and experts alike can use to learn about the computer. I went through the Tutor program in about 10 minutes and learned how the system worked. Using the Tutor program is the first step you should make when you get your new Integral; it makes the documentation redundant.

After going through the Tutor, I found the introductions and novice material to be boring. But both manuals will be very helpful when you want to find that persnickety little detail.

Of the two manuals, the Comprehensive Guide should be the most useful. Neither of the manuals had an index; instead, each had a page entitled "Index" that contained the words "to be completed." I hope HP doesn't skimp on the index because, with the Tutor program, these manuals will be used primarily as reference manuals.

Continued on page 75

WHAT'S THE UNIX CONNECTION? WORD PROCESSING FROM MARC!



Compatibility and communication in one single program.
WordMARC™ is *the* professional word processing system that runs on many different UNIX systems* as well as most other non-UNIX computers. This lets you easily transfer documents from mainframe to mini, minis to macros. Regardless of model, regardless of size, the only word processing systems to select is WordMARC.™

Currently used by major Fortune companies, government agencies and educational institutions around the world, WordMARC™ is the intelligent and efficient alternative to stand alone systems.

And it doesn't just work for all these people, it works extremely well.

Performance from the word go.
Inside of two hours employees can be turning out high quality letters, reports and memos. Not only is documentation complete and easy to understand, the on-screen prompts speed the learning process. But ease of use is just the beginning. WordMARC™ can be integrated with other popular application software, such as databases and spreadsheets.

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And WordMARC™ supports over 40 printers and 80 terminals so chances are the price of WordMARC™ is the only investment you'll have to make.

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AT&T 3B2/3B5	Compaq	Wang
Cadlinc	Corona	Zenith 150
HP 9000 S-200	Eagle	**Minis and Mainframes**
HP 9000 S-500	IBM PC	Apollo
IBM PC/AT (Xenix)	IBM PC/XT	DECsystem-10
Masscomp	IBM PC/AT	DECsystem-20
Pyramid	NEC APC	Harris
Sun Microsystems	OSM	Prime/PRIMOS
NCR Tower	Rainbow	Prime INFORMATION
VAX (Ultrix)	Seequa	Pro 350
Wicat	Sperry	VAX-VMS
	TeleVideo	

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The system already comes with 500 megabytes of Winchester storage. And our patent-pending high-speed SMD disk controller for fast access to data.

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Or even double user capacity from 8 to 16. The hardware is already in place.

When it comes to value, no supermicro system offers you more than the 83/500. Because along with the computer, you get a 9-track, 1600 BPI phase-encoded tape drive for reliable disk backup and quick file transfers to other systems.

There's a convenient one megabyte double-sided/double-density floppy disk drive that protects individual files.

And the industry standard UniPlus+™ implementation of AT&T's UNIX System V with Berkeley enhancements. Plus a multi-user license.

All at no extra cost.

And while you're speedily going about processing your data, we're protecting your investment. For free. With a comprehensive 12-month warranty. And a nationwide service network that protects your system whether it's in or out of warranty.

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Continued from page 72

HARDWARE AND ADD-ONS

The Integral's integrated ink-jet printer incorporates the same mechanism used in the HP ThinkJet printer. The print quality is very good, and it is quiet enough to use in an office with other people about. I counted about 96 lines per inch. It uses nonstandard ink-jet paper, which is softer and more porous than normal paper. The print head is a disposable ink cartridge containing a full bladder of ink.

Included with my review prototype of the Integral was a mouse pointing device. The mouse is optional, but I suggest that you get it with your machine. You can use the window system without the mouse (by using the cursor control keys), but then you would be inching along with cursor keys when you could be soaring with eagles.

HP's mouse is a track-ball mouse, which I don't like for a number of reasons. First, they are harder to maintain (they get dirty and start to malfunction). Second, they tend to skip on many surfaces (more important, they skip on my desk).

I have used 3-1/2-inch microfloppy disks before, and they have several advantages. For one, the size is very convenient—I like it that I can stick them in my shirt pocket. The hard cover and auto-closing door protect them from dirt and damage. And get this, you can put a rubber band around the disks and not destroy them!

More important is that the 3-1/2-inch disks contain 710K bytes of storage, about twice as much as a 5-1/4-inch floppy. In addition, disk drives for this size disk are smaller and cheaper than drives for the larger disks.

Add-ons that HP supplies include the C compiler, Multiplan, a communications package (a good one, too), a simple editor, and a calculator program. One of the advantages of the Unix system is that you don't have to rely on HP to supply software; it should be available from a number of sources. HP supplies a lot of hardware for the HP Integral, including 256K-byte and 512K-byte memory expansion cards, as well as a serial card. These expansion cards are inserted in the back of the machine.

The Integral uses the HP-IB bus for disk and other peripherals. In addition, it will support a second microfloppy ($950), a 15-Mbyte hard disk ($3200), and a 24-Mbyte and a 55-Mbyte hard disk. The HP-IB also supports a wide range of laboratory test and measurement equipment. This equipment, the Unix system, and the low price will make the machine very attractive for laboratory data acquisition and analysis.

THE UNIX SYSTEM ON FLOPPY DISKS

The Unix system was designed to run with a hard disk, and I was worried when I saw that the Integral does not have one. But HP did two things to make it work. First, the firm used internal memory to simulate a disk (very common in microcomputers), and it rewrote the Unix system kernel to allow users to remove the floppy disk whenever they want to.

This might seem like a small matter to people who are used to MS-DOS, but normally you must `mount` and `umount` Unix system disks. On other Unix systems, taking out a floppy disk without `umount`ing it would scramble the disk's files. On the Integral you can remove the disk whenever the computer is not reading or writing.

The RAM disk is very handy. I placed my most-used programs into the RAM disk, saving the effort of finding and loading the programs when I needed them. Floppy disks are also very slow, and placing the application into RAM increased the system response dramatically.

Placing the Unix system into a small transportable personal computer required ingenious engineering and careful programming.

These changes have other implications. First, because the user can remove the floppy disk at any time, HP could not use it for swapping. (Actually, swapping to a microfloppy would be so slow that it would be impossible to get any work done.)

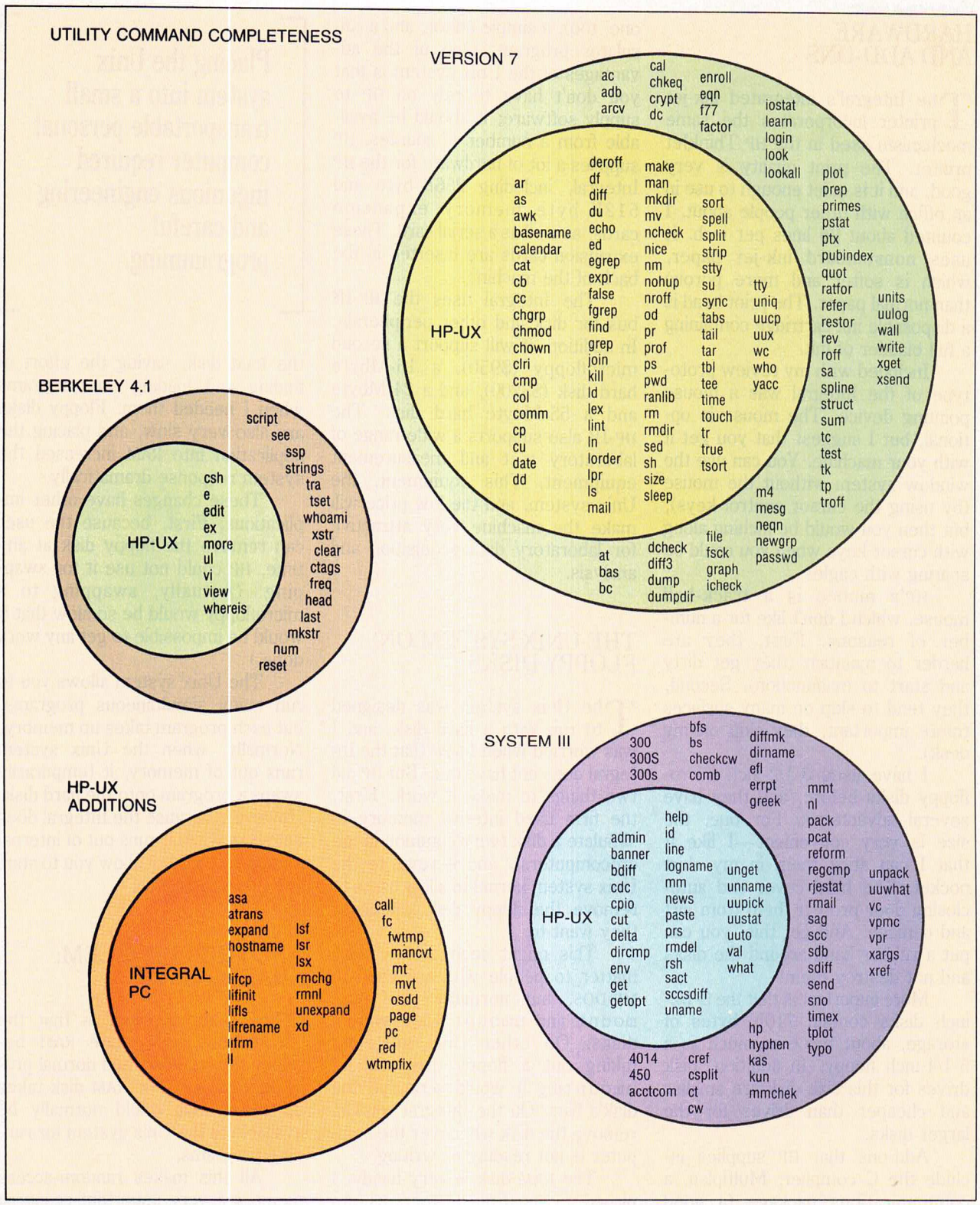
The Unix system allows you to run many simultaneous programs, but each program takes up memory. Normally, when the Unix system runs out of memory, it temporarily swaps a program onto the hard disk. However, because the Integral does not swap when it runs out of internal memory, it will not allow you to start any more programs.

ANOTHER PROBLEM: SHARING RAM

The other problem is that the system must share RAM between the RAM disk and normal program memory. The RAM disk takes up space that would normally be available to the Unix system for running programs.

All this makes random-access memory a very important resource

Continued on page 78


UTILITY COMMAND COMPLETENESS
VERSION 7
HP-UX
ac
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rev
roff
sa
spline
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test
tk
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troff
units
uulog
wall
write
xget
xsend
m4
mesg
neqn
newgrp
passwd
at
bas
bc
dcheck
diff3
dump
dumpdir
file
fsck
graph
icheck
BERKELEY 4.1
HP-UX
csh
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edit
ex
more
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vi
view
whereis
script
see
ssp
strings
tra
tset
whoami
xstr
clear
ctags
freq
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last
mkstr
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reset
SYSTEM III
HP-UX
300
300S
300s
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bs
checkcw
comb
diffmk
dirname
efl
errpt
greek
admin
banner
bdiff
cdc
cpio
cut
delta
dircmp
env
get
getopt
help
id
line
logname
mm
news
paste
prs
rmdel
rsh
sact
sccsdiff
uname
unget
unname
uupick
uustat
uuto
val
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mmt
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pcat
reform
regcmp
rjestat
rmail
sag
scc
sdb
sdiff
send
sno
timex
tplot
typo
unpack
uuwhat
vc
vpmc
vpr
xargs
xref
hp
hyphen
kas
kun
mmchek
4014
450
acctcom
cref
csplit
ct
cw
HP-UX ADDITIONS
INTEGRAL PC
asa
atrans
expand
hostname
lifcp
lifinit
lifls
lifrename
lifrm
lsf
lsr
lsx
rmchg
rmnl
unexpand
xd
call
fc
fwtmp
mancvt
mt
mvt
osdd
page
pc
red
wtmpfix

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SPERRY

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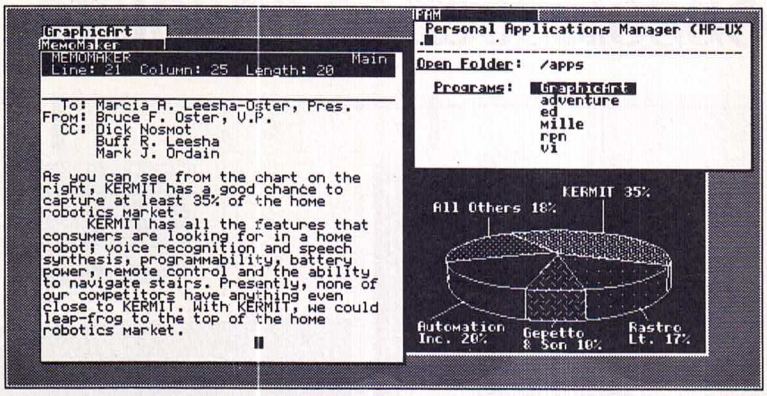
COMPARISONS WITH THE MAC

This example shows the Integral's use of multiple windows.



The big advantage the HP Integral has over the Macintosh is in software. When Apple released the Mac, only a few applications ran on it, and these were just toy programs. Although some real applications for the Mac (at least for the Fat Mac) are now available, the HP Integral will start out with all the Unix system applications. This base will continue to grow quickly as the Unix system grows. But the Mac will always remain limited because of Apple's proprietary operating system.

Granted, the Mac is cheaper, but not by a lot. The retail price for a Fat Mac with the Mac Printer is $3775, and the Mac includes MacPaint and MacWrite. The Integral comes with the Unix system, Integral Utilities, a CAI Tutor disk, customer diagnostics, and a standard applications disk that contains programs ranging from a simple calculator to a primitive graphics program.

I don't like MS-DOS. Don't misunderstand me, I use it every day for writing articles, manipulating spreadsheets, planning projects, and many other things, but I would rather use the Unix system. The big advantages MS-DOS machines have over the Unix system-based machines are software and price. I hope that more manufacturers follow HP's lead, and we can get rid of MS-DOS.

However, the HP Integral is more functional than my IBM PC clone. The addition of multitasking (the Unix system) and windows to the basic personal computer is great! The windows allowed me to bounce from one working environment to another without having to finish one thing and start another. This is how I really work—juggling seven things at once.

—so important that I altered my working habits to minimize the amount of memory I used. With the basic Integral (with 512K-byte memory), I found that I could not run programs from `vi`. This caused me to exit from `vi` each time I wanted to do something else.

After talking to someone at HP, I received an additional 512K bytes. This made my life much easier, but I still occasionally ran out of memory. Perhaps, having the maximum 1-1/2 Mbytes of memory would make me happy, but that seems a little extreme.

Adding memory was very simple. Kermit Yensen (the Integral project leader) simply removed a plate from the back of the unit by unscrewing two thumbscrews, slid in the additional memory, and screwed it in place. The whole operation was over in a minute.

Adding a hard disk does not solve the problem, though, because even with a hard disk the Integral does not swap. Unlike normal Unix systems, the Integral places a severe restriction on the number of simultaneous programs. This reduces, somewhat, that advantage of the Unix system.

The basic HP Integral comes with one microfloppy disk. I realize that a single microfloppy can store twice as much as many 5-1/4-inch floppy disks, but even with this large storage, *you still need two floppy disks.* Working with one floppy required that I either load the data files or the application program into the RAM disk.

Data files are small and load quickly, but I worry about power failures (which are becoming more common). Application programs take up a lot of room, and memory is precious. Ideally, if you had two disks, you could place the application on one disk and the data files on an-

other. HP does sell a second microfloppy drive for $950, but I think it should be included in the basic system.

CONCLUSIONS

Reviewing this machine was fun—it was one I liked working on. The only problem was that I kept wanting to show it to people—I wanted to show them how a personal computer should work. But HP had not even announced the machine, so I couldn't show it to anyone. I found myself getting caught up in the corporate paranoia—I was hiding the unit in my closet when I had to leave home, covering it with a dropcloth when I carried it in my car.

At one point I was carrying it across the HP parking lot when someone asked me what I was carrying. I lied and said that it was a sewing machine. What would I be doing carrying a sewing machine in HP's parking lot? The real hard part, though, was giving it back, but that is always hard.

Placing the Unix system into a small transportable personal computer may have been an obvious step, but doing it well required both ingenious engineering and careful programming. Considering that this machine will allow the HP Series 80 user to step up to a better machine, and that engineers and scientists can bring the Unix system into their labs for a very reasonable price, it ought to do well. HP has done a good job—its Integral is a functional, friendly, and useful machine that will satisfy many users. The price is a bit high, but you have always had to pay more for HP quality. □

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

MULTIPLAN FOR THE AT&T 3B2

It may not be the most powerful spreadsheet for a Unix system, but Multiplan does offer ease of use and well-written documentation.

BY HARRY AVANT

Microsoft's Multiplan, part of AT&T's Office Productivity Series software, is an example of a popular trend in software houses to port established programs from MS-DOS to the Unix system. In the MS-DOS world, Multiplan has been eclipsed by more sophisticated spreadsheet programs that feature superior graphics and integration of more than one application. But Multiplan is an easy spreadsheet to learn, being very menu-driven and crash-proof, and users making an upward migration from MS-DOS will find only a couple of new commands when using Multiplan under Unix System V.

In keeping with the original MS-DOS version, Multiplan features an on-line help capability that users can call up at any time to provide on-screen information about current options. For the Unix system version, path names are allowed, and a "Control-J" provides an escape to the shell to run a Unix system command without leaving Multiplan as an active process.

When initially brought up, the Multiplan screen presents 19 rows by 7 columns of cells. The current cell is distinguished by a spreadsheet cursor. This cursor appears in inverse video (if your terminal supports it), or it is outlined by a pair of brackets. The cell currently awaiting

PRODUCT AND COMPANY OVERVIEW:

Multiplan, by Microsoft, version 1.06, AT&T Office Productivity Series

System requirements:	**This review was conducted on an AT&T 3B2/300 with 2 Mbytes of main memory and a 32-Mbyte hard-disk drive running Unix System V.**
Price:	**$500**
Vendor contract:	**Mr. Ram Chelluri, Senior Engineer AT&T Technology Systems 4513 Western Ave. Lisle, IL 60532 312/810-6223**

Multiplan for Unix system environments is also available on the following hardware:

Radio Shack Model 16
Fortune Systems 32:16
Altos Computer 586
NCR Corp. Tower
Apple Corp. Lisa II

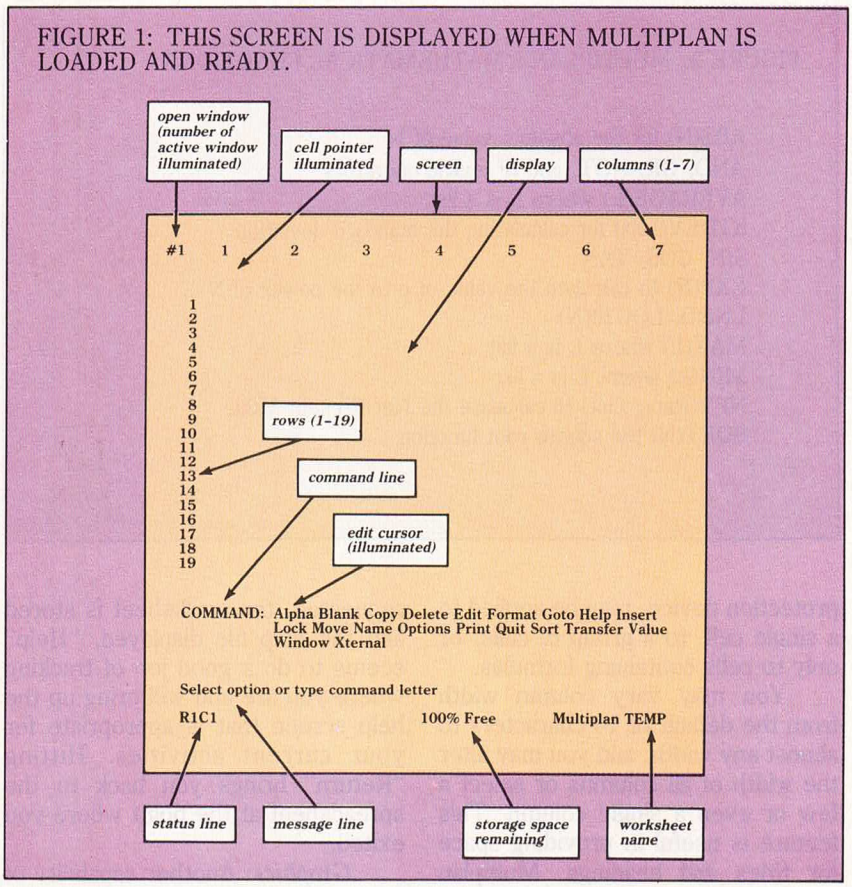
data is referred to as the "active cell." You can change its position by moving the spreadsheet cursor, either by using the control key in conjunction with the D, S, E, and X keys, or, in a fully implemented system, by using the arrow keys. The sequence of keys for cursor movement is identical to those used by WordStar and dBase II.

At the bottom of the display is a selection of available commands. You select a command either by using the space bar to move the command cursor to the desired command, or by typing the command's first letter (see Figure 1). Multiplan is rather easy to get started with because of its on-line help capability and because its major commands are always visible.

If you make an error while entering command data, "Control-C" acts as a cancel key. If you do enter inappropriate data for a command, an error message will appear. Using "Control-C" will undo the erroneous entry, or you may edit the entry by using special editing commands.

Many commands have a subcommand menu for selecting options. In addition, some of the commands are multilevel. For example, if you select the `WINDOW` command, you will be presented with a further choice of `Split`, `Border`, `Close`, or `Link`. If you choose `Split`, you will be asked to select from `Horizontal`, `Vertical`, or `Titles`. At any time, a "Control-C" will undo your current command.

FIGURE 1: THIS SCREEN IS DISPLAYED WHEN MULTIPLAN IS LOADED AND READY.



FUNCTIONS AND CELL ADDRESSING

Multiplan is not a limited program in terms of capabilities (see Figure 2). However, with its complement of math functions and running (in the case of this review) on a 32-bit computer (an AT&T 3B2 Model 300), it seems odd that the upper and lower limits on numbers are 10 to the plus or minus 63rd power. Numbers are calculated with 14 digits of precision. Neither of these limits is apt to tax the 32-bit CPU.

The following are the logical functions available for comparing values: AND, OR, NOT, IF and constants TRUE and FALSE. Also supported are less than, less than or equal to, equal to, greater than or equal to, greater than, and not equal to. These return a TRUE or FALSE, depending on the result.

Like most spreadsheet programs, Multiplan uses the row-column as a basic cell location reference. In addition to this absolute citation, a relative reference and a name reference may be used to specify cell location. The relative reference locates a target cell in respect to the site of the current cell. The name reference derives from Multiplan's ability to "name" a cell or group of cells. A typical use is to name an absolute location with a descriptive term such as "Sales." By using name functions, users may generate formulas based on name relationships, such as `Profit = Sales - Cost`. All cell reference types may apply to a specific cell or to a range or union of cells.

A protect feature allows you to designate cells that you do not want to alter accidentally. This useful feature can prevent the inadvertent loss of complex formulas and expressions. If you really want to change a protected cell, there is an `unprotect` command available. The `LOCK` function, which is the

FIGURE 2: MULTIPLAN'S MATHEMATICAL FUNCTIONS

ABS(N) for the absolute value of N
AND, OR, NOT, and IF logical operators
AVERAGE(L) where L is a list
STDEV(List) for calculating the standard deviation
SIN, COS, TAN
EXP(N) to calculate the value of e to the power of N
LN(N), LOG10(N)
MAX(L) where L is a list
MIN(L) where L is a list
NPV(Rate, List) to calculate the Net Present Value
SQRT(N) the square root function

protection device, may be applied to a single cell, to a group of cells, or only to cells containing formulas.

You may vary column width from the default of 10 characters to almost any width, and you may alter the width of all columns or select a few or even a single column. This feature is useful in providing space for titles and headings. Multiplan also provides a feature that will lock the spreadsheet titles in place while you scroll through various portions of the sheet.

A `format cells` command controls the way information is displayed. Cell contents may be centered, aligned text left with numbers aligned to the right, or left justified. Numbers may be displayed using scientific notation, fixed point, or they may be in integer form. The dollar format displays money with a leading dollar sign and two decimal places.

OTHER FEATURES

Help: You may call up an on-line help menu from the main command menu by typing an "H" or by using the question mark key. When requested, the worksheet is stored and the help file displayed. "Help" seems to do a good job of tracking where you are and will bring up the help screen that is appropriate for your current activities. Hitting "Return" brings you back to the spreadsheet at the point where you exited.

Graphics: Another capability of this program is its ability to generate simple graphic representations of spreadsheet data. The graphic option will provide scaled plots of your data. These simple bar graphs are not in the same league as those generated by true graphics programs, but they can be of some help.

Linked Sheets: Multiplan allows you to set up relations between different worksheets, and these separate worksheets can exchange information. Supporting sheets are those that can provide data for another worksheet, the dependent sheet. One of Multiplan's built-in commands, `external copy`, allows you to copy information from the sheet on which you are currently working to another sheet.

SYLK format: SYLK is an acronym for SYmbolic LinK type of file format. This format is used to exchange data between different Microsoft application programs. Although it has some use in the MS-DOS world, nothing seems to be gained by having it available under the Unix system, unless other Microsoft programs are going to be made available for the 3B series computers.

Printing: Spreadsheets may be printed either to a file or to a regular printer. Unless you specify different values, the program will print material using default settings for margins and maximum width. You may specify portions or the entire sheet for printing. It is possible to have the printout substitute the formulas held in the cells instead of the values. If the material is "printed" to a file, then it may be used with a text editor and merged into a document.

DOCUMENTATION AND LOADING

In its CP/M and MS-DOS versions, Multiplan has been noted for its high-quality documentation, and the Unix system version follows in kind. The documentation consists of a single 6-by-9-inch three-ring binder. A sheet listing 10 errors is located at the front, along with a note explaining how to escape from the program to the Unix system shell.

However, the documentation is a repackaging of the MS-DOS version, and it has too many references about saving files to diskette and how to convert VisiCalc programs. There is also a quick reference card, but it would be far more useful without the page devoted to generating special characters. This seems to be applicable to an IBM PC and is not especially useful for most Unix systems. I would have preferred to see the 15-page Quick Reference Guide that is supplied with the MS-DOS ver-

Continued on page 84

WHY MULTIPLAN ON A MULTIUSER UNIX SYSTEM?

Running Microsoft's Multiplan electronic spreadsheet, or any other personal productivity software package for that matter, on a multiuser Unix system-based computer has several inherent advantages over running the same application on stand-alone or networked personal computers.

For one thing, Unix system-based computers are almost always multiuser, allowing users in a company or department to easily share data amongst themselves. In the stand-alone PC world, to share a financial model with others, users would have to pass their diskettes about the office or copy their diskettes for others. Obviously, both modes of "data sharing" are threats to the integrity of that data. Even with networked PCs, the data must be sent out of the network to other users. In a Unix system-based multiuser computer, all you need to do is tell your fellow workers the filename, and let them do the rest.

The biggest question by far is one of information integrity: How can we arrive at the same bottom line if we are all looking at different data massaged in a vacuum in our own individual PC database? Consider a real-life minidrama that involved a Big 8 accounting firm. An hour-long fight over the book value of a mid-sized company was resolved when the chairman discovered that the senior accountant had failed to hit the recalculate button before printing out a balance sheet. Perhaps we should add a new basic law to Information Theory in this computer age: Single-user PCs degrade the value of information by the square of their numbers.

Now you say that common databases can be dangerous, that anyone knowing the filename could open it and tamper or destroy the data. Not so. The Unix system's security features permit only the owner or others with permission to alter the data. In other words, you can look, but you can't touch.

Another advantage of Unix system-based applications is that users have the whole world of Unix system utilities available to them by simply exiting to the shell. And because the Unix system is multitasking in addition to be being multiuser, you don't have to exit Multiplan or any other application to get at those Unix system utilities.

Let's also consider the enormous amount of disk capacity available to the user on a multiuser Unix system-based computer, usually several orders of magnitude over that available on the typical hard disk-based PC.

Finally, there's the cost and the fact that multiple users can access the same copy of applications software. In the PC world, you've got to pay for each and every user to have his or her own copy of the application. Not so in the realm of multiuser Unix systems. Although pricing is typically higher for a single copy, once you've passed two or three users, you're saving money on software as well as hardware.

To be honest, speed is easily one of the largest arguments against multiuser system spreadsheets. It's unlikely that spreadsheeting on shared-resource computers will ever satisfy the heavy PC, or "power," user when frustration over recalculation times for annual budgets is pushing heavy financial types to buy PC ATs. For those types, consultants now recommend "engines," dedicated PCs hooked to multiuser file servers.

Philip J. Gill
Editor-In-Chief

sion because it has most of the commands summarized and is much more useful.

Loading Multiplan is pretty straightforward. A 20-page "Read Me First" booklet accompanies the software, and it is complete. (A sheet included with the software diskette indicates that the program does not know its own name after being loaded!) After the program is loaded, you must edit the file `/etc/profile` to correct the misspelling of the MPTOOLS filename. Somebody certainly goofed here; this should have been fixed before the program was released.

Multiplan also seems to have a problem when spreadsheets are saved in the Symbolic Link format. During the save process, a file with an incorrectly spelled name will be generated. This is another one that should have been caught by AT&T during its beta testing.

The "Applications" section of the documentation has a fair amount of text devoted to forecasting models such as linear regression and exponential functions. None of these powerful functions are built into this spreadsheet. If you want to perform a linear regression, you will have to enter the formula for the slope and intersect. The program could be improved if Microsoft provided such basic functions as `y=mx+b`, rather than putting the user through needless algebra. The omission of features that could set this version of the program apart from its 8- and 16-bit counterparts is inconsistent with the power of the computers on which this release is to run.

Although I can't question Multiplan's ease of use, I am not sure this offsets its inability to utilize the power of the computer I tested it on. Microsoft can, and should, do a better job of using the CPU and memory.

MEMORY USAGE

When I first started using this program, a real surprise for me was the matrix limit of 255 rows by 63 columns. These are the same limits I had when using Multiplan on an 8-bit CP/M system. I had thought that running Multiplan on an AT&T 3B2 with 2 Mbytes of memory would give me the ability to generate larger sheets than were possible with an 8-bit microcomputer.

Multiplan always displays the percentage of memory left. I tried a simple experiment to see just how quickly the memory gets used. First, I generated a sample sheet that had rows 1 to 254 in column 1 filled with the number *1*. Row 255 had the sum of column 1. When this column was finished, 92 percent of the memory was shown as being available. I repeated this for column 2 but filled the column with the number *2*. After a sum at row 255, Multiplan showed that 84 percent of the memory remained. I continued this up to column 7, which, when summed, indicated that 45 percent of the 3B2's memory was still available. This is what I would expect from an IBM PC with far less memory! Evidently, in porting this program over to the Unix system, Microsoft has not altered the limits of rows and columns or the ability to utilize the fully available memory.

Multiplan features an iteration option that can be used to solve problems that develop circular references. To illustrate this, I set up a test sheet that had the number *1* in the first 199 cells of column 1. The cell located at row 5, column 1, was changed to hold the value of row 1, column 2. In the cell located at row 1, column 2, I put in the standard deviation function for all cells in column 1 from the rows 1 to 199. Because the value to be computed in row 1, column 2, required the value of row 5, column 1, and because the value in that cell required the value of row 1, column 2, a circular reference was generated. When I tried to calculate this, the expected error message was generated.

Through an iteration option, Multiplan offers a way to solve this type of problem. I changed the value in row 1, column 1, to *10* in order to generate a standard deviation greater than zero. The recalculation process took four seconds. In com-

parison, this same example running under MS-DOS using an 8-megahertz 8088 CPU also required four seconds. (The 3B2 was running without anyone else on the system during testing.)

At the end of the recalculation, the spreadsheet cursor did not return to the active cell but remained over the standard deviation cell. I had to press the "Escape" key several times to restore normal operations. This error repeated each of the nine times I ran the test, but only on the 3B2 and not on the MS-DOS machine.

Another interesting "bug" appeared while the iteration option was being set. During the display of the options submenu, a message indicated that 65,520 total bytes were remaining. On the MS-DOS computer, a similar message appeared indicating that 413,620 bytes remained. Because the MS-DOS machine has 512K bytes of memory, I can understand its message. But I have no idea where the Unix system version of Multiplan gets its remaining memory values; it does not appear to be based on the available memory in the computer.

PATHNAMES

If you select the Transfer option to load a previously defined spreadsheet, you can respond to the filename with any cursor key. This will list the names of files in the current subdirectory. You cannot read the names of files in any other directory unless you have previously loaded or written a file to that directory or have called up the program from that directory.

Using a "Control-J" to escape to the shell and using cd to change to a new directory does not indicate an error, but Multiplan will not record this change and, therefore, not allow you to read filenames stored there.

In sum, then, Multiplan may not be the most powerful spreadsheet for a Unix system, but it does have its strong points—ease of use and documentation that is well written. Users already familiar with the program running under either CP/M or MS-DOS will need to learn only a few new commands. If the next release makes better use of computer memory, Multiplan will become a more useful program.

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.

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NEW PRODUCTS

VIRTUAL NETWORKING SYSTEM FROM BANYAN

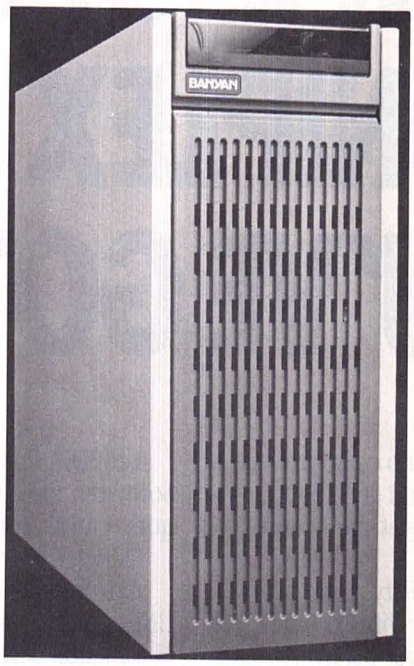
Banyan Systems Inc. has introduced a family of network communications and services software on a supermicrocomputer optimized to function as a network server. The software facilitates the location, movement, and use of information in personal computer networks and PC-mainframe environments.

Also introduced was Banyan's virtual networking system, Vines. The proprietary Vines architecture features Street Talk, a naming and addressing database that permits network users to locate information, other users, and shared resources anywhere in a network, without knowing their exact location.

The Banyan system also handles all file and peripherals management functions for up to four local-area networks (LANs) at the same time, enabling users to access, share, and use information among each other, including such network resources as printers, storage devices, communications facilities, other processors, and external data networks. In essence, it creates a "virtual network" that incorporates the multiuser functionality of the mainframe and minicomputer with the desk-top power and simplicity of the personal computer.

The first hardware base upon which Banyan has overlaid its Vines virtual networking software is an M68000-based 32-bit computer designed and manufactured by Banyan, called the Banyan Network Server. The system contains 512K bytes of random access memory (RAM), expandable to 3 Mbytes, and it can be configured with 43 to 160 Mbytes of Winchester disk storage. In addition, it comes with a 60-Mbyte tape drive for backup.

Base pricing for a Banyan system, consisting of the Banyan Network Server with 512K bytes of main memory, 43 Mbytes of disk storage, a 60-Mbyte tape drive, and



the basic system software is $16,900. Prices range upward to approximately $40,000, depending on the amount of additional memory and software options desired.

For more information, contact Banyan Systems Inc., 135 Flanders Rd., Westboro, MA 01581; 617/366-6681.

Please circle Reader Service Number 160.

COMPATIBLE SOFTWARE DEVELOPER'S TOOL KIT FOR THE IBM PC

Lantech Systems Inc. has introduced a software developer's tool kit designed to allow the IBM PC to be used as a development workstation in mainframe, mini, and microcomputer environments. Retailing for less than $400, the Tool Kit contains a choice of text editors, a terminal emulator, and windowing capability.

Users can choose from among four editors—the Bell Editor (an implementation of the Rand Editor), `vi` editor, `ed` editor, and an EMACS-like editor called Epsilon.

The Tool Kit also includes uNETix, the Unix system-compatible multitasking operating system developed by Lantech.

Another product option is the Lattice C compiler. This option permits development of applications in a local mode without requiring an expensive Unix system host machine. Lattice C cross-compiler tools can also be applied.

For more information, contact Lantech Systems Inc., 9635 Wendell Rd., Dallas, TX 75243; 214/340-4932.

Please circle Reader Service Number 161.

INTERFACE LINKING APOLLO DOMAIN NETWORK, ELXSI 6400

Elxsi's System 6400 superminicomputers can now be integrated with Apollo's Domain network via a TCP/IP interface developed by Dan-

NEW RELEASE

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ford Corp. The interface, which Elxsi will market, will allow users to combine the graphics and networking advantages of Apollo's Domain systems with the number-crunching capabilities of Elxsi's 64-bit, general-purpose, multiprocessor superminicomputer, the firm said.

Apollo's Domain processing concept links Apollo's workstations in a local-area network that allows the sharing of resources and compute power. Elxsi's System 6400 can be expanded from one to ten CPUs, offering up to 40 million instructions per second (MIPS), without modification to software, user environment, or existing hardware.

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

Please circle Reader Service Number 162.

AI DEVELOPMENT FOR UNIX SYSTEM MACHINES

Quintus Computer Systems Inc. has announced an application development software program for creating software for symbolic processing called Quintus Prolog Release 1.0. Based on the logic programming language Prolog, the system is both an application development environment and a backbone for end-user applications. It runs on the widely used DEC VAX series under Unix 4.2 and VMS, on the Unix system M68000-based Sun-2 workstation from Sun Microsystems, and on the MegaFrame from Convergent Technologies.

Quintus Prolog's tools include an incremental compiler allowing programmers to compile selected portions of a program; a text editor interface that reduces most editing operations to a single keystroke; a style checker for early detection of errors; and a debugger.

Other central features are its compatibility with the most widely used Prolog systems, DEC-10/20 Prolog and C-Prolog, and a C interface for calling C programs from within Prolog.

For more information, contact Quintus Computer Systems Inc., 2345 Yale St., Palo Alto, CA 94306; 415/494-3612.

Please circle Reader Service Number 163.

REALWORLD INTRODUCES 4-IN-1 BASIC ACCOUNTING

RealWorld Corp. has introduced a basic accounting package called 4-in-1 Basic Accounting that contains four integrated modules: accounts receivable, accounts payable, payroll, and general ledger. It is designed for use by small businesses in the under-$5 million range.

In addition to features expected of a good accounting system, the package can also be used to perform the following: print invoices, statements, payroll and disbursements checks, W2 forms, and deposit slips; reconcile up to three checkbooks; age receivables; amortize loans and track principal reduction and deductible interest payments; handle both cash and credit sales; automatically post recurring purchases, disbursements, and sales; and provide thorough audit trails.

The 4-in-1 package has a suggested retail price of $995 and will be available through most distributors and dealers of RealWorld Software for most popular microcomputers.

For more information, contact RealWorld Corp., Dover Rd., Chichester, NH 03263; 603/798-5700.

Please circle Reader Service Number 164.

RELATIONAL TECHNOLOGY, BURROUGHS SIGN AGREEMENT

Relational Technology Inc. (RTI) and Burroughs Corp. have signed an OEM pact granting Burroughs the right to distribute RTI's Ingres relational database management system (RDBMS) with Burroughs' new supermicrocomputer.

The announcement coincided with Burroughs' unveiling of the XE 550, a new M68000, Unix system-based supermicrocomputer designed for multiuser office environments.

Under the agreement, Ingres will be the only third-party relational database management system that Burroughs will market directly on the XE 550. Burroughs has also assumed responsibility for supporting the software. Pricing will be $6000 for a single application processor version, and $9000 for a multiple application processor version.

Ingres combines a relational database mangement system with forms-based Visual Programming tools, allowing end-users to create, control, and view data simply as tables.

For more information, contact Relational Technology, 2855 Telegraph Ave., Berkeley, CA 94705; 415/845-1700.

Please circle Reader Service Number 165.

SUPERCOMPUTER FROM CONVEX COMPUTER CORP.

Convex Computer Corp. has announced its C-1 supercomputer, a general-purpose supercomputer that features 64-bit integrated scalar and vector processing and a pipelined architecture.

A company spokesman said the Convex C-1 system "bridges the gap" between supercomputers and minicomputers by offering "the performance level of a supercomputer with the interactivity and price of a minicomputer."

The C-1 system combines the key characteristics of traditional supercomputers, including a 64-bit word length, integrated vector processing and pipelining, high I/O bandwidth, and up to 16 megawords (128 Mbytes) of main memory, with a 50-nanosecond, 64K-byte physical cache.

All processing algorithms common to the Cray, including data restructuring and FORTRAN coding style, are directly applicable to the C-1 system.

Additional C-1 features include a proprietary optimizing vectorizing FORTRAN compiler, large real memory, and high-speed intelligent I/O subsystems. The C-1's architecture was specifically designed to host an interactive, virtual-memory operating system without sacrificing system performance. The heart of this environment is the Convex Unix operating system, an implementation of the Unix 4.2BSD operating system. This system is capable of executing in excess of 60 million operations per second.

A basic system includes the C-1 processor with one-half megaword (4 Mbytes) of 64-bit ECC memory, one I/O processor, a service processor unit, a hard-copy console subsystem, a 414-Mbyte (formatted) Winchester disk drive, a 6250-bpi tape drive, and one Multibus I/O chassis. Also packaged with the basic system is the Convex Unix system, the Convex vectorizing FORTRAN compiler, and a C compiler. Price for the basic system is $495,000, U.S. list. Shipments were expected to begin early this year.

For more information, contact Convex Computer Corp., 1819 Firman Dr., Suite 151, Richardson, TX 75081; 214/669-3700.

Please circle Reader Service Number 166.

TOM SOFTWARE ON UNIX SYSTEM

TOM Software, a developer and distributor of business application software and productivity tools, has transported its Speed I line of business application software to an expanded list of computers.

Speed I software, which originally ran exclusively on the Wang 2200 series of computers, has been transported to the Fortune 32:16, Hewlett-Packard 9000, Pixel 80 and 100, Plexus P/35 and P/60, and Zilog System 8000. Additionally, TOM software is now being transported to several other computers, including the Altos 586 and 68000, Apple Lisa 2, Data General Eclipse/MV, Honeywell DPS 6 series, Intel 286/310, Perkin-Elmer 3200 series, Prime 50, Sage IV, and Visual 2000.

New TOM Speed I-based products recently released include the A&M Manufacturing Business Management System, the Attorney Business Management System, and a Project Cost Accounting module. The Medical Group/Clinic Management Information System has been undergoing beta site testing and will be released soon.

For more information, contact TOM Software, 127 S.W. 156th St., Seattle, WA 98166; 206/246-7022.

Please circle Reader Service Number 167.

BRIDGE OFFERS TCP/IP NETWORK PROTOCOLS

Bridge Communications Inc. has introduced an Ethernet local-area network-based terminal server implementing the TCP/IP network protocols. These protocols have been standardized by the Defense Department and are an integral part of the Unix 4.2BSD operating system.

Bridge's CS/1 server with TCP/IP software performs the function of a terminal or host server, allowing up to 32 asynchronous devices (terminals, printers, computers) to access host computers that support TCP/IP and that are attached to an Ethernet LAN.

The CS/1 with TCP/IP software uses a standard Telnet protocol to support virtual circuits between terminals and host computers; both User and Server Telnet are supported. Also implemented on the unit to supplement the TCP/IP protocols are the DOD universal datagram protocol (UDP) and the Ethernet address resolution protocol (ARP).

The CS/1 with TCP/IP is available 60 days after receipt of order. The unit is priced at $9900, with eight serial ports; additional 8-port expansion boards (for up to 32 ports) cost $1900 each. A one-year TCP/IP software license (including maintenance) costs $250.

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

Please circle Reader Service Number 168.

UNISOURCE IS FIRST MARKETER FOR DOS CONNECTOR

Unisource Software Corp. disclosed that it has been named the first marketer for The Connector, which enables a personal computer to run both DOS and Unix system applications on the same machine at the same time. The Connector was developed by Uniform Software Systems Inc. of Carpinteria, Calif., the Unix system software startup founded by former Bendix chief Bill Agee.

The Connector is designed to run under two licensed implementations of the Unix operating system —IBM's PC/IX and Venturcom's Venix, marketed by Unisource. The program enables users to switch between DOS and the Unix system with a single command. Acting as an invisible bridge, The Connector runs PC-DOS and PC-DOS applications as Unix system tasks under either PC/IX or Venix. Because of the system's multitasking capability, users can run one program under PC-DOS and at the same time run other Unix system software. The product is distributed on a single diskette and retails for $229.

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

Please circle Reader Service Number 169.

UNIPLEX II INTEGRATED SOFTWARE

Uniplex Integration Systems, the American subsidiary of U.K.-based Redwood Software, has introduced Uniplex II, an integrated applications software package for Unix-based systems that consists of word-processing, spreadsheet, and relational database applications.

The Uniplex II word processor offers the following: spelling checker, extra-wide documents, full cut and paste, and comprehensive help facilities. Individual users can have their own personal keystrokes, menus, and messages. Additional facilities include horizontal scrolling, automatic document backup, and multiuser file locking.

The spreadsheet can be used for general spreadsheet applications. Through extensive control facilities, it may be used in application and system building because it provides budgeting, forecasting, and

other planning functions where information manipulation in table form is required.

The relational database offers capabilities for the experienced user to customize applications, but it is equally user-friendly to the novice who simply follows fill-in-the-form interfaces in creating databases and editing tables. Uniplex II offers the power of IBM and ANSI standard database query language (SQL). Database system flexibility allows stored information to be available to all parts of Uniplex II.

Written in C, Uniplex software has been ported to virtually all major Unix system hardware—mini and micro, stand-alone or multiuser. In addition, all modules are easily translatable for non-English multilingual applications.

For more information, contact Uniplex Integration Systems, 13355 Noel Rd., Suite 500, Dallas, TX 75240; 214/851-4213.

Please circle Reader Service Number 170.

DATAMEDIA'S SUPERMICROS AND TERMINALS

Datamedia Corp. has introduced a new family of supermicrocomputers and display terminals as well as supporting software. The family consists of five 932 Supermicrocomputer models and two display terminals.

Three 932 Supermicrocomputer models—the 1610, 1620, and 1624—are designed for a Unix system environment and feature a Datamedia-enhanced Unix System V operating system. The 932 Supermicrocomputer models 20P and 30P incorporate the Pick operating system.

Of the new display terminals, the Elite 90 is designed for use in a Unix system environment with the 932 Supermicrocomputer, while the Elite 60 terminal is a DEC-compatible display.

The 932 Supermicrocomputer features interchangeable tape car-

tridges, disk storage that exceeds ½ gigabyte, and support for 6 to 26 users.

For more information, contact Datamedia Corp., 491 Amherst St., Nashua, NH 03063; 603/886-1570.

Please circle Reader Service Number 171.

SIBOL AVAILABLE ON CODATA'S 3300 UNIX SYSTEM

Contel-Codata Systems Corp. has announced that Codata's 3300-range Unix systems can now run DEC PDP-11 and VAX business programs when used with the new SIBOL compiler from Software Ireland of Belfast.

SIBOL, which accommodates a wide range of computers using Unix operating systems, is a widely used compiler for the DIBOL language available from Digital Equipment Corp. (DEC) on its VAX, PDP-11, and PRO 350 series of minicomputers.

DIBOL is regarded as a language suited to traditional industrial and commercial data-processing applications. In addition, software houses use DIBOL because its structure facilitates efficient debugging and maintenance.

For more information, contact Contel/Codata Systems Corp., 285 North Wolf Rd., Sunnyvale, CA 94086; 408/735-1744.

Please circle Reader Service Number 172.

REX-TOOLS SOFTWARE DEVELOPMENT PACKAGE

Systems and Software Inc. has introduced Rex-Tools, a C programming package that converts virtually any M68000-based host computer operating under Unix System III, System V, or Berkeley 4.x into a multiprogrammer, microprocessor software development system.

The new product—designed specifically for developing, testing, and debugging software—is targeted at Intel 8086, 8087, 8088, and 80186 microprocessor-based systems. It integrates four separate tools: SoftProbe Simulator, C Cross-Compiler, Rex-SMA Assembler, and Rex Real-Time Executive.

The SoftProbe Simulator is an interactive symbolic simulator that provides simulations of the Intel 8086 and 80186 environments for module program testing. It also supports debugging and logic analysis in both assembly and high-level language.

The C cross-compiler package includes an assembler, linker, and object code locater to allow development in both C and assembly language. The cross-compiler generates ROMable re-entrant object code aimed at real-time embedded systems applications such as automation devices, robotics equipment, and real-time controllers.

The Rex/SMA Assembler is basically four utility programs—a structured macro assembler (SMA), an object code linker, an absolute code locater, and object librarian—that are compatible with the Intel ASM86/87/88 and 186 at source code, relocatable, and absolute code level.

The Real-Time Executive is an event-driven real-time executive that provides a number of functions, including intertask synchronization, time-based synchronization, asynchronous event coordination, interrupt handling, memory management, and 8087 co-processor synchronization.

A 30-minute on-line demonstration of Rex-Tools is available by telephone for those having a VT100-compatible terminal and a 1200-baud modem. Rex-Tools' starting price is $5500 (for the C cross-compiler); quantity prices are available for hardware vendors and system integrators.

For more information, contact Systems and Software Inc., 3303 Harbor Blvd., Suite C-11, Costa Mesa, CA 92626; 714/241-8650.

Please circle Reader Service Number 173.

V2.0—FORTRAN-77 FOR SCIENTIFIC, ENGINEERING USERS

Absoft Corp. has released its V2.0 ANSI FORTRAN-77 compiler. V2.0 is designed especially for scientific/engineering-oriented M68000-based Unix systems.

Absoft V2.0 includes a new Unix system interface and overlays that provide increased execution speed. Mathematical hardware support also has been expanded and now includes: SKY FFP hardware, National 16081, and MC68881 (when available). Also, Absoft V2.0 is capable of supporting SKY's "Warrior" 15 MIP 32/64 bit array processor.

V2.0 comes with symbolic debugger, linker, library manager, profiler, virtual array support, run-time library, and 300-page reference manual. Versions are available for 10 different Unix or Unix-like operating systems, including System V .

For more information, contact Absoft Corp., 4268 N. Woodward, Royal Oak, MI 48072; 313/549-7111..

Please circle Reader Service Number 174.

SIR/DBMS NOW RUNS UNDER UNIX SYSTEMS

SIR Inc. has made SIR/DBMS, its relational database management system, available for four Unix-based operating systems. SIR/DBMS now operates under the following Unix

4.2BSD systems: DEC VAX; Hewlett-Packard's HP9000 Series 500 (HP-UX); and Data General's DG MV/UX.

SIR/DBMS also operates under AUX, Apollo's implementation of AT&T's Unix system software. Berkeley extension conversion for Sun Microsystems is underway as well. In addition to the Unix-based systems, SIR software runs on over 20 different mainframe, mini, and 32-bit Unix system-based supermicrocomputers .

Designed as a set of tools for information analysts in business, industry, and government, SIR/DBMS supports relational, hierarchical, and network views of data.

Included in the SIR/DBMS package is SQL+, an expansion of IBM's Structured Query Language. SQL+ is an interactive relational query system that lets users of SIR/DBMS interrogate their databases using English language commands. It automatically displays the information requested.

Other features include an active data dictionary for data integrity and quality control; direct interfaces with BMDP, SAS, and SPSS statistical software packages; and flexible report generation.

In addition to DBMS and SQL+, SIR/DBMS includes the following integrated components: Forms, for interactive screen-oriented data entry and query-by-forms; Host, a language interface for access to one or more SIR/DBMS databases; Help, for on-line documentation and user assistance; and Graph, for production of scientific and business graphics.

For more information, contact SIR Inc., 820 Davis St., Evanston, IL 60201; 312/475-2314.

Please circle Reader Service Number 175.

INTEL'S NEWEST iDIS SYSTEM

Intel Corp. has introduced the latest version of its iDIS database information system. The new iDIS 715 system—based on Intel's new

The Power of a Mini, The Cost of a Micro, The Clout of UNIX.

Introducing The Perfect System Builder

With the VISUAL 2000, we've designed the perfect tool for system builders and integrators. A multi-user computer system that supports more terminals, offers more expandability, and gives you more configuration flexibility than any other system in its price range. Truth is, it outperforms a lot of higher priced systems as well.

What that means for you is an important competitive edge in delivering integrated business solutions. An edge that comes not just from the VISUAL 2000's surprisingly low price. But from its higher technology. Technology that gives you . . .

Power to support more on-line users in demanding applications—up to 16 independent terminals or workstations.

Flexibility to accommodate a remarkable variety of application requirements, thanks to an open architecture, compatibility with mainstream industry standards, and a full spectrum of configuration options.

Expandability that can take you further than any other system in its class—an unrivaled upgrade path to protect your system investment.

Put the Full Power of Intel's 286 in Your Systems

The Intel 286 is today's chip of choice for UNIX-based systems. Only the 286 gives you: on-chip memory management; an instruction set optimized for multi-tasking; pipelined architecture; and an optional 287 numeric coprocessor which can speed up floating point by a factor of 10. What do these features mean to the end user? Faster response time, more users supported, and lower system cost.

A "Mainframe" on a Single Board

The VISUAL 2000's single-board base-level design is the key to higher performance, greater reliability and lower cost. A single high-density board includes the 286 CPU; 512KB-2MB of RAM; controllers for Winchester, floppy and streaming tape; an intelligent communications processor; six RS-232 ports; and a parallel printer port. There's even a real-time clock with battery backup. A few short years ago a system with these features might have been called a mainframe.

From a Multi-User System to a Multi-System Network

With the VISUAL 2000 you never pay for more system than you need, and never have to settle for less. Up to 6 megabytes of RAM. 4 Winchester disk drives. Floppy. Streaming tape backup. And mainframe communications. All in a small stand-up enclosure which looks right at home next to a desk.

Use it as a central processor for inexpensive video terminals, or as a database manager for a cluster of intelligent workstations or personal computers, including VISUAL's own IBM®-compatible COMMUTER™.

And if a fully expanded VISUAL 2000

VISUAL 2000

isn't enough, you can connect up to 254 systems in an ARCNET® local area network.

In all configurations, the VISUAL 2000 achieves an exceptional ratio of price/performance.

Software: A Complete System Builder's Tool Kit

Ultimately, the strength of a system is the strength of its software. And there too, the VISUAL 2000 really shines. Start with XENIX™, Microsoft's enhanced version of UNIX™, which gives you everything you expect from UNIX *plus* greater speed, reliability and ease of use in business applications. Then add all the tools you need to deliver end-user applications quickly and easily. Languages such as C, SMC BASIC, RM/COBOL™, TOM BASIC™, SOFTBOL™, and MicroFocus Level II COBOL™ to give you instant compatibility with hundreds of proven business applications. Plus sophisticated system foundations such as INFORMIX™ database management and RealWorld™ modular accounting. And professional productivity software such as 20/20™ spreadsheet modelling and XED™ word processing.

The Bottom Line

High performance. Superior flexibility. Extensive software. And low cost . . . VISUAL 2000 systems start at under $10,000, suggested list. No one gives you more in a UNIX-based multi-user system.

And when you consider that VISUAL has long been a leader in video terminals, and can supply a full range of compatible terminals and workstations, we think you'll agree that VISUAL is the system builder's system supplier.

The VISUAL 2000.

It began with a better design. And it's available *now* to help you build better systems. But don't take our word for it.

See for yourself.

Call VISUAL today.

VISUAL **See for yourself®**

Visual Technology Incorporated
540 Main Street, Tewksbury, MA 01876

For more product information call
1-800-341-5400 (1-800-462-5560 in MA)
or 1-617-851-5000.

Please circle Ad No. 43 on inquiry card.

286/310-41 supermicrocomputer system—runs under Xenix, offers 40 Mbytes of hard-disk storage, and takes advantage of the 80286 microprocessor for data sharing and processing among 10 terminals and personal computers.

Under the iDIS 715 system, mainframe data files are downloaded, stored locally in a relational database management system (DBMS), then shared by a network of up to 10 terminals, personal computers, and remote job entry (RJE) communications ports.

The iDIS 715 system features an array of application development tools, including a menu development system, C compiler, text editor, and all Xenix utilities. Standard multiuser capabilities that come with the system include spreadsheet (Multiplan), electronic mail, and word-processing applications.

Enhanced iDIS software features also allow data to be transferred bi-directionally from single-user personal computer files to multiuser Xenix files. The system's menu-driven file conversion and transfer facility lets users convert database and spreadsheet files from a variety of personal computer file formats to relational iDIS file formats.

The iDIS communications facilities provide RJE support to mainframe hosts through HASP, 2780/3780, and 3270 bisynchronous emulation. Tty pass-through facilities also provide direct access to remote applications, including other iDIS systems and personal computers. Multiple iDIS 715 systems also can be interconnected.

Intel's basic iDIS 715 system with Xenix 3.0, accommodating up to 10 terminals and personal computers, is priced at $20,240 in single quantities; volume discounts range up to 35 percent. Expansion kits to support additional terminals also are available.

For more information, contact Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051.

Please circle Reader Service Number 176.

THE PROGRESS DATABASE PLUS APPLICATION DEVELOPMENT SYSTEM

Data Language Corp. has introduced Progress, an application development system for supermicrocomputers. Progress is in use on Unix systems from AT&T, Fortune Systems, NCR, Convergent Technologies, and others.

Progress includes in one system the capabilities of conventional programming languages such as BASIC or COBOL, the functionality of database management systems, as well as features for screen and report generation, error recovery, and on-line tutorial.

The full Progress application development system is available starting at $1450 for single users and at $1950 for multiuser systems. The Progress Introductory System is $295, includes an on-line tutorial, full documentation, and all Progress facilities for building a working application limited only by database size.

For more information, contact Data Language Corp., 5 Andover Rd., Billerica, MA 01821; 617/663-5000.

Please circle Reader Service Number 177.

PACIFIC MICROCOMPUTERS' ENHANCED SINGLE-BOARD COMPUTER

Pacific Microcomputers Inc. has begun shipping an enhanced version of its single-board computer, the PM68D, that will feature one full Mbyte of dual-ported RAM—a four-fold increase over the original version.

Utilizing new 256K RAM chips, the memory of the PM68D (whose processor supports such operating systems as Unix) has been increased from 1/4 Mbyte to 1 Mbyte. Prior to incorporating these new chips, it was necessary to augment the PM68D with the company's MX68D expansion modules to obtain the full 1-Mbyte capacity. In its enhanced version, the PM68D features the full 1 Mbyte of on-board, no-wait-state RAM on a single board, greatly reducing the amount of space required for this capacity, while at the same time drawing less power and offering greater reliability.

The MX68D expansion boards will also be available with the new 256K chips, raising their capacity from 3/4 Mbyte to 3 Mbytes, and from 1 Mbyte to 4 Mbytes.

The no-wait-state memory can be expanded to 8 Mbytes by adding a 3-Mbyte expansion board and a 4-Mbyte expansion board. Previously, a total of eight expansion boards were required to achieve what is now done with only two boards. The expansion boards are connected to the processor through a private memory bus via the auxiliary P2 connector.

The CPU board will also carry 1 Mbyte of on-board memory with the new chip. Pricing starts at under $4200, with OEM and quantity discounts available.

For more information, contact Pacific Microcomputers Inc., P.O. Box A81383, San Diego, CA 92138; 619/436-8649.

Please circle Reader Service Number 178.

APPGEN ENVIRONMENT 5 FROM SOFTWARE EXPRESS

Software Express, the developer of the APPGEN application development environment, has announced the Environment 5 series of productivity tools. Three initial productivity tools form the core of Environment 5: Screen Painter, Automated Assurance Facility, and the ISIS Integration Language.

Screen Painter allows a developer to "paint" new screens, menus, and reports and to pass automatically the resultant specifications to the APPGEN Development Environment in real time.

The Automated Quality Assurance facility simplifies the ongoing quality assurance process for the development and maintenance of business applications produced by APPGEN.

The ISIS Integration Language provides users of APPGEN and APPGEN-developed applications easy access to all third-party applications and productivity tools that comply with the ISIS standard.

APPGEN currently runs under the Unix system (Version 7, System III, System V, 4.2BSD), Xenix, and Pick systems. It has been ported to over 40 different machines to date.

For more information, contact Software Express, 2925 Briarpark Dr., Houston, TX 77042; 713/974-2298.

Please circle Reader Service Number 179.

3B BLAST LINKS AT&T, 80 COMPUTERS

Communications Research Group has released 3B Blast for AT&T's 3B series minicomputers. 3B Blast provides file transfer and terminal mode access to link AT&T computers with any other computer running Blast software.

Blast is priced at $250 (micros), $595 to $895 (minis), and $2495/up for mainframes. Any computer with Blast can transfer files to any other computer with Blast. No add-on hardware or boards are required to use Blast software via standard RS-232 ports.

Blast includes a virtual file format that translates text files among different operating systems. Blast communications software provides

full-duplex asynchronous file transfer among micros, minis, or mainframes, linking many different vendors and operating systems, despite the many diskette and data format differences. For instance, users of DEC VAX/VMS or Hewlett-Packard can transfer data files error-free to AT&T's 3B20 using Blast. Operating out of standard RS-232 ports and on regular dial-up telephones, Blast uses low-cost asynchronous modems, or it can be directly cabled at speeds to 19,200.

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

Please circle Reader Service Number 180.

DOBL PROGRAM DESIGN LANGUAGE

Custom Development Environments has created a new software tool for application designers called Dobl (pronounced "double"). Dobl consists of an English-like command language for defining program specifications and a program generator, which takes those specifications and writes programs in the C language that perform the defined operations. When accompanied by the Dobl run-time support library, these programs may be transported to other systems that support C.

Dobl's command language speeds up implementation times, increases maintainability, and offers the user local control. Designs can be implemented and modified immediately by the user, instead of having to wait for a data-processing department to do it. Because Dobl is Unix system-based, it is readily transported to a variety of different hardware environments. This combination of features enables newcomers, as well as sophisticated users, to program and to build applications using the power of Unix systems without having to learn to program in C.

For more information, contact Custom Development Environments, 21 Old Concord Rd., Lincoln, MA 01773; 617/259-0328.

Please circle Reader Service Number 181.

DEBUGGING XENIX SOFTWARE DEVICE DRIVERS

Our authors help simplify and demystify the debugging of Xenix software device drivers. Here are the tools and techniques and how to use them.

BY PARESH K. VAISH AND JEAN MARIE MCNAMARA

PART TWO

This month we conclude our two-part series on debugging Xenix device drivers. You may recall that last month we discussed several tools for debugging device drivers, including a debugging monitor and such Xenix software utilities as `adb`, `nm`, `cc`, `tprint`, `ctags`, and `lint`. We also discussed several hardware and software tools. In this article we offer hints for trouble-shooting problems that device driver developers frequently encounter, and we end with suggestions that will help device driver writers produce bug-free code. First come the problems and tips on solving them.

Problem: New kernel does not boot.

Solution: When you create your new kernel, check its size (using the `size` utility) before you try to boot it. This utility provides you with code size, data size, and uninitialized data (bss) size of your kernel. Ensure that these values do not exceed the maximum sizes your machine architecture allows for them. If the kernel starts to boot but hangs after printing out a few messages, look at `dinitsw` in the file `c.c` produced as part of your kernel-generation process.

Each routine in this data structure is called sequentially at boot time, and each usually prints out a message. Most likely, the routine in this data structure that

corresponds to your driver is where the kernel is getting halted. If everything looks all right in the routines, pull out all new boards added to the system, reducing it to the minimum configuration, and try again. Those boards may have been tying up a bus in your system. Another way to verify that you have no hardware problems is to boot a kernel that you know works (for example, the kernel with which the system was shipped to you).

Problem: Board/device appears not to work when commands are issued to it.

Solution: If possible, first swap out your board and try a new one. If this board exhibits the same symptoms, you most likely don't have a bad board. Next, check the jumper settings on your board against those suggested in the hardware reference manual. If your device has any connections to terminals, Ethernet cable, or anything else, verify that all the connections are good and locked in place.

Then try to use the debug monitor discussed earlier to verify that you are passing parameters to the board correctly. If they look correct, use a logic analyzer to verify that the board is getting the values you intended. If they don't look correct or if nothing is being passed, you probably have device-configuration problems. Check to make sure that you added your driver correctly to the `master` file in `/sys/conf`. Then verify that the file `/sys/conf/c.c` is being created correctly. Look especially at the data structures `bdevsw` and `cdevsw`.

One other configuration issue you should be concerned with at this point is having correct device node major/minor numbers. Also verify that the node is of the correct type (block or character). Finally, consider all the data structures the driver initializes in the driver-specific configuration file located in `/sys/cfg` and make sure you have no configuration problems there. If all this looks correct, contact the board vendor and discuss with someone there the scenario you are trying so that you understand the hardware interface correctly.

Problem: Device ties up the system's data/address bus.

Symptoms: The data or address bus is tied up when the main system processor is unable to execute any instructions at all. System confidence tests will not work, and no I/O to or from the system is possible.

Solution: Try removing the new board(s) you added to your system and see if the problem disappears. If it does, try another new board, verify the jumper settings, and see if this board works. If it doesn't, contact the board vendor and verify that the board is intended for use on your system bus. If the problem does not go away once you have removed from the system the board that you added, you have a bad system—a problem outside the scope of this article.

Problem: The board works in some slots but not in others.

Solution: If your system bus is prioritized, the board is probably in the wrong priority slot. Check the bus manual for the board's correct position. If, however, the bus is not prioritized, as in the case of Multibus, then you have a problem. First, check the board's hardware configuration. If this is incorrect, the board could behave unpredictably. Next, verify that the board's firmware is the correct revision and that it is installed correctly. Finally, check your bus' jumpering of priority levels, if any, to ensure that it is correct.

Problem: Driver software does not always function correctly (race conditions).

Symptoms: The problem disappears when delays are introduced, events occur in an unexpected sequence, and problems occur intermittently.

Solution: Try to isolate the code involved and decide what the critical timing events are. This is one of the most difficult and time-consuming debugging tasks associated with device drivers because the problem is often not repeatable. Try to find a case that *is* repeatable, then use `tprint` or the monitor to step through the code and check variable values.

Introducing delays at strategic places may give more information about where in the code the race condition exists. You may use the kernel routine `delay()` to do this. Shared code sections are highly suspect areas for race conditions. Make sure these areas are mutually excluded upon correctly. If you do not have a case where the problem has occurred (for example, if your system has just issued a panic and your system is idling), try to break into the monitor immediately, study the stack and the various variables your driver uses, and try to determine what sequence of events caused the problem.

Another frequently used technique to solve race condition problems is to form a hypothesis about the chain of events that could be causing the problem and then use the tools we described last month to prove or disprove that hypothesis.

Problem: Various data structures seem to be destroyed (overwriting memory).

Solution: This typically results from bad or uninitialized pointers. Because the driver runs as part of the kernel, it is not restricted from writing wherever it pleases (whether intended or not!). Thus, the driver may destroy the file system on a disk or perhaps even wipe

out parts of the kernel's code.

An example of this problem is a case where a procedure declares a pointer, then proceeds to use it to store values in a structure without initializing the pointer to point to an instance of that structure. To correct this, the pointer(s) at fault must be isolated. The best way to do this is as follows: Using the monitor, single-step through the program, checking the various pointer values as you go.

Less commonly, incrementing or decrementing a register may cause register overflow. If this is not an expected event, the symptoms described may result. You can detect this in much the same way you detect an errant pointer: Use the monitor to step through the program and check the registers as you go. If the device interface contains a register, it is possible for it to overflow also.

Writing to the u-structure at interrupt time is not appropriate because the kernel does not guarantee which process will be running at interrupt time. Thus, another process' u-structure may be overwritten. This may result in problems for the driver process as well as for another process.

It is generally important to remember that a device driver is kernel code and that any access of user space (user text and data are distinct from kernel text and data) must be done explicitly, using special system routines. If this is not done, the driver may inadvertently overwrite system memory.

Problem: Characters being sent to a terminal appear to be getting lost.

Solution: This is a fairly general problem. One often overlooked possibility in this case is that the hardware (either the board or the terminal) may not be able to keep up with the baud rate the device driver is trying to obtain.

TIPS FOR BUG-FREE CODE

In this section we present some warnings or suggestions that will help device driver developers produce bug-free code.

(1) The kernel does not guarantee that the maximum kernel stack size normally available to processes will be available to the interrupt-handling code at interrupt time. This is so because interrupt handlers use the stack of the process that was executing when the interrupt came in. Thus, interrupt-handlers and procedures these handlers invoked should use minimal data structures. For example, using large arrays, which have to be stored on the process' stack, could lead to stack overflows and to data being overwritten.

(2) Before doing any testing of the hardware/software system, developers should check all connections to the system from the board/device. This includes connections to terminals from communications boards, connections to Ethernet taps from Ethernet controllers, and so on. Whatever connections can be locked together in hardware should be so locked. Finally, check the edge connectors on the new board to ensure that the connections to the system bus are not covered with any form of insulator.

(3) User programs cannot access kernel space. However, a device driver is not a user program; it is part of the kernel. As a result, device driver code has the capability of accessing any part of the kernel and has the potential for overwriting user text and data. Thus, the driver writer needs to understand clearly the difference between kernel and user space.

(4) Static data structures the driver uses should have a prefix (like "d—") that will help differentiate these data structures from kernel data structures of the same name. This is important because name conflicts could otherwise result.

(5) In C, if you try to access a variable in a structure *x*, which was declared as part of another structure *y* and not in *x* at all, then some C compilers (`cc`) may well not object, and unpredictable behavior may result. Thus, all structure references, especially assignment of values to parameter blocks, should be carefully coded and checked.

(6) Interrupt-handlers should not use the kernel procedure `sleep()` or invoke any procedure that invokes `sleep()`.

Invoking the `sleep()` kernel procedure from the handler will, as mentioned earlier, cause unexpected system behavior.

(7) It is usually a good idea to compile driver code without optimization switches until it is entirely debugged. Optimize switches may produce code that has bugs introduced during the optimization process. The main reason optimizing code can cause problems is that optimizers may not handle the case where, even though a variable does not appear to be changed for several lines of code, it is actually modified by the interrupt handler that might be invoked in between the execution of those lines of code. □

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

BY BILL TUTHILL

In this two-part series, we'll examine the two shells in widespread use on the Unix system: the Bourne shell, which is best for programming scripts, and the C shell, which is best for interactive use. Both shells, however, can serve either purpose, so the shell that predominates at a particular installation generally serves double duty. This is the way things are, not the way they should be.

Ideally, there should be only one shell, but failing that, the Bourne shell should be used as a programming tool and the C shell as the Unix system command interpreter. The best solution may be the new Korn shell—currently available only inside AT&T. It is upwardly compatible with the Bourne shell, but it provides most of the extra features from the C shell.

The Bourne shell (`sh`) is fast, compact, and provides good constructs for writing programs. It is easy to debug shell procedures and to get them working quickly. The C shell (`csh`), on the other hand, provides aliasing, a history mechanism, and job control, all of which are convenient for interactive use but of little consequence in writing shell scripts. Because none of these features is available in the Bourne shell, almost anyone who knows both shells chooses the C shell for interactive use.

However, for shell scripts, the Bourne shell is from two to five times faster than the C shell, and it sometimes may appear to run as fast as a compiled program. C shell scripts, on the other hand, start slowly, execute sluggishly, and are difficult to interrupt. Occasionally, though, C shell scripts execute more quickly than equivalent Bourne shell scripts because of built-in constructs that are available in the C shell but not in the Bourne shell.

The Bourne shell's syntax was derived from Algol 68, while the C shell's syntax was inspired by the C language—hence its name, plus a pun. The Bourne shell is named after its author. Many Americans find the syntax of Algol 68, and hence the Bourne shell, weird and distasteful. Certainly, for someone familiar with the C language, the C shell is more natural to learn.

Both shells (especially the C shell) contain bugs, and both do memory allocation in a kludged-up way. The Bourne shell is not complete in itself, for it requires several external programs to work correctly. The C shell, on the other hand, has an idiosynchratic parsing mechanism—some people would say no parsing mechanism at all.

SHELL METACHARACTERS

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

LEARN BOTH SHELLS

This article takes the point of view that you should learn the Bourne shell as a programming language and the C shell as your command interpreter. Learning both languages is not as hard as it might seem because, even though the two shells have different syntaxes, many of their metacharacters are identical. In any case, it would be difficult to have a single unified shell. The features that make the C shell convenient also make it slow, and the lack of features in the Bourne shell is what makes it fast.

If you run the C shell interactively, you can write shell scripts in either language. C shell scripts must begin with a sharp (#), while Bourne shell scripts must not. (However, on 32V systems and its successors, such as 4.1 and 4.2BSD, Bourne shell scripts may begin with `#!/bin/sh`, in which case they can be called directly by `exec`. C shell scripts may likewise begin with `!/bin/csh`.) Thus, to say "hello," the `sh` and `csh` scripts might be written as shown in Figure 1A. Once you have written a script, you should make it executable, as shown in Figure 1B.

You execute a shell script merely by typing its name. When you execute a Bourne shell script, the C shell realizes that it doesn't start with a sharp and passes it along to the Bourne shell. When you execute a C shell script, the C shell sees the sharp and passes it along to another invocation of the C shell.

If you run the Bourne shell interactively, you can write shell scripts, make them executable with the `chmod` command shown in Figure 1B, and run them by typing their name. However, the only way to run a C shell script is to invoke the `csh` command on it as follows: `csh hello`. (You must, of course, have the C shell on your system.)

FIGURE 1A: COMPARISON OF TWO SIMPLE BOURNE VERSUS C SHELL SCRIPTS

```
BOURNE
echo hello

C
#
echo hello
```

FIGURE 1B: MAKING A SHELL SCRIPT EXECUTABLE

```
% chmod +x hello
% hello
```

FIGURE 2A: SETTING SHELL VARIABLES

```
BOURNE
$ resolution=300
$ options=-Txerox

C
% set resolution = 300
% set options = -Txerox
```

FIGURE 2B: SETTING THE TERM ENVIRONMENT VARIABLE

```
BOURNE
$ TERM=z29; export TERM

C
% setenv TERM z29
```

This is not very civil of the Bourne shell; the C shell at least makes an attempt to be cosmopolitan. If you're too lazy to `chmod`, you can always explicitly invoke a shell: `sh hello`.

In most cases, you will get error messages if you try to run Bourne shell scripts with the C shell, or C shell scripts with the Bourne shell. The exceptions to this rule are scripts that simply invoke Unix system commands without making use of fancy shell procedures. Learning which error messages come from which shell is a useful investment of your time. This series will give you an idea of incompatible features in the two shells.

SETTING VARIABLES

To set variables in the Bourne shell, you specify a variable name and type an equal sign followed by the value the variable is to take. There cannot be spaces around the equal sign. To set variables in the C shell, you use the `set` command, specify a variable name, and type an equal sign followed by the value to be assigned. Spaces around the equal sign are optional (see Figure 2A). Variables

FIGURE 2C: SETTING THE COMMAND SEARCH PATH VARIABLES

```
BOURNE
$ PATH=/bin:/usr/bin::
export PATH

C
% set path = (/bin /usr/bin . )
```

FIGURE 3: COMMAND NOT FOUND ERROR MESSAGES

```
BOURNE
$ vi payroll
vi: not found

C
% vi payroll
vi: Command not found.
```

FIGURE 4: TO TEST IF A FILE IS READABLE

```
BOURNE
if test -r /etc/news
     then page /etc/news
elif test -r /usr/lib/news
     then page /usr/lib/news
else
     echo no news | mail root
fi

C
#
if (-r /etc/news) then
     page /etc/news
else if (-r /usr/lib/news) then
     page /usr/lib/news
else
     echo no news | mail root
endif
```

FIGURE 5: THREE EQUIVALENT BOURNE SHELL `if` STATEMENTS

```
if test -f /etc/news
then
     page /etc/news
fi
-------------------------------------------------
if test -f /etc/news; then
     page /etc/news
fi
-------------------------------------------------
if [ -f /etc/news ]
     then page /etc/news
fi
```

may be either numbers or strings, as in Figure 2A, but they are always treated as strings.

The shell keeps track of variables that have been set using this method. Once the shell goes away or executes another program, shell variables disappear. However, there is a more permanent method for storing variables: the environment. The environment is passed from process to process, so it lives outside the shell.

All programs can gain access to environment variables. When the shell invokes an editor, for example, it can pass the TERM environment to that editor. By agreement, environment variables are all uppercase, while simple shell variables are lowercase.

To place a variable in the environment with the Bourne shell, you need to set a shell variable and then `export` it. On System V the `env` command may be used instead of `export`. For backward compatibility with older systems, however, `export` is recommended. To set the environment in the C shell, you simply use the `setenv` command (see Figure 2B).

Environment variables may be either numbers or strings, but in all cases they are treated as strings. Some common environment variables are PATH, HOME, SHELL, and TERM. The TERM variable specifies your terminal type, while SHELL is your log-in shell, either `/bin/csh` or `/bin/sh`. The HOME environment variable is extremely important because the `cd` command uses it to go back to your home directory.

The PATH is also critical because the shell uses it when deciding where to look for a program. To reset the PATH from the Bourne shell, you need to separate directories with a colon; an empty directory name means the current directory. The C shell has a built-in `path` variable, which parallels the

PATH environment variable (see Figure 2C).

The C shell command line shown in Figure 2C will automatically reset the PATH environment variable and also remake the hash tables to executable commands. A hash table is a lookup mechanism used here to speed up command invocation.

Users sometimes specify a path expression that is completely incorrect and consequently cannot execute any of the system commands except ones built into the shells, such as `cd` (change directory). The shells give slightly different error messages when they can't find a program, but in either case it is alarming (see Figure 3).

The only solution to this dilemma is to reset the path to something valid. Because `export` and `set` are built-in commands, resetting the search path is possible even when no system commands can be found.

CONTROL FLOW CONSTRUCTS

The `if` statement is built into the C shell, whereas the Bourne shell requires the external program, `test`, in order to work. (There are versions of the Bourne shell with a built-in `test` command, but you can't rely on it. The System V Bourne shell has a built-in `test` command, for example.) To test if a file is readable and to type it out if it is, see Figure 4 for what you would do in either shell.

There are other ways of representing these `if` statements in the two shells. A single `if` statement in the C shell can be abbreviated `if -r /etc/news page /etc/news`.

In other words, the parentheses are unnecessary, and the command can be placed on the same line as the test. However, if there are multiple commands, you must use a block `if` statement, and the `then` keyword must be in the exact position specified in Figure 4. The Bourne shell `if` statement can be represented any one of three ways (see Figure 5), in addition to that shown in Figure 4.

The first example shows that there may be a newline after the `then` keyword. In the second example, the semicolon acts as a newline; there must be a separator between the `test` command and the `then` keyword. The third example demonstrates that, on most sys-

FIGURE 6A: COMPARISON OF `while` LOOPS

```
BOURNE
while true
do
     echo y
done

C
#
while (1)
     echo y
end
```

FIGURE 6B: THREE EQUIVALENT BOURNE SHELL `while` LOOPS

```
while true; do
     echo y
done
----------------------------------------
while true
     do echo y
done
----------------------------------------

while :
     do echo y
done
```

FIGURE 7A: COMPARISON OF `for` STATEMENTS

```
BOURNE
for file in $*
do
     echo === $file ===
     cat $file
done

C
#
foreach file ($*)
     echo === $file ===
     cat $file
end
```

tems, there is a command /bin/[linked to /bin/test. The test command ignores the closing bracket. The style shown in the last example is not recommended because /bin/[may be missing from future Unix system releases.

The while loops in the two shells are similar, but again the Bourne shell requires an external program, while the C shell's expression handling is built in. Here is an infinite loop in the two shells. The Bourne shell uses the external true program, which always exits with a status of zero (see Figure 6A).

This is an unusual example because the C shell script runs much faster than the Bourne shell script in Figure 6A. Built-in commands run faster, but, by their inclusion in the shell, they make everything else slower. The while loop in the C shell requires the exact format specified in Figure 6A. The Bourne shell script, on the other hand, could be written differently (see Figure 6B).

The final version, using the colon (a null statement), will run much faster than the other versions, which use the external true command, because there is much less subprocess overhead. Using the colon, the Bourne script would be slightly faster than the equivalent C shell script.

FIGURE 7B: TWO PROGRAMS TO READ COMMAND-LINE ARGUMENTS

```
BOURNE
copies= flags=
for i in $*
do case $1 in
     -[cC]*)
        copies=$1
        shift ;;
     -*)
        flags="$flags $1"
        shift ;;
   esac
done

C
#
set copies =( ) flags=( )
top:
if ($#argv > 0) then
  switch ($argv[1])
     case -c*:
     case -C*:
        set copies=$argv[1]
        shift argv
        goto top
     case -*:
        set flags=($flags $argv[1])
        shift argv
        goto top
  endsw
endif
```

THE for STATEMENT

The for statement in a shell is generally used for processing a group of files in order. Its syntax is not akin to the for loop of a normal programming language. To type out all files on the command line (separated by an identifying line), the programs shown in Figure 7A would do the job.

The $* abbreviation in either shell stands for all the arguments specified on the command line. The command name itself is not considered an argument.

Command-line arguments are generally parsed in both shells with the case construct. Bourne shell programmers who are conscious of how fast their scripts run also substitute case statements for test commands whenever possible. This is because the case construct is always built into the shell, whereas the test program often is not. Figure 7B shows two programs to read command-line arguments.

As you can see from Figure 7B, argument parsing with the Bourne shell is much easier than with the C shell. In the C shell it is generally necessary to use the goto statement to do parsing. The Bourne shell is sadly lacking the goto feature, but it does have break n and continue n statements to get out of tightly nested loops.

At this point we'll end the opening segment of our two-part series. Next month, we'll conclude by taking a look at some similarities the two shells share, at Bourne shell features not found in the C shell, and at C shell features not found in the Bourne shell. □

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AT&T ENDORSES /USR/GROUP STANDARD—ALMOST

AT&T has announced a program designed to ensure the portability of application software running under Unix System V, its future releases, and various System V derivatives offered by AT&T licensees.

"This program has important implications for the computer industry as well as the computer user," said Thomas Crowley, Software Systems vice president. "For applications developers, it means writing programs for a wide variety of hardware and realizing greater returns on their investments in development. Hardware manufacturers will have a blueprint for systems development that will ensure a large and ready supply of proven applications.

"Finally, and most importantly, computer users will be free from the tyranny imposed by proprietary operating systems. They will be able to buy software with confidence, knowing that the next generation of computers will not render their existing software obsolete."

The fundamental element of the AT&T program is the "System V Interface Definition," a document that defines the relationship between an applications program (a spreadsheet or word processor, for example) and System V.

Specifically, the document defines a minimum set of system calls (commands to the operating system) and library routines that should be common to all operating systems based on AT&T's Unix System V. The remaining commands and utilities have been grouped into a logical series of optional extensions to the basic definition.

The goal is to have any applications written under the AT&T System V definition execute unchanged on any system that conforms to that definition.

"We are striving for a 'plug and socket' relationship," said Mike DeFazio, manager of Software Systems marketing and development. "We want to ensure that an application will 'plug' into any implementation of System V and run. Similarly, we want to ensure that the system is designed to accept that application without modification. The document is designed to define the symbiotic relationship between the two."

The System V Interface Definition is being distributed for review to a representative sample of licensees and members of the various standards groups, including the /usr/group standards committee. The document was scheduled to be made generally available in January 1985.

An AT&T spokesman said the publication of the System V Interface Definition amounted to "an endorsement" of a large part of the /usr/group standards proposal.

He said differences between the System V Interface Definition and the /usr/group standards proposal are outlined in the System V Interface Definition document now being distributed under nondisclosure to various individuals and groups.

The AT&T spokesman said the document contains a minimum set of system commands that should be included in every implementation of System V, from microprocessors on up to supercomputers.

The System V Interface Definition also contains outlines of specific extensions to the kernel, including extensions for basic utilities, advanced utilities, software development, network services, large machine administration, graphics, user interface, text processing, and database management.

The AT&T program also includes a service to help system developers conform to the System V Interface Definition. The System V Verification Service will be made available to licensees of Unix System V during 1985. The service will test for conformity implementations of Unix System V on other computers.

In summarizing the announcement, Crowley said: "AT&T is the custodian of the Unix system. In that role, it is our responsibility to provide a clear and logical statement of our direction and pledge our commitment to it. The program we announce today is an affirmation. The document is the foundation upon which our future System V development will be built. And although Unix System V will continue to evolve, we are committed to keeping critical portions of it stable to protect future applications portability.

"We recognize that there is still much to be done, and we will continue to work with established standards groups to define standards for the C language and other elements of System V. However, we consider this program to be a critical step in bringing stability to this rapidly emerging market. We welcome the industry to join us." □

MOVING FROM CP/M TO THE UNIX SYSTEM

BY BILL TUTHILL

CP/M is the most prevalent operating system in the world, measured by number of installations. It may not, however, be the most popular. Those who use it are simply trying to get a job done, and it doesn't get in their way. Nobody extols the virtues of CP/M anymore, and magazines that wrote about it are going out of business.

CP/M is easier to learn than the Unix system. That's because there is a lot less to know. A typical Unix system has at least 200 commands, some of them very complex and powerful in their own right. A typical CP/M system has 15 system commands and perhaps four add-on application programs: spreadsheet, word processor, spelling checker, and database.

Wags have often said that the Unix system is the operating system without applications. This is less true today than it was two years ago. The /usr/group catalog lists all kinds of Unix system applications packages. Nonetheless, VisiCalc and WordStar are not available for the Unix system and may never be, so the user interfaces you're accustomed to are probably missing from the Unix system. Other ones will take their place, eventually. For now you're stuck with the shell, which is much like CP/M's command interpreter.

CONTROL CHARACTERS

To err is human; to erase mistakes requires the intervention of a machine. On CP/M, either DELETE or BACKSPACE will erase the last character. The Unix system isn't so polymorphous—even though you can set your own erase character, you can have only one at a time.

The typical Unix system hacker can't remember what the erase character is this week. Version 7 and System V use the sharp (#) to erase. This is a lousy choice, except for the zillions of people who still use teletypes. If you are one of the lucky few with a video display terminal, then you will probably want to use BACKSPACE or DELETE as your erase character.

Many Unix system vendors have already changed their default erase character to BACKSPACE. On 4.2BSD, DELETE is the default erase character, and the old interrupt character (DELETE) has been changed to "Control-C."

You can find out what your Unix system erase character is by invoking the `stty` command. If it is not what you want and if you would like to set it to something else, use the following command: `stty erase ^H`. You can give anything you want in place of ^H (Control-H). However, making e your erase character is probably not a good idea.

The kill character (for erasing a line) is the "at" sign (@) on both Version 7 and System V. Again, this is best for folks who have a teletype. Many vendors change the kill character to "Control-X." On 4.2BSD the kill character is "Control-U," but both work on CP/M. As with erase, you can set your Unix system kill character with the `stty` command.

The end-of-file character is "Control-Z" on CP/M, but "Control-D" on the Unix system. As with erase and kill, you can change this using the `stty` command. On CP/M, you stop and start output with "Control-S." On the Unix system, you stop output with "Control-S," and resume with "Control-Q" (this is an ASCII standard).

COMMAND INTERPRETATION

The CP/M console command processor, which is built into the operating system, is functionally similar to the Unix shell. The shell, though, is a stand-alone program that can be replaced at will. Four common Unix system shells are the C shell, the Bourne shell, the Korn shell, and the Visual shell.

Most Unix system shells take the question mark (?) to represent any single character in a filename. The asterisk (*), on the other hand, represents any sequence of characters in a filename. These have the same meaning as the metacharacters used on CP/M. On the Unix system, however, filename suffixes are not required, so periods are never required in filenames. Some programs expect files to have a certain suffix (the C compiler expects files to end with `.c`, for example), but the operating system does not require this.

One nice feature of the Unix system, when compared to CP/M, is that you don't ever need to change

the current disk by typing `A:` or `B:`. On the Unix system, a disk drive (or part of a large disk) corresponds to a file system. When a file system is mounted (generally this is done automatically at boot time), the files become transparently available as part of the Unix system directory hierarchy. No matter what disk a file or program resides on, you only need to specify its name to find it.

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

CP/M	UNIX	NOTES
ERA	rm	remove
DIR	ls	list
REN	mv	move
SAVE		no Unix equivalent
TYPE	cat	catenate and print
PIP	cp	copy
DUMP	od -x	octal dump with hex option
STAT	du	disk usage
SUBMIT	sh	shell command script
ED	vi	visual editor
ASM	cc	C compiler replaces assembler
LOAD	cc	compiles, assembles, and loads
DDT	adb	most prevalent debugger
SYSGEN	mkfs	make file system
MOVCPM	mkconf	make configuration table

FIGURE 1: CP/M COMMANDS AND THEIR UNIX SYSTEM COUNTERPARTS

SYSTEM COMMANDS

CP/M has two types of commands: built-in and transient. Built-in commands are part of the operating system, whereas transient commands reside in executable form on disk, from where they are loaded when required. Transient commands are too large, or too infrequently used, to deserve a place inside the operating system.

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

Figure 1 lists CP/M commands and their counterparts on the Unix system. Of course, the Unix system has many more commands than these, but at least this is a start. As with erasing a CP/M file, removing a Unix system file obliterates it for good. On the Unix system, it is possible to write memory to disk, as done by CP/M's `SAVE` command, but no user-level program is provided for doing so.

The CP/M `PIP` program is more powerful than the Unix system `cp` (copy) command, but there are other more powerful Unix system utilities for data exchange. Reasonable people want hex dumps (`-x`) rather than octal dumps, which are the default with `od`. Another useful option for this program is `-c` to produce character dumps. The screen-oriented editor `vi` is much more powerful than CP/M's `ED`; in fact, some people prefer `vi` to WordStar. Even the low-end Unix system editor `ed` is superior to the CP/M editor.

Unix system programmers shy away from assembly code because C code is nearly as efficient and is far more portable. Unfortunately, the Unix system debugger `adb` is generally not as helpful as CP/M's `DDT`. The `mkfs` and `mkconf` programs are quite esoteric, requiring a higher level of expertise than do `SYSGEN` or `MOVCPM`.

MULTITASKING AND PORTABILITY

One reason computer users are abandoning CP/M and MS-DOS is that they are single-tasking systems. If you want to print out a long file, for example, you have to wait until it is finished before you can do anything else. Because the Unix system is multitasking, you can print a long file in background while you are doing other work. More importantly, several users can share a system, all getting work done at the same time. Multitasking implies multiuser.

Another reason for the success of the Unix system is its portability. Because the operating system and its utilities are written in C, rather than in some kind of assembler, the Unix system can be ported to new machine architectures with a minimum of effort. □

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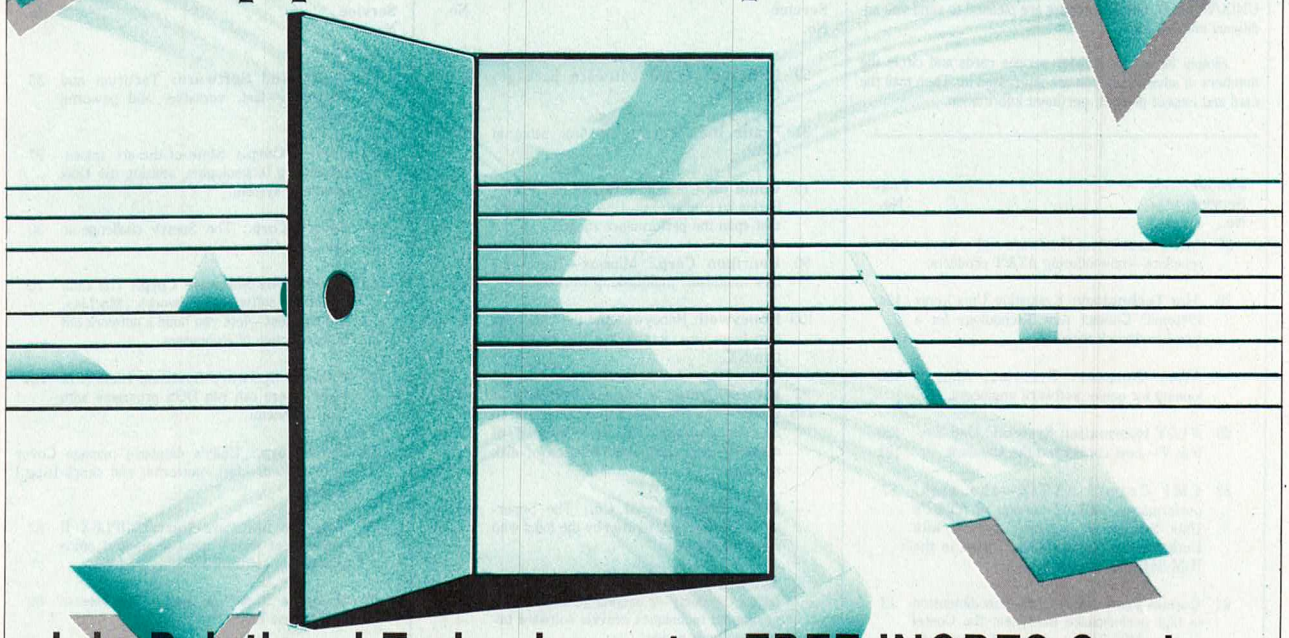

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AN INTERACTIVE FRONT-END FOR THE UNIX SYSTEM find COMMAND

BY DR. REBECCA THOMAS

Locating files with certain characteristics is the function of the powerful Unix system `find` command. This command can locate files with a specified filename, number of links, file owner, group owner, size, time of last modification, and more. However, `find` has an awkward syntax that makes it difficult to use for beginning as well as seasoned users.

This month's contribution, from Mike Elola, helps bring this command's power within reach of every Unix system user. Figure 1 lists his interactive shell script, named `refind`, that drives the `find` command. The shell script prompts the user for information that will be used to build the desired `find` command line, which is executed in the last step of the shell script.

Users must first name one or more directories from which `find` will begin its search. The directories are searched recursively; that is, first each directory, then all its subdirectories, and so on are searched until the entire directory hierarchy sub-tree below the starting directory has been scanned.

You may name a complete or partial pathname to the desired starting directory. Also, more than one starting directory may be listed if it's separated from the other pathnames by white space (space or tab) characters. As a default case, press RETURN in response to the `Starting directory(ies):` prompt to begin the search from your current directory.

Next, you'll be prompted successively for up to eight attributes or selection criteria for the desired files. You can select files that have a certain name or group of characters in their name. The filename (or wildcard) generation (or matching) rules used by the shell may be used as long as the metacharacters, *, ?, [, and] are escaped (or quoted) so they can be passed onto `find` without interpretation by the shell running the script.

For instance, `'*.bak'` or `\*.bak` selects all files whose names end in ".bak". `'chapter?'` or `chapter\?` selects all files whose names begin with "chapter" followed by exactly one character. And `'chap[1-3]'` or `chap\[1-3\]` selects files named `chap1`, `chap2`, or `chap3`.

You can select files owned by certain system users by indicating their user (or account) name or user identification number (UID) in response to the `Owned by:` prompt. You can select files belonging to a certain group association by indicating their group name or group identification number (GID) after the `Group-owned by:` prompt. You

```
$ cat -n refind

  1  echo ''refind BOURNE SHELL SCRIPT-(c) 1984 by Michael Elola''
  2  echo
  3  dollar=''$''
  4  prompt1=' ..................................................... File name of: '
  5  prompt2=' ....................................................... Owned by: '
  6  prompt3=' ................................................... Group-owned by: '
  7  prompt4=' ..................................... Permissions equal (octal): '
  8  prompt5=' ................................. Modified more recently than (file): '
  9  prompt6=' ................................. Last Modified N days ago; N equals: '
 10  prompt7=' ................................. Last Accessed N days ago; N equals: '
 11  prompt8=' ..................................................... Block size equals: '
 12  prompt9='N amount of filenames linked; N equals: '
 13  option1='-name'
 14  option2='-user'
 15  option3='-group'
 16  option4='-perm'
 17  option5='-newer'
 18  option6='-mtime'
 19  option7='-atime'
 20  option8='-size'
```

Continued

FIGURE 1: LISTING OF THE `refind` SHELL SCRIPT

Continued from page 113

```
option9='-links'
count=0 ; continue=y ; attributes= ''''
echo ''If search is to include several equal-level directories, enter''
echo ''them as a list, separated by spaces.''
echo
echo ''Starting directory(ies): ''
echo ''Press RETURN for current directory otherwise state pathname(s):''
read response
if test -z ''$response''
then
  paths='' .''
else
  paths='' .''
fi
echo 'Select file attributes (press RETURN for next attribute):'
echo
for count in 1 2 3 4 5 6 7 8 9
do
 eval echo -n ''${dollar}prompt$count\''
 read response
 if test -n ''$response''
 then
  if test 5 -lt $count
  then
    echo
    echo ''Exactly $response       (Press RETURN)''
    echo ''Greater than $response (Enter +)''
    echo ''Less than $response    (Enter -)''
    echo -n ''                                Selection? ''
    read bandwidth
    echo
  fi
  component='eval echo -n ''${dollar}option$count '
  attributes=''$attributes $component $bandwidth$response''
  bandwidth=''''
  echo -n 'Other attributes as well (y or n)? '
  read response
  if test $response = n
  then
    echo
   break
  fi
 fi
done
echo
echo ''Press RETURN for no other action than indicating the files found.''
echo ''Select actions to be applied to files found:''
print=''print''
echo
echo -n 'To each file found, apply the following UNIX command: $ '
read command
if test -n ''$command''
then
 echo -n 'Prompt yes/no for each file before executing (y/n)? '
 read prompt
 if test $prompt != ''y''
 then
  command=''-exec $command {} \; ''
```

Continued

FIGURE 1: CONTINUED

Continued from page 114

```
 79    echo -n 'Show the current filename before each command (y/n)? '
 80    read response
 81    if test $response != ''y''
 82    then
 83      print=''''
 84    fi
 85   else
 86    command=''-ok $command {} \; ''
 87    print=''''
 88   fi
 89  fi
 90  echo
 91  echo
 92  echo ''Select manner of find's operation:''
 93  echo
 94  echo ''To view output of find operation at terminal, press RETURN.''
 95  echo -n 'Redirect output into (file): >'
 96  read response
 97  echo
 98  if test -n ''$response''
 99  then
100   redirect=''>$response''
101   echo -n 'Run in background (y or n)? '
102   read response
103   if test $response = ''y''
104   then
105      back=''&''
106   fi
107  fi
108  echo
109  eval find $paths $attributes $command $print $redirect $back

$ []
```

FIGURE 1: CONTINUED

can even select files that have a certain set of permissions by indicating the permissions mode value in octal after the `Permissions equal (octal):` prompt.

Next, you can select files that have been modified (by writing to them) more recently than the file you name in response to the `Modified more recently than (file):` prompt. This property might be useful, say, for deciding which files to back up at the end of a work session. You would update a dummy file at the beginning of your session. When finished, specify that `refind` locate all files "newer" than the dummy file. The resulting list of files represents all those created or updated during your work session.

Files can be selected based on when they were last modified (or updated) or simply accessed (read but not changed). Designate the number of days after the `Last Modified N days ago; N equals:` and `Last Accessed N days ago; N equals:` prompts, respectively. Then you will be prompted for whether you mean exactly *N* days ago, more than *N* days ago, or less than *N* days ago. Press RETURN, +, or −, respectively, in response to the `Selection?` prompt.

TWO OTHER CRITERIA

Two other criteria take numerical values—block size and number of filenames linked. As with the modification and access times, you can indicate exactly, greater than, or less than the numerical value specified previously.

You may name more than one file attribute when running `refind`. If so, the attributes are combined in a logical AND sense. For instance, let's say you first requested all files that were modified over two weeks ago and then those greater than 10 blocks in size. The `refind` script would locate all files over 14 days old

AND that were larger than 10 blocks.

However, unlike `find`, `refind` itself is not capable of indicating an OR logical association between the attributes. But if you wish to use an OR association, run `refind` separately for each attribute condition. For instance, run `refind` once to locate all files older than two weeks and then run `refind` again to locate all files larger than 10 blocks. The entire set of filenames reported from these two runs represents all files older than two weeks OR larger than 10 blocks.

If you answer with a RETURN at each attribute prompt, `refind` will skip the current attribute and will prompt you for the next one (if any remain). After you respond to each attribute prompt, `refind` prompts you with `Other attributes as well (y or n)?`. If you enter n, then you will not be prompted for any remaining attributes.

Next, `refind` asks what action to take for each located file. Generally, you'd simply press RETURN, and `refind` would report the pathnames of the located files. Alternatively, you could name a Unix system command to operate on the files by indicating the command name and any options for the command after the prompt, `To each file found, apply the following UNIX command: $`. If you do indicate a Unix system command, you'll next be asked if you'd like to be prompted by a yes/no decision for executing the command on each located file in turn. If you answer in the negative, you next have the choice at least to view the name of the file before the Unix system command acts on it.

Then, you can specify that the

```
$ refind
REFIND—Version 1.0              Copyright (c) 1984 by Michael Elola

If search is to include several equal-level directories, enter them as a list,
separated by spaces.

''Starting directory(ies): ''
Press RETURN for current directory otherwise state pathname(s):
/
Select file attributes sought (press RETURN to skip to next attribute):

Other attributes as well (y or n)? y

Exactly 7       (Press RETURN)
Greater than 7  (Enter +)
Less than 7     (Enter -)
                                        Selection? +

Other attributes as well (y or n)? n

Press RETURN for no other action than indicating the files found.
Select actions to be applied to files found:

To each file found, apply the following UNIX command: $ rm
Prompt yes/no for each file before executing (y or n): y

Select manner of find's operation:

To view output of find operation at terminal, press RETURN.
Redirect output into (file): >

< rm ... /usr/sys/stand/a.out > ? y
rm: override protection 511 for /usr/sys/stand/a.out? y
< rm ... /usr/sys/mdec/a.out > ? n
$
```

FIGURE 2: USING THE `refind` SHELL SCRIPT

result of `refind`'s action be displayed on the terminal or be stored in a disk file by entering RETURN or the filename, respectively, after the prompt `Redirect output into (file): >`. If the output is to be redirected to a file, you can have the resulting `find` command process execute in the background or foreground by entering `y` or `n`, respectively, after the prompt `Run in background (y or n)?`. Note that you can't answer queries for each located file if you run the `find` command in the background.

As an example of using `refind`, Figure 2 shows a typical interactive session for erasing superfluous files that are consuming valuable disk space. The entire file system will be scanned because I began the search with the root directory (/). The selection attributes requested all files with the name `a.out` that haven't been accessed in over a week. Such files are not likely to be of any value and could be re-created, if necessary, by recompiling their source code.

However, to "play it safe" I elect the option to be queried with each file's pathname before requesting its removal. In our example, I remove the first file by answering `y` to the query `< rm ... /usr/sys/stand/a.out>?`, Furthermore, because the file was write-protected, I had to override its write protection by answering `y` to the `rm: override protection 511 for /usr/sys/stand/a.out?` query. The second (and last) file located was not removed. □

Contributed by Mike Elola, independent writer/programmer, San Jose, Calif.

A USER GUIDE TO THE UNIX SYSTEM, SECOND EDITION

A User Guide to the Unix System, Second Edition by Dr. Rebecca Thomas and Jean Yates

PUBLISHED BY OSBORNE/MCGRAW-HILL, 716 PAGES, $18.95

REVIEWED BY RAY SWARTZ

Without knowing it, the Unix system community recently passed a milestone: A book about the Unix system was published in its second edition. The book, *A User Guide to the Unix System*, by Dr. Rebecca Thomas and Jean Yates, suggests two things about the Unix system. First, the Unix system has expanded such that earlier works now require revision. Second, there is enough interest in the Unix system to warrant publishers and authors revising already published books.

The Unix system is a large one that includes a number of interdependent parts. This means that authors of Unix system introductions must decide how much of the Unix system they are going to cover. Some books cater to the first-time user, the computer novice. Generally, these books include a mild introduction to computers, as well as to the Unix system material.

Other books focus on writers, spending most of their time with the Unix system's well-known editing and formatting capabilities; still others are aimed toward those who program on the Unix system.

The first edition of this book was written for Unix system beginners and included a brief introduction to computers. Since that first edition was published, in 1982, there has been an explosion of interest in the Unix system specifically and in computers in general. As a result, Thomas and Yates, while still writing for beginners, cover more ground and provide fuller examples and explanations. Even though the book is primarily written to familiarize beginners with the Unix system, it will also help clear up much of the mystery for those who already use the Unix system but lack a firm grasp of the why or how of it.

SYSTEM ADMINISTRATION

Today, with the advances that have taken place in computer hardware, the Unix system is available on small, relatively inexpensive computers. However, because the Unix system is a multiuser system, it is significantly different from single-user microcomputers. While the owner/operator of a microcomputer can be expected to fully maintain the machine, initialize disks, and perform backups, system administration is a much tougher task on the Unix system.

Thus, when a company buys a Unix system machine, it needs more than a user's introduction to the Unix system; it needs a system administrator who can maintain the integrity of the file system, create new users, load and unload file systems, manage disk space, make backups, and perform a number of other important jobs.

Realizing this, Thomas and Yates have included an entire appendix (43 pages' worth) entitled "The Essentials of System Administration." In this way, the second edition's audience includes more than just Unix system beginners; in fact, the book strives to be a true guidebook both for those who use and those who support the Unix system.

REVIEW HIGHLIGHTS

- Highly recommended for anyone wanting to become Unix system literate.
- Maximum recommendation for anyone who will be buying or who has just bought a Unix system.
- Not recommended for seasoned Unix system users looking for a reference guide.
- Special recommendation to newly appointed Unix system administrators.

The first of the book's four parts is a two-chapter introduction. The next part consists of a set of tutorials that read like the transcript of a "hands-on" introductory Unix system class, while part three is made up of a single, lengthy chapter entitled "Commonly Used Unix System Commands." Part four contains seven appendices, ranging from a compendium of Unix system resources to the above-mentioned essentials of system administration.

The book's prose is straightforward, and the authors have made a significant attempt to augment the text with meaningful graphics. Although a few of the examples are hard to follow, most of them are to

the point and helpfully illustrative. In addition, the book's layout strongly enhances the material presented. The layout, for example, helps reduce confusion. It clarifies what you should enter and what the system's response should be, making the tutorials easy to follow.

CONTENTS

The first two chapters acquaint readers with the (brief) history of the Unix system, the different parts of the Unix system, and an explanation of who should use the Unix system for what. Although this section covers a good deal of valuable introductory material, especially in Chapter 2, too much of it is included in both chapters. The redundancy is unnecessary and, at times, confusing. It would have been much better if these two chapters had been combined into one comprehensive overview of the Unix system. In any case, I recommend skimming Chapter 1; Chapter two contains all a beginner needs to know before continuing.

The three chapters in part two consist of 12 tutorial sessions, which cover a lot of ground in their 270 total pages. Generally, each session begins by explaining the concepts that are later demonstrated by exercises the reader performs at the terminal.

Chapter 3, "Fundamentals of Using the Unix System," begins by defining some basic Unix system terms and by identifying the conventions used in the tutorials. The first of the chapter's five sessions covers logging in to the Unix system, establishing or changing a password, and logging out. The second session demonstrates how to interact with the Unix system from the keyboard. Session three shows how to send and receive mail and introduces text creating and editing with `ed` and `ex`.

Session four discusses the Unix system file system; the commands `ls`, `cat`, `cp`, `rm`, `mv`, and `ln`; and file permissions. The last session focuses on the directory hierarchy, explaining what it is and how it works; demonstrates `mkdir`, `cd`, `pwd`, and `rmdir`; and discusses the on-line Unix system documentation and the `man` command.

Chapter 4, "Mastering the Special Features of the Unix System," contains three sessions covering both the Bourne and C shells. Session six introduces the concept of standard input and output, redirection, pipelines, filters, and wildcard characters; session seven deals with process control and shows the `ps`, `nohup`, `nice`, `kill`, `at`, and `sleep` commands; and session eight explains special features of the C shell such as shell variables, command aliases, the history mechanism, and the shell setup files (`.login` and `.cshrc`).

Chapter 5, "Text Processing," contains four sessions dealing with the Unix system text editors and formatters. Session nine expands on the work done in session three by detailing the `ed` and `ex` text editors. This is a full discussion of editing features, including the use of regular expressions and metacharacters.

Session ten builds upon session nine by showing how to use the editor to perform special editing tasks and how to execute system commands from the editor. It also lists the editing options available. Session eleven discusses the Unix system screen editor, `vi`, covering much the same material as sessions nine and ten did for `ex` and `ed`. Session twelve deals with text formatting using `nroff`.

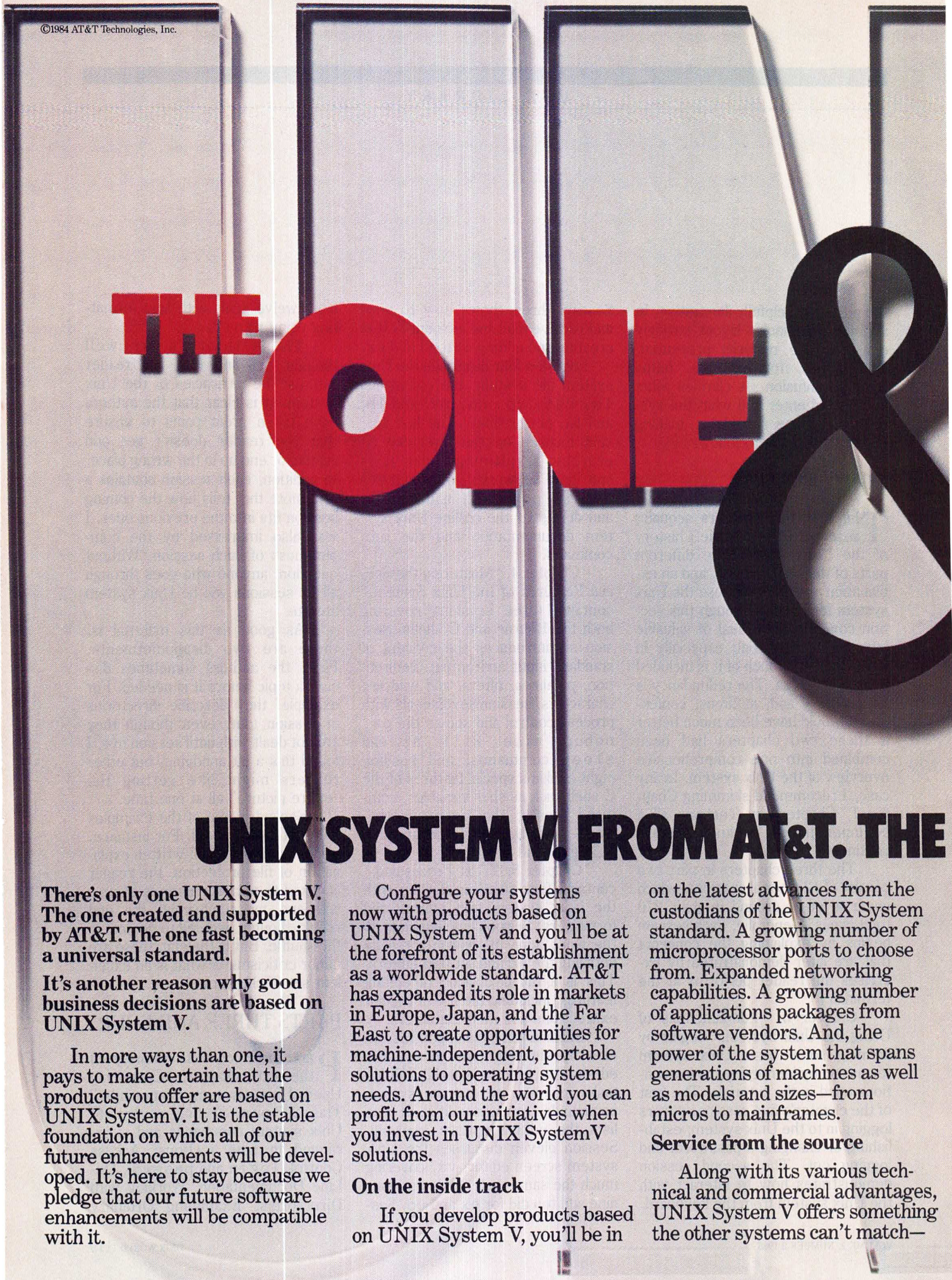
These tutorials are well thought out and lead the reader through the intricacies of the Unix system. It is clear that the authors have taken great pains to ensure that the reader doesn't get odd results or end up in the wrong place. In addition, each session contains a brief note that tells how the coming session fits into the previous ones. I was also impressed by the completeness of each session. Without question, anyone who goes through all 12 sessions will be Unix system literate.

As good as this material is, there are two disappointments. First, the authors sometimes discuss a topic before it is needed. For example, they describe directories in session four, even though they are not dealt with until session five. I found this a bit annoying, but other readers might like getting the "entire picture" all at one time.

Second, some of the examples are a bit too involved. For instance, to demonstrate a well-written explanation of file protection, the reader is asked to perform a series of `cp`, `mv`, and `rm` commands; the end result, though, seemed to get lost in the shuffle. But in the end, these are minor criticisms of what is an excellent set of chapters.

PARTS THREE AND FOUR

Part three consists entirely of the sixth chapter, "Commonly Used Unix System Commands." This 223-page section covers 44 Unix system commands and is arranged in nine sections: Access Control (`login` and `passwd`), On-Line Documentation, Working with Directories, Examining Ordinary



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The format for each command begins with a listing of how the command is invoked and any available options. An option is identified by which Unix system version it applies to and what it does. This is followed by examples of usage. Where warranted, a brief discussion of a command's special features is included. Each summary ends by cataloging all the messages printed by the specified command.

The information contained in this summary is extensive. Not only is each command described and demonstrated, but differences that exist in command options are identified by Unix system version. In addition, this is the first time I have seen a compendium of the messages (error or otherwise) displayed by Unix system commands. Again, the authors have gone the extra mile to provide truly useful information.

However, I'm uncertain how the authors intended this section to be used. If it was intended for reference usage, it has not been organized properly. Grouping the commands by function makes it troublesome to locate information on any single command. Learning how to use `cal`, for example, requires that the reader turn to page 313, examine the commands listed, turn the page, locate the entry for `cal` in the "Getting Status Information" section, and then go to page 433, where `cal` is explained.

I should point out that three Unix system commands — `awk`, `sed`, and `od`—are conspicuously absent from the summary. Although I can understand the elimination of an advanced tool like `awk`, I see no reason to ignore `sed` and `od`. The Unix system editors are covered in great detail in the tutorials. I think `sed` could have been described without introducing much, if any, new material. As for `od`, it is a useful tool and is not hard to understand.

Part four contains seven appendices: the first lists makers of Unix system computers, software, and other Unix system resources; the second identifies the programs that make up Unix System V and explains each with a one-line description; the third covers communicating with the Unix system; the fourth includes information for a Unix system administrator, including directions for booting the Unix system, checking, repairing, mounting, and dismounting file systems, etc.; the fifth is a one-page list of the ASCII Character Set; the sixth contains the commands discussed in part three, including a one-sentence description of command function and a listing of available options; and the seventh is a detailed bibliography of papers, magazine articles, and books about the Unix system.

In sum, this book represents what must have been a massive effort not only to update the authors' previous book but also to extend it to cover a greatly expanded subject. Although the second edition contains much new material, its format is consistent with that of the previous edition. □

Ray Swartz is the founder of Berkeley Decision/Systems Inc., Santa Cruz, Calif. Mr. Swartz also teaches at UC Santa Cruz, where he is a visiting lecturer in the Computer and Information Sciences Department.

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

EXPLODING THE UNIX MYTH
March 11-13, 1985
Orlando, Fla.

A discussion on the Unix system's promise to deliver a multiuser, multitasking, portable operating system standard and IBM's strategy in the Unix system market. Contact Lynn Bentley, Gartner Group Inc., 72 Cummings Point Road, P.O. Box 10212, Stamford, CT 06904; 203/964-0096.

INDUSTRY SERVICE CONFERENCE
March 18-20, 1985
Los Angeles, Calif.

This conference will examine trends and future developments in specific information industry sectors. Contact Lynn Bentley, Gartner Group, Inc. 72 Cummings Point Road, P.O. Box 10212, Stamford, CT 06904; 203/964-0096.

UNIX AND ULTRIX UTILITIES AND COMMANDS
February 25-March 1, 1985
Santa Clara, Calif.
Landover, Md.

A course to provide hands-on

experience designed to teach the practical commands and techniques to ensure effective interacting with the Unix-based system. Contact Cheryl Anne Lamb, Digital Equipment Corp., 12 Crosby Drive, BUO/E55, Bedford, MA 01730; 617/276-4572.

PROGRAMMING IN C
February 25-March 1, 1985
Bedford, Mass.

Comprehensive training in all aspects of the C language for programmers already proficient in another language. Contact Cheryl Anne Lamb, Digital Equipment Corp., 12 Crosby Drive, BUO/E55, Bedford, MA 01730; 617/276-4572.

DBASE II
February 28-March 1, 1985
Long Island, N.Y.

This seminar will teach the essentials of dBASE II as well as techniques for more fully utilizing its features and optimizing its performance. Contact Herb Stern, Center for Advanced Professional Education, 1820 E. Geary St., Suite 110, Santa Ana, CA 92705; 714/261-0240.

UNIX SYSTEM DESIGN AND SOFTWARE DEVELOPMENT
February 27-March 1, 1985
San Juan, Puerto Rico

Topics include the principal features of the Unix system and how to use them, and how to exploit Unix system strengths and circumvent weaknesses. Contact Herb Stern, Center for Advanced Professional Education, 1820 E. Geary St., Suite 110, Santa Ana, CA 92705; 714/261-0240. □

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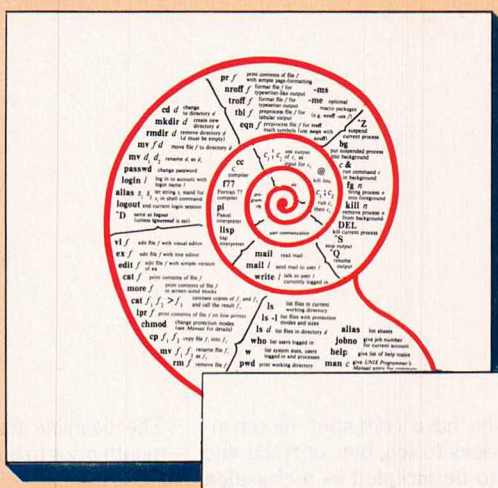

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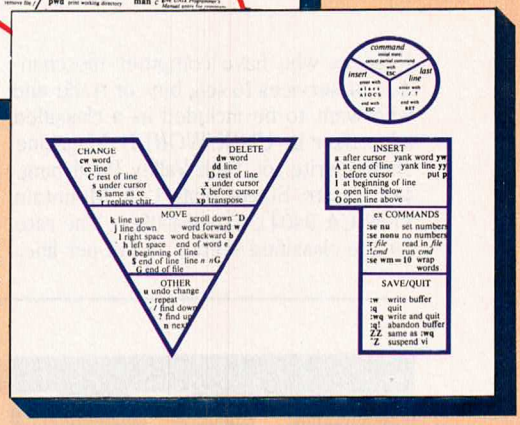

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market. The earlier of these, originally called the "Armatron" but later dubbed "Robotron" for distribution through Radio Shack, costs about $40 and could form the basis for substantial experiments. In fact, there have been reports of experimenters who successfully interfaced this arm with a simple home computer and were able to build fairly sophisticated game-playing devices for demonstration purposes.

The biggest problem with the Armatron is that all of the control functions are entirely mechanical, making it difficult to interface to a computer—it requires solenoids and other mechanical linkages. Still, it's far better than starting from scratch.

Very recently a new toy, dubbed "Robotix," was released by Milton Bradley. The advanced model of this "toy," the series R-2000, has an ingenious system for creating a wide variety of mechanical manipulators and grabbers, using interlocking high-impact plastic "octagon" linkages. Most importantly, this unit includes four independent motors (with internal gearing to provide high torque).

Unlike the Robotron, which only has one motor and requires mechanical interfaces, the Robotix motors can be interfaced through simple optical isolators quickly and for very little money. Robotix, being more of a "building" toy than a preassembled device, is also much more versatile. For example, I've used two motors for arm/hand control and two motors to provide movement for the arm "platform" around the floor, and it all worked quite well indeed. Robotix costs just under $50 at discount outlets and comes personally recommended by yours truly. It's also a lot of fun!

This only really scratches the surface of using toys for robotics experiments. There are other items on the market that can also be of use, including the Milton Bradley "Big Trak," which can be modified into an accurately controllable mobile platform for other experiments. If you want to get even more sophisticated, you can modify cheap walkie-talkies to provide radio links between an outboard control computer and the robot hardware, thereby eliminating control cables while still not requiring all of the robot's processing power to be carried with the unit itself.

If you're interested in exploring this area, I'd recommend that you check out the excellent periodical *Robotics Age*. It discusses not only commercial robotics, but is also oriented toward the experimenter, and it includes articles on the use of "toys" as robotic components and subsystems.

The combination of readily accessible computer hardware, a few items from the toy store, and some elbow grease can result in some fascinating robotic creations without breaking or even straining the budget. If you've ever wanted to investigate one of the leading edges of technology and computing, robotics can indeed be an enjoyable area to explore. □

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--Lauren--
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Lauren Weinstein is a computer/telecommunications consultant based in Los Angeles. He has been involved in a wide range of projects ranging from the mundane to the bizarre. He has particular expertise in the fields of computer networking (more than a decade working with ARPANET and other networks), the Unix system (around eleven years), microcomputer technology, and telecommunications systems ranging from dials and ringers to modern satellite systems.

FUN WITH ROBOTS

BY LAUREN WEINSTEIN

There's more to technology than the hardcore world of computer operating systems. One of the more esoteric facets of today's changing technology is robotics, a field which certainly involves computers and computer science, but which includes many other disciplines as well. So this month, let's take a look at something a little different—building your own robots!

A wide variety of sophisticated devices are gaining increasing use in manufacturing, both abroad and in this country. By and large, complex computer software systems are an integral part of many such units, controlling the motion and sensory mechanisms, as well as providing the artificial "intelligence" that makes these creatures perform.

Of course, today's industrial robots aren't usually what first spring to mind when we hear the word *robot.* Those of us who cut our teeth on science fiction tend to think first of the more anthropomorphic (and generally rather intelligent) devices in a variety of films from the past. The very term *robotics* was coined by a science-fiction writer—Isaac Asimov, to be exact.

Unfortunately, we have quite a long way to go before we'll be able to tinker together something as versatile as "Robbie the Robot" from the classic film *Forbidden Planet* or (for those of you better versed on more recent films) a non-anthropomorphic automaton as clever as R2D2. But even with currently available technology, we can certainly have some fun with robotics, even if we can't create an automated housekeeper just yet.

DO IT YOURSELF

So how can an individual get involved with robot building, especially on a limited budget? Let's face it, commercial robot systems are very expensive, and even the simple robot "kits" (mobile platforms, arms, etc.) directed toward the "serious" experimenter might be prohibitively expensive for the more casual robot aficionado.

Oddly enough, the *least* difficult part (from a hardware standpoint) of a homemade robotic creation is probably the most theoretically sophisticated—the brain. Inexpensive computers with enough computational punch to serve as even fairly sophisticated robot control systems are available everywhere, including larger supermarkets!

For serious robotic applications, high-speed processing is a must, but for the casual investigator, there's no need to spend so much for some basic dabbling in the robotic arts. The essential software for image processing, pattern recognition, and other aspects of artificial intelligence can run, albeit slowly, on even very inexpensive processors.

As a practical matter, reasonable software for nondemanding robotic applications, when developed with small, inexpensive home computers rather than monstrous mainframes in mind, can be quite effective. If you've got a computer running a version of the Unix system or even another multi tasking operating system, with a serial port to spare, it's possible to wire simple robotics hardware directly into that port and let your robot's brain share cycles with other applications. Oh yeah, having the robot share time with C compilations might not be such a good idea, but with a fairly light load the poor robot should be able to get enough cycles to putter along pretty well.

The trickiest part of building inexpensive robots involves not the computer aspects, but rather the *mechanical* aspects. Arms, hands, and mechanisms for general locomotion are not simple to build, and they can involve quite sophisticated machining and tools to which many of us might not have easy access.

Luckily, affordable solutions to some of these problems already exist, thanks to the ingenuity of the commercial toy manufacturers. In many cases, items marketed as toys, mass produced and with clever (often Japanese-based) designs, can be easily used as inexpensive elements in fairly sophisticated robotic devices. Even the more elaborate of these "toys" carry price tags many orders of magnitude beneath those of commercial industrial equivalents, and even far, far below the prices for the "experimenter" versions of such devices.

GIVE ME A HAND

For example, at least two inexpensive robot hand/arm toys, complete with grasping and substantial lifting capabilities, are on the

Continued on page 127

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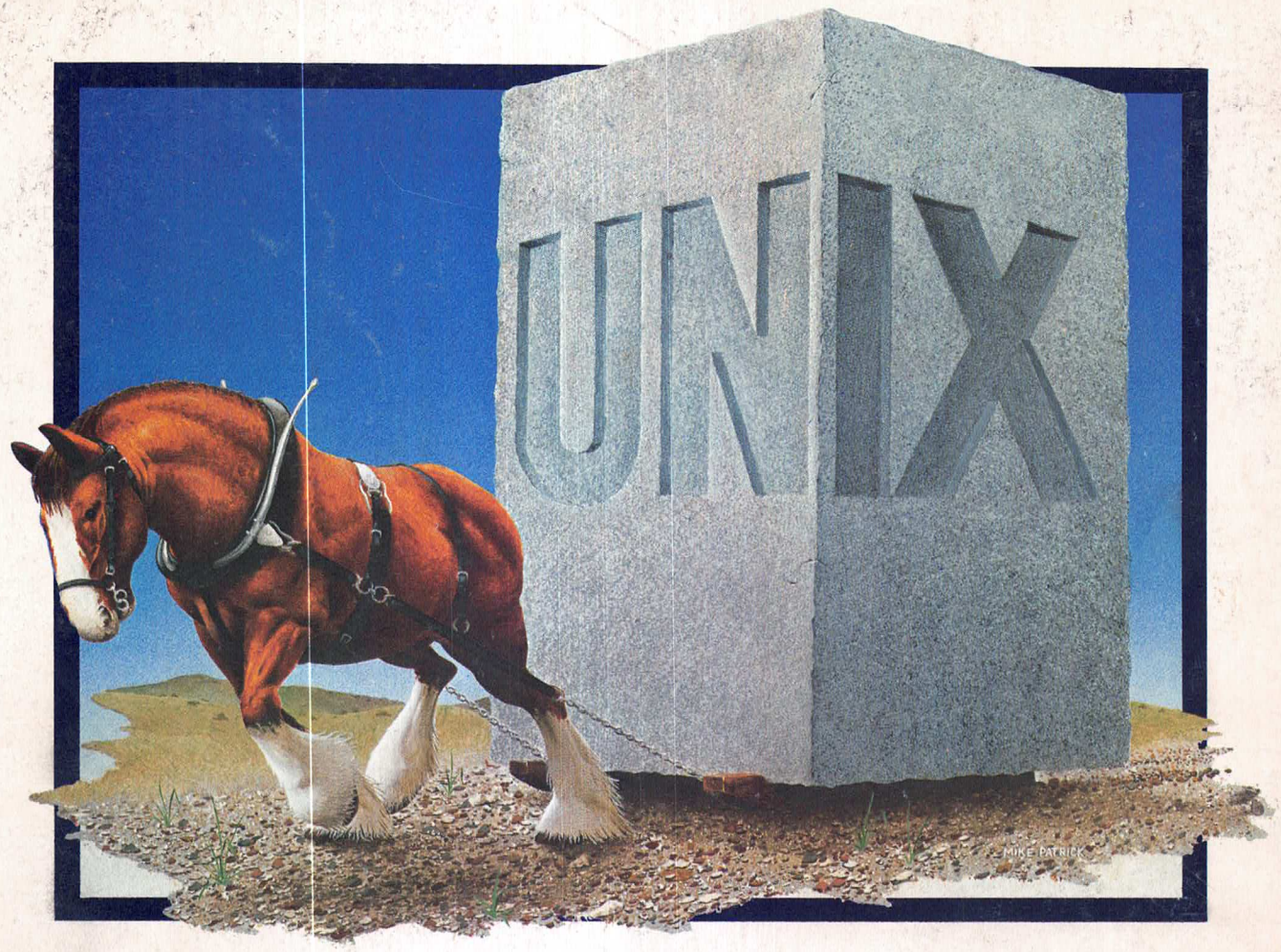

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