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WHY DIRECTORS CAN'T PROTECT THE SHAREHOLDERS

BY HAROLD GENEEN

HOW THE
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THE HOLES
IN AT&T'S
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THE CROWDED
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TECHNOLOGY

THE HOLES IN AT&T'S COMPUTER STRATEGY

With help from its famous software property called Unix, AT&T intends to build a huge new computer business. But competitors could adopt Unix and run away with it. ■ by Gene Bylinsky

THAT GREAT AMERICAN invention factory, AT&T's Bell Laboratories, planted the seed of today's computer industry when it gave the world the transistor. Now it's shaking the tree with another innovation, a computer operating system called Unix. Nobel Prize astrophysicist Arno Penzias, AT&T's vice president for research, ranks Unix second in importance to the transistor among Bell Labs inventions. And AT&T sees it as the main lever in the company's plans to create a huge new computer business. But it's possible that, like the transistor, Unix could change the world without greatly enriching AT&T.

Operating systems are to computers what hotel staffs are to hostleries—they direct the internal housekeeping of the machines. An operating system is the permanent software that gives a computer its personality, determining what applications programs it can run. One thing that sets Unix apart from other operating systems is a characteristic that computer people call "portability"—it can run a variety of machines. While most other operating systems are designed to go with particular hardware, Unix can be fairly easily adapted to run *any* computer, from micro to supercomputer. This means that the applications software written for Unix can be used on the whole range of those machines, at desktops and in the air-conditioned rooms

RESEARCH ASSOCIATE Sarah Smith

that house corporate mainframes.

If Unix comes to be widely adopted in the computer industry, the consequences may be revolutionary. Computer users whose machines run on Unix can switch to Unix-run hardware of another manufacturer without having to switch applications software, with all the expense and bother that entails. IBM has enjoyed a captive audience of users for some of its hardware, largely because the company has proprietary operating systems and makes sure that software written for them can run only on IBM's machines.

AT&T hopes that Unix will force IBM and other manufacturers to compete on the price and performance of their products and services because their proprietary operating systems will no longer help them as much in the marketplace as before. Jack M. Scanlon, AT&T's vice president for computers, says Unix will "level the playing field."

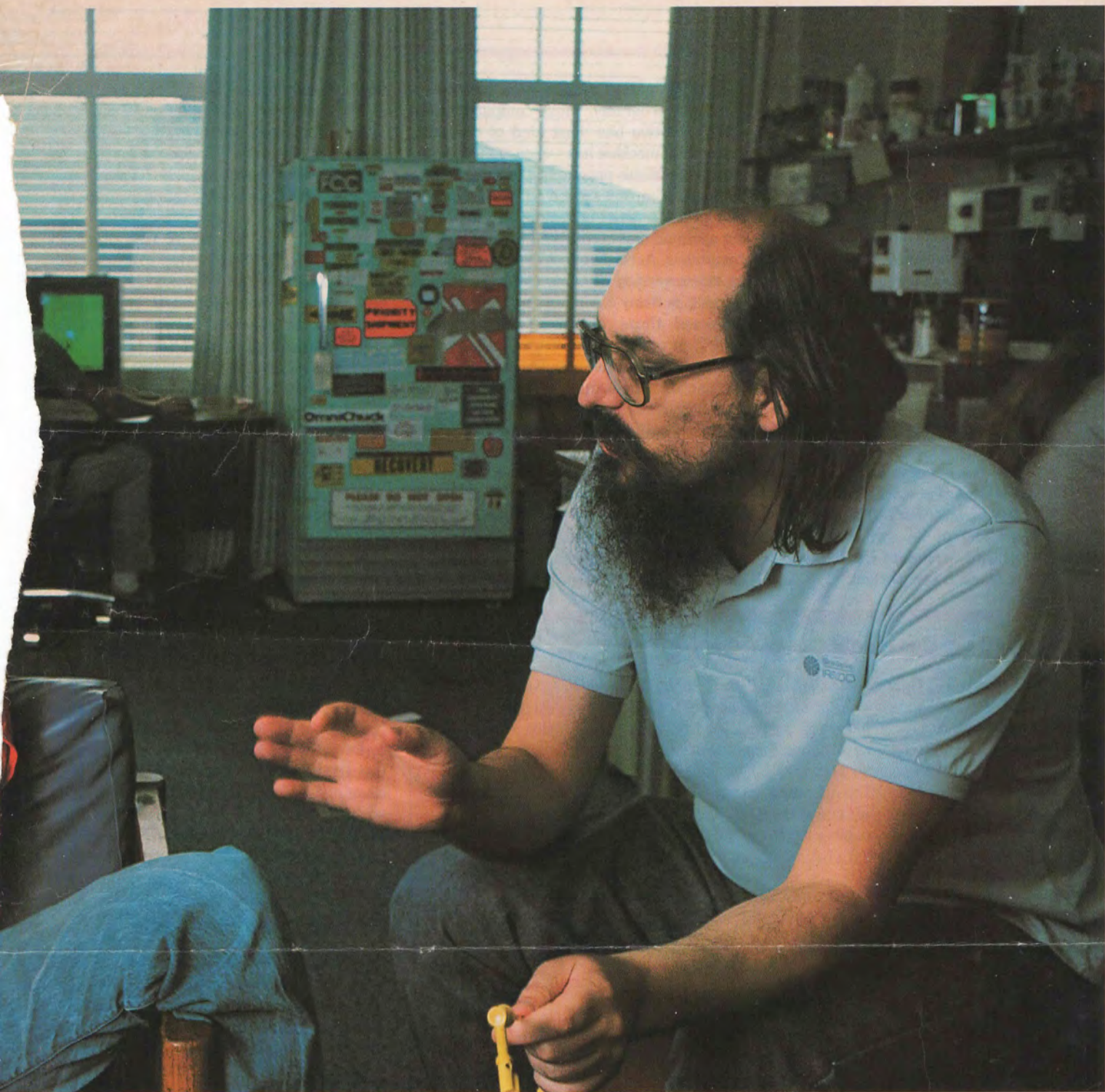
The company wants to see software houses write applications programs not for particular machines, but for an operating system—Unix—that can run business programs on machines of all manufacturers. If things work out that way, computers could become a commodity business, except for highly specialized or very large machines. Markets would open up for new contenders with advantages in hardware design or manufacturing skills—including AT&T, or so it hopes.

AT&T is still a newcomer in the business



The main creators of Unix were Ken Thompson,

of making computers for use outside the company. It remains primarily a telecommunications company, with long-distance telephone service its principal business. But Scanlon talks about emerging "near the top" in computers in the late 1980s. "We didn't go into the business to come out a distant third or fourth," he says. Scanlon's computer systems group has 900 employees, supported by about 4,000 in various divisions involved



(right), and Dennis Ritchie, 43, of Bell Labs. Thompson began devising the computer operating system because he found others too sluggish. Ritchie joined in.

AT&T computers. Of the company's seven operating divisions, five are or will be in the computer business in some way.

In the spring of this year AT&T fired its first hardware salvo, introducing its 3B series of supermicros. Then came the AT&T personal computer. Due next year are more powerful machines. AT&T's personal computer does not run on Unix, however. It runs on the same operating system as IBM's

PC—called PC-DOS, and licensed from Microsoft Corp. of Bellevue, Washington. Right now AT&T couldn't sell many Unix-run personal computers, because few Unix applications programs are available for them, while software for the popular PC-DOS and Microsoft's similar MS-DOS is abundant. But AT&T will probably come out with a Unix system for its personal computer later on. And the company seems bent on making a

range of Unix-based machines from lap-size portables to mainframes.

Unix is spreading quickly through the computer industry, with AT&T licensing manufacturers in the U.S. and abroad. So far at least 85 manufacturers have equipped 150 different computer models with Unix or Unix-like operating systems, ranging from microcomputers to the Cray II, which will be the most powerful computer in the world.

Even IBM, swallowing its pride, has been paying royalties to AT&T since last year for the right to offer a version of Unix as an additional system on its personal computer. It has also begun to offer other derivatives of Unix on its 4300 series mainframes, on its Series I minicomputer, and on a scientific computer aimed at the large contingent of Unix addicts in the academic and technical worlds.

In the computer industry these days, people sometimes use the term Unix to mean not just AT&T's own versions but all the variants together. In this broad sense, Unix is already a great success. Hardly anybody doubts that more and more of the computers manufactured in the next several years will be fitted with one version or another of Unix, and that a growing stream of royalties will flow to AT&T. But success for Unix in the broad sense will not necessarily bring a commensurate payoff for AT&T. The company wants to sell lots of its own computers, fitted with its own version of Unix. Success in that sense is much less certain.

AT&T's contest with IBM will turn on applications programs. Most computer users don't care two bits what kind of operating system the machine has—they want to know what applications programs it will take. Since software companies need to make a profit, they prefer to write programs for the operating systems that are, or will be, in the most computers. Accordingly, AT&T wants to get its latest version of Unix, called System V, running as many computers as possible—its own and those of other manufacturers. AT&T, in other words, is striving to establish System V as the standard Unix system, the one that most other manufacturers will also adopt. Then software outfits will write lots of programs for it, and that will help AT&T's computers compete—as well as favor the further spread of System V.

AT&T may already have lost that battle. IBM's new Personal Computer AT, announced in August, runs not on System V—as AT&T would have liked—but on a Unix offshoot called Xenix, produced by Microsoft

under license from AT&T. Like Unix, Xenix is what is known in computer jargon as a multitasking, multiuser operating system—a number of users can work on the machine on different tasks simultaneously. That is a major feature of Unix and operating systems derived from it.

By adopting it for the AT (for advanced technology), IBM took a step toward establishing Xenix as the standard for Unix-like operating systems. Software houses and hardware manufacturers swing with IBM like its shadow; when IBM brings out a new product, the rest of the industry rushes to imitate and serve the IBM machine.

Yet from IBM's point of view, no standard can be as desirable as one of its own. Industry observers widely believe that IBM's longer-term strategy calls for bringing a version of Unix under the umbrella of one of its own proprietary operating systems. That way IBM could offer users the advantages of Unix, yet keep them in the IBM fold. AT&T might then be forced to become another copycat company making equipment to run on IBM-controlled software.

A close observer of Unix and its prospects is Jean Yates, the blunt-talking president of Yates Ventures of Palo Alto, California, a firm that specializes in Unix market studies (see box, page 78). "Within 18 months," ventures Yates, "AT&T will be conforming to the IBM standard—Xenix. IBM will pick them up, shake them around, and do exactly what it wants." Echoes Stephen Cohen, an analyst for the Gartner Group, a Stamford, Connecticut, computer market watcher: "AT&T will find itself shouting in the wilderness: 'But Unix System V is the standard! But Unix System V is the standard!'"

A LITTLE TYPING DOES A LOT

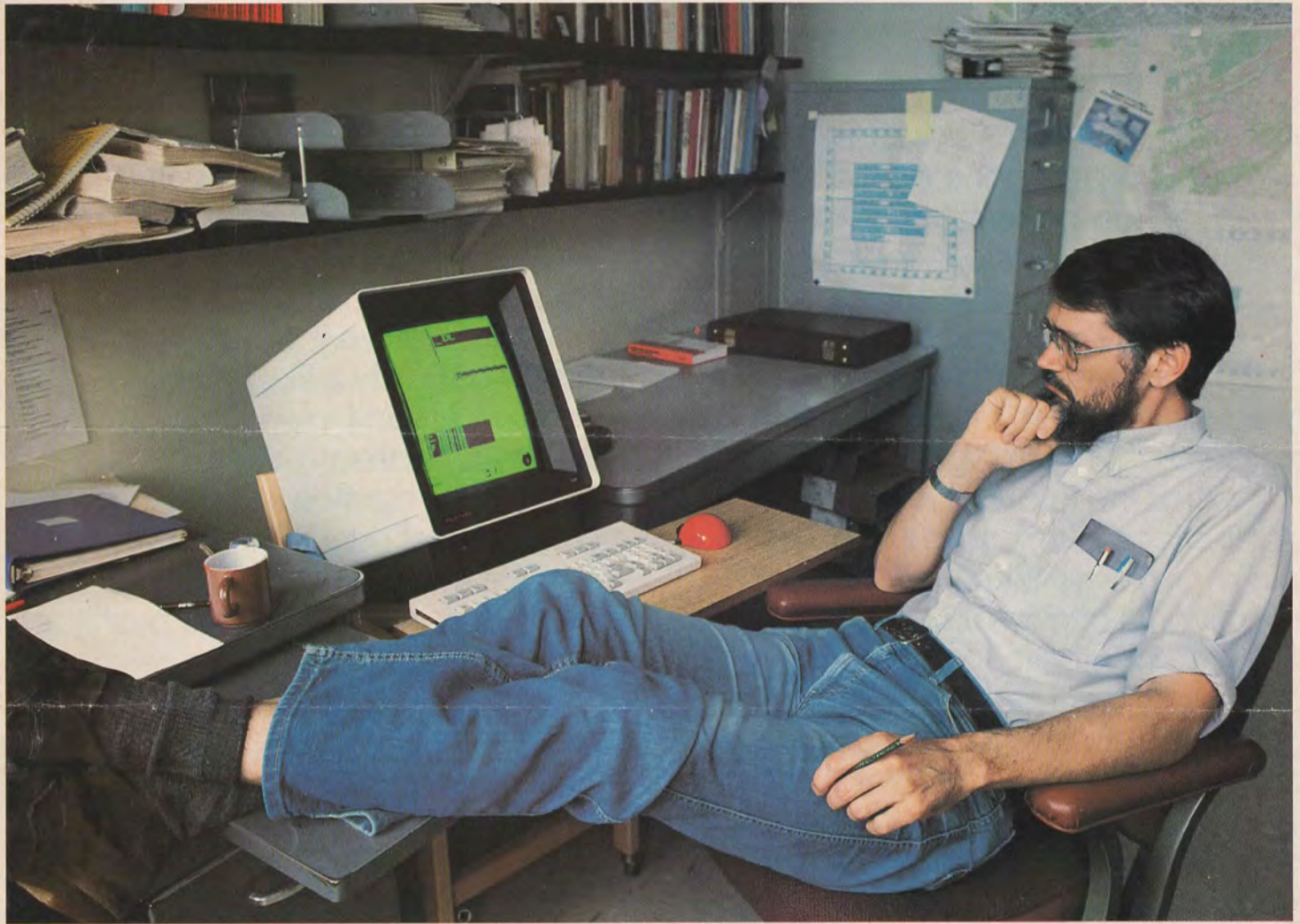
■ A major virtue of Unix is leverage—a little tapping on the keyboard can bring on a lot of action in the computer. As an example, people at Bell Laboratories point to the set of instructions below. They tell a computer to print out each word in a document, along with the number of times the word occurs, arranging the words in descending order of frequency. That may not be what you want from your computer, but it's a pretty good test of an operating system. A while back, a Bell Labs programmer asked outsiders to estimate how many lines of instructions the task would require—lines, in this sense, meaning commands—and most of the replies fell in the range of 100 to 1,000. With Unix, just seven short commands do the trick.

- tr [A-Z] [a-z] |**Make capital letters lower case.
- tr -d "(,;:\\"' -_!?)\" |**Delete punctuation.
- tr " " \"012\" |**Put each word on a separate line.
- sed -e "/^ *\$/d" |**Delete blank lines.
- sort |**Sort words in alphabetical order.
- uniq -c |**Count occurrences of each word.
- sort -nr**Sort by frequency, in descending order.

Where does the leverage come from? Brian W. Kernighan, the Bell Labs programmer who coined the name Unix, explains that pieces of the job are already done before the user taps a single key. Each of those seven brief directives begins with a general purpose command, such as "tr" or "sort," that is a program in itself. And Unix is so designed that instructions to modify the general purpose command can readily be "glued on," as Kernighan puts it.

Kernighan himself doesn't believe it would take anywhere near 1,000 lines of instructions to get the same job done without Unix—something like 100 lines should be enough, he says. But he adds with a chuckle that one outsider, an executive at a computer company, guessed 20,000 lines.

SHOULD AT&T fail to establish Unix System V as the standard, the company will still have a future as a computer maker, though a smaller future than it now hopes for. AT&T is a company with formidable resources. Even after the breakup, it has assets of \$39 billion, compared with IBM's \$38 billion. While its labor costs are high, AT&T has some of the world's best semiconductor-manufacturing facilities, which turn out advanced logic and memory chips, vital innards of computers. More and more, says Jack Scanlon, AT&T will be incorporating Unix into microprocessor chips to become the world's lowest-cost producer of Unix computers. "With our technology," he says, "if we can't win the battle of building outstanding price-performance Unix engines, we won't deserve to win the



The name Unix was coined by programmer Brian Kernighan, 42, recalling an earlier system named Multics.

race." To him, winning means being No. 2 by the end of this decade.

BUT TO WIN in terms that ambitious, AT&T will have to do better in the struggle to establish System V as the Unix standard. Northern Business Information Inc., a New York market research firm, estimates that with Unix System V the standard, the company's computer revenues would pass \$4 billion in 1988. With Xenix or some other variant the standard, AT&T's computer business would be only about half that size.

All this lay completely beyond the visions of the Bell Labs programmers who originally devised Unix. Work on it started back in 1969 because Ken Thompson, 41, a bearded, long-haired programming pioneer who has been known to work 30 hours at a stretch, felt frustrated in constructing a computer game he called Space Travel. The project

was an exercise in writing an applications program, and Thompson was dissatisfied with the sluggishness and unresponsiveness of the computers at hand.

Big operating systems of the sort that ran those computers are normally a product of hundreds of systems designers and programmers, and they incorporate many compromises. Thompson decided to strive for simplicity. Instead of incorporating rigid rules, he wanted as much freedom and flexibility for users as possible.

Thompson was soon joined by another Bell Labs programmer, Dennis Ritchie, also bearded and inquisitive, and the two began incorporating into Unix the best features they could find in various operating systems as well as contributing their own concepts. One of their most brilliant additions was the concept of "pipes," through which one command can be connected to another, allowing the user to create new applications programs

by stringing together Unix "words" into "sentences." The Unix language provides an unusually large number of preprogrammed commands—more than 200—for sorting data, manipulating text, or searching for information (see box, page 70). These "utilities" can be used in thousands of combinations, offering the user a range of instruments of unusual scope, versatility, and power. "Unix," one user observed recently, "is the Swiss army knife of software."

In the 1970s Unix came to be widely used throughout AT&T and began reaching outside, even though AT&T wasn't pushing it as a commercial product. The company proceeded warily, because restrictions imposed by the Department of Justice prior to the breakup barred it from entering the computer business. Licensees got only the basic Unix "source code," the bare bones of the system, for \$20,000. Universities, however, were licensed free of charge—now it's

TECHNOLOGY

\$800—and that proved a smart idea. Some 750 universities around the world, about 80% of those with computer science departments, are Unix licensees. It is hard for a computer science major to graduate without having been exposed to Unix. As a result, a substantial portion of the country's total programming force is trained in Unix. As former students begin to attain positions of responsibility in their companies, many of them will put in Unix systems.

The licensing of Unix proved a mixed

blessing for AT&T as enterprising programmers working for licensees undertook to improve the system. Unix derivatives now come in nearly as many flavors as Howard Johnson's ice cream. In the roster of variants with Xenix are Venix, Zeus, Uniplus, Unity, and about 25 other licensed versions, as well as nine unauthorized Unix look-alikes with names like Cromix, Qnix, Unos, and Unetix. AT&T itself has contributed seven versions of Unix—the results of *its* enhancements of the original. Although close in content,

sometimes sharing as much as 90% of the original's instructions, the Unix variants create confusion in the market and mean additional work if a user wants to make software for them interchangeable.

In efforts to establish System V as the Unix standard, AT&T has concluded a pact with Digital Research, a \$40-million-a-year software company and rival of Microsoft, to write applications programs for Unix-run machines and to assemble a library of such programs from other software producers. The objective is to greatly increase the number of Unix applications programs—for microcomputers, minicomputers, and mainframes. The number now stands at 300, a puny total compared with the thousands of programs available for personal computers alone.

INFORMATION WORTH MILLIONS

■ Unix authority Jean Yates, 30, is a zoologist by training who got hooked on computers when she bought herself one in 1979. She quit her job selling radioactive biochemicals and went to work for one of the first ComputerLand stores, in downtown San Francisco. Noting that "customers were just dying for information," she decided she was in the right place at the right time. "If I worked real hard, I could make my millions." She did, but not at ComputerLand.

In 1981 she joined a California market research firm, where she concentrated on the computer industry. While doing a study for a Japanese computer company, Yates and her co-workers concluded that the operating system it should use for its high-performance machines was AT&T's Unix. Needing money for a down payment on a house, she decided to write a computer book, and with a co-author she produced a user's guide to Unix. About 200,000 copies have been sold so far.

Yates started Yates Ventures in May 1982 "with \$1,500 in the living room," as she puts it. Its mission was to provide market research on Unix and its variants and to publish a newsletter, the *Yates Perspective*, on the Unix market, although the market barely existed then. As the use of Unix and Unix-like operating systems has spread, the firm and the newsletter have flourished. Six months ago, with revenues running at about \$4 million a year, Yates sold Yates Ventures to International Data Group, a computer research and publishing company in Framingham, Massachusetts, for a price in the millions.



Jean Yates, president of Yates Ventures, struck it rich with Unix.

UNIX SOFTWARE will proliferate with the exploding population of Unix-run computers. Of the 235,000 installed computers of all sizes that run on Unix or variants, according to Yates Ventures, 90,000 were shipped last year and 115,000 so far this year. AT&T's problem, now aggravated by IBM's choice of Xenix, is how to get fast growth in the number of System V computers. About half the installed computers with Unix or Unix-like operating systems run on Microsoft's Xenix and only 5,000 on System V. AT&T's Scanlon observes that "every time a copy of Xenix is sold, my cash register jumps," but so far all the Unix licenses together bring in only tens of millions of dollars a year to AT&T, a drop-let in the company's estimated \$35 billion in annual revenues.

In fact, AT&T is still pricing its licenses to spread the system rather than maximize profits. A user pays \$43,000 to fit one of his own installed computers with Unix, but his second Unix will cost \$16,000, and additional purchases drop to \$1,000 apiece if he helps push Unix by sublicensing it to others. For a mere \$25,000, a manufacturer can get a license allowing him to sell machines of his own that run on Unix. The manufacturer pays AT&T a royalty on each machine sold, ranging from \$24 on a small computer up to thousands of dollars on large mainframes.

To get Unix on more machines, AT&T is enlisting software manufacturers to purchase the basic instructions that make Unix run, and adapt them to particular computers. Toward that same goal of increasing the population of Unix-directed computers, AT&T recently entered into agreements with four semiconductor manufacturers—Motorola, Intel, National Semiconductor,

and Zilog—to have them adapt Unix to their 32-bit microprocessors. These are the engines that will drive the emerging desktop supermicros, as powerful as much larger minicomputers were just a few years ago. Under the arrangements with AT&T, certain architectural features are incorporated into the chip design to enable these microprocessors to run Unix efficiently. AT&T wants to ensure that when those central processors are incorporated into computers, they will be

able to run a version of Unix System V that comes from AT&T. Those chips, however, are flexible enough to run Microsoft's Xenix and other non-AT&T versions of Unix.

Besides having to buck Xenix and other Unix cousins, System V is starting to encounter competition from improved versions of operating systems that are not based on Unix. Microsoft, for example, is upgrading its MS-DOS, which is used, with variations, in more than two million personal comput-

ers. The company has begun incorporating Unix-like multitasking features to compete against Unix.

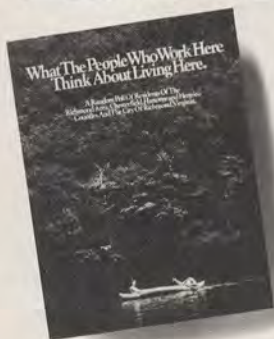
Some of AT&T's problems were self-inflicted. For one thing, the company draws criticism for not putting a "friendlier" face on Unix for the commercial market; the language devised for Unix bristles with sometimes puzzling clumps of letters. Jean Yates condemns as "ridiculous" AT&T's failure to provide System V with "record locking," a safety feature to prevent loss of data. Xenix does offer record locking as well as a friendlier interface with the user.

AT&T also appears to be doing a poor job of marketing its new Unix-run computers. For instance, Carl H. Reynolds, staff vice president in charge of data processing at Hughes Aircraft, was intrigued by AT&T's new Unix-run 3B supermicros. AT&T salesmen called on one of his subordinates, but when the man asked for a demonstration system, they said they couldn't make one available. "They kind of ignored me," says Reynolds. And he is the sort of computer executive who could help AT&T spread Unix. The verdict from Reynolds: "They don't know how to sell in the data processing market."

JEAN YATES is severely critical of the way AT&T has handled Unix, but she nonetheless thinks highly of the prospects for Unix-based systems. She predicts that they will come to be used in the majority of companies, both small businesses and FORTUNE 1,000 corporations, before the end of the decade. Most analysts seem to share the Yates Ventures outlook in predicting fourfold to fivefold growth for Unix and its derivatives in the next four years.

Among the principal beneficiaries of Unix will be Japanese computer manufacturers. For the Japanese, who have been notoriously weak in designing imaginative software, the popularity of Unix comes as a godsend. They can now license Unix from AT&T, much as they licensed the transistor, and cash in on their superior manufacturing capabilities. The Japanese have chosen a fast-growing segment of the computer market, engineering work stations, as their entry point with Unix-run machines. And they are widely expected to manufacture a variety of Unix-run machines to compete with IBM around the world. So by a roundabout Pacific route, Unix may yet prove to be quite painful for IBM—even if it doesn't live up to all of AT&T's high hopes. **F**

Two Opinions On Living In Richmond.



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You can ask the people who live here, as an independent research firm recently did. They discovered that both new and long-time Richmond residents believe they have a lot to be thankful for.

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The Richmond Area

Find out what the people who work here think about living here.

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