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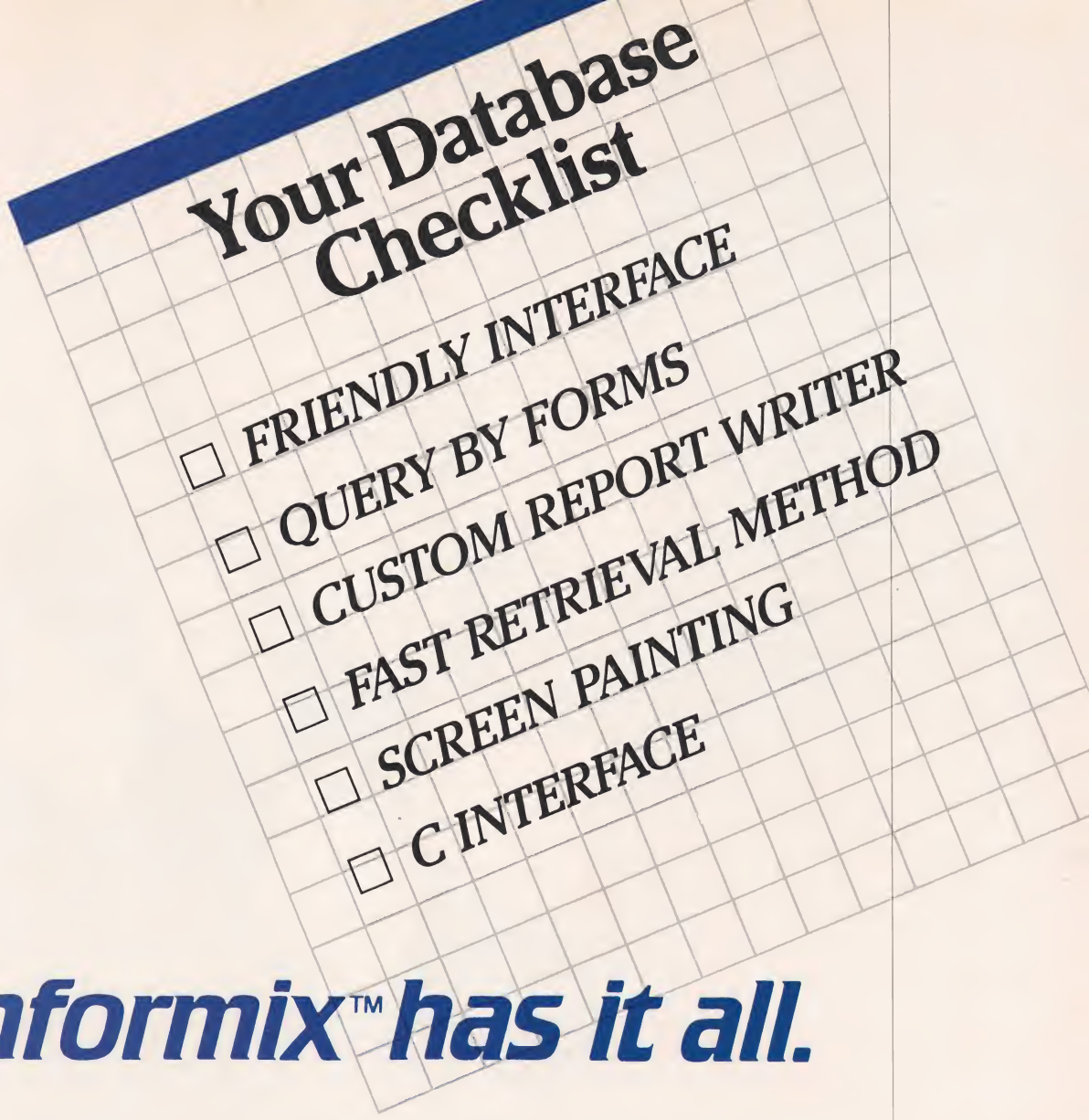

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THE PUBLICATION FOR THE UNIX COMMUNITY

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July 1984

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VIEWPOINT

AT&T crosses the threshold

Those of you who saw a copy of last month's issue may recall our focus on IBM's first UNIX offering, PC/IX. This month, we offer the obvious companion piece, an issue devoted to AT&T's entry into the world of computer merchandizing.

Not only are IBM and AT&T now the two largest players in the UNIX field, they're also apparently intent on wooing the same market: Fortune 1000 accounts. Developments in the race should keep industry watchers entertained for months.

To familiarize you with the 3B products AT&T has to offer and the directions it intends to take, we have included articles from a variety of perspectives. Harry Avant and Andy Felong, two systems analysts working with Jet Propulsion Laboratories, offer the first independent hands-on review of the 3B2 to appear anywhere. Fact sheets developed by *UNIX REVIEW* in conjuction with Lillian Bjorseth, senior public relations officer for AT&T's Commarize specifications for the 3B5 and 3B2 computers. Both Don Anselmo, AT&T product manager for the 3B line, and regular *UNIX REVIEW* columnist Mark Sobell assess the directions AT&T will take in its new role as a computer company. Comparisons between AT&T and IBM are drawn by Ned Peirce, a systems analyst at Bell Laboratories. And Larry Crume, director of Systems Engineering and Planning at Bell Laboratories, shares his thoughts on the future directions of UNIX.

If this lineup seems heavily weighted with AT&T input, it's only because nobody knows the company or its products as well as those working on the inside. We've also tried to include as much independent comment as possible, but on the whole we've gone straight to the source to get the best information available.

We hardly expect this to be the last word on the 3B family of computers. Articles by the score are sure to appear in the months ahead as more information becomes available. But, if any more exhaustive assessment of AT&T's entry into the computing business has been made to date, we're unaware of it.

In the months to come, *UNIX REVIEW* will move away from vendor-specific issues to cover more generic topics, such as document production and system administration under UNIX. Themes related to product announcements are unusual for us, but when giants such as AT&T and IBM make major UNIX announcements, it's news. And our commitment is to bring you all the UNIX news that's fit to print. That's a promise we mean to keep.

Mark Compton

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DEVIL'S ADVOCATE

The world according to Stan

by Stan Kelly-Bootle

This is the second of my reader-friendly columns. Owing to the wonderful advances in CAD (Computer Aided Delay) and the publishers' cranky deadlines, it is being penned before any feedback on my June contribution, positive or otherwise, has hit either me or my fan. Rumor has it that the jury is out to lunch and refuses to come back.

However, some of my colleagues who follow that branch of Statistics and Measure Theory known as Baseball assure me that I can already claim a *streak*. In BASEBOL, a *streak* is a fundamental two-dimensional data type of the form [integer N, boolean B], where N is the length and B is the type of streak, with values 1 for "winning" and 0 for losing. The BASEBOL Standards Committee has yet to assign a value for "ties," but a decision is promised before the ALL* break of 1997.

At any rate, I hereby claim a [1,X] streak, with X to be determined. "Way to go! Hang in there!" I hear you cry. Yet your sarcasm is misplaced – I have made that quantum leap away from the null-streak. Move over Mencken! Cool it Caen! Resign Royko! My [1,X] is the stuff that dynasties are made of.

Last month, I left you as the IBM/AT&T battlelines were being drawn. As you may have heard,

UNIX REVIEW successfully outbid NBC for exclusive news coverage of the conflict, so I hasten to assuage your natural curiosity. "O For a Muse of Fire," indeed, for the events I am to unfold are momentous, cosmos-shattering and unreported elsewhere. First, though, let me invoke the copious pen of James Michener to trace the roots of the war which entwine deeply within the corporate compost of the past.

Shortly after the Big Bang, silicon appeared, and then from the swirling galaxies the Earth was formed, bringing algae, dinosaurs, primates and inventors like Alexander Graham Bell.

It is 1873, and we find Bell busy perfecting his prototype telephone. One day, in a blinding flash of prophecy, he realized that Information Processing would need both Communications *and* Computing. Further, Bell reasoned, Computing would need a flexible multitasking, portable Operating System...but, wait, he thought, one thing at a time: let's get this damn phone off the hook first.

Nervously, he dialed his first number ever, no mean feat in those pre-directory days, and lost his only dime. The dour, inventive spirit is undeterred by such setbacks: Bell immediately dashed out to the nearest 7-11 for change. His diary for that day tells us, "Good progress with the coin recovery mechanism, but perhaps the answer lies in some form of encoded credit card." Experience had, of course, taught Bell to confine these fertile speculations

---

Stan Kelly-Bootle is a grizzled mainframer who worked on the pioneer EDSAC I at Cambridge University in the early 1950s. As founder/President of the LISA Moaners' Club, he urges more machismo and less user-molly-coddling in software. In spite of some reservations, he feels that UNIX is a bandwagon heading in the right direction. His exposé of computer scientific epistemology in the lexicographic environment, "The Devil's DP Dictionary" (McGraw-Hill, 1981), is to appear soon in a Japanese language edition (Shizen Sha, Tokyo).

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to his diary and deaf-mute housekeeper.

His financial backers were growing restless. "He's a rum one, and no mistake," they mused. "Keeps coming back for more seed money. Twenty dollars a week in nickels and dimes."

Bell pressed on, though, driven by reports that his rivals were getting closer. His diary entries were becoming brief and frantic. "Am going crazy! Heard ghostly voices today say, 'The service you have reached is uninvented at this time.' Then got three *busy* signals! Who? How? Perhaps the answer lies in some form of clandestine tapping device?"

By 1876, Bell had ironed out most of the gremlins and felt ready for his master stroke: the birth of teleprocessing. During his first public demonstration of the telephone, he was going to propose a merger between his fledgling Bell Telephone Company and IBM, or to avoid blatant anachronisms, IBM's precursor, CTR (Computing-Tabulating-Recording Corporation) in Endicott, NY.

His famous proposal echoed round the world: "Watson, come here! I want you!"

The world cheered the first-ever telephone call but had no understanding of its profound significance; nor until now, was T.J. Watson's reaction ever revealed. Watson simply grunted, "No. You come here," and hung up. They were never to meet. The golden chance had slipped away. They each took separate roads, built separate Romes. And the rancor of that brief altercation smoldered for a hundred years...

It is 1981. Peter Drucker writes, "IBM is at a point where its product is becoming the 'wrong' product... even AT&T, despite the intelligent management of its monopoly, is now at the point where its product is the 'wrong' product."

The two giants, thus eyeing the other's domain with growing envy, had reached their respective positions via radically different routes. AT&T's monopoly had been "thrust upon it" but carried the increasingly irksome burden of regulation, especially in the form of consent decrees against competing outside the communications arena.

On the other hand, IBM's effective monopoly in computers, which it had always hotly, expensively and successfully denied in the courts, had been gained the hard way, namely by outselling every dwarf on the block. It had even made significant incursions into AT&T's preserve by acquiring CML Satellite Corporation and Rolm Corporation.

Consider, then, two of life's most risible ironies (see my forthcoming book, *Life's 50 Most Risible Ironies*): IBM's predominance is the result of Bell Labs' technical innovations (the work of such pioneers as Stibitz, Shannon, Bardeen, Brattain, Shockley...)

Photo courtesy of Pat Johnson Studios

Stan and his wife Iwonka are ready to take advantage of the great marketing war.

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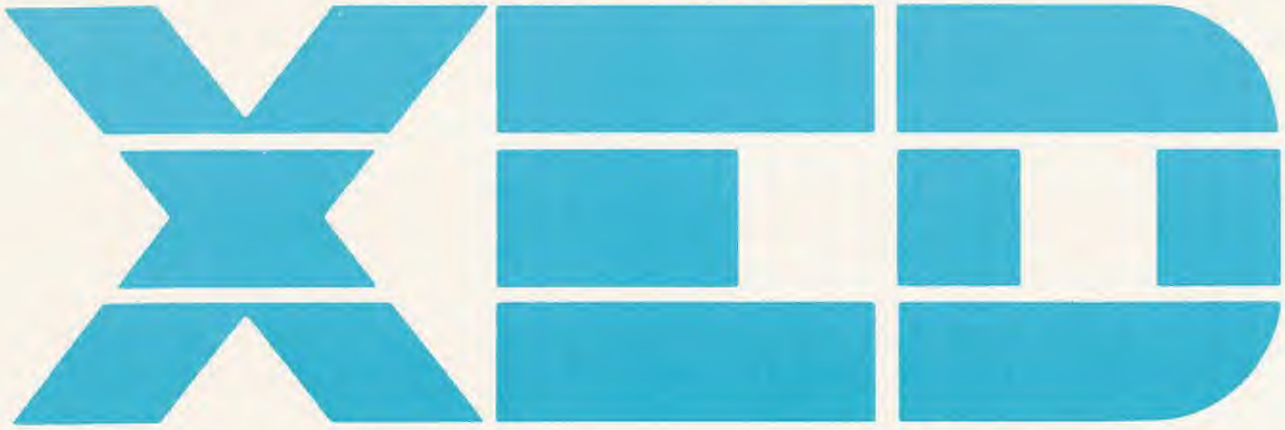

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and NCR's marketing finesse (inherited and honed by T.J. Watson, Sr. via marketing masters Patterson and Flint). Also, IBM's monopoly extends to anti-antitrust legal expertise, leaving AT&T defenseless against US Government plans to dismantle Ma Bell's Gang.

It is 1983. At a secret AT&T facility, a marketing consultant brought in from Drano Inc., is addressing a newly formed sales team.

"I have some good news, some not-so-good news and some thoroughly depressing news. The good news is that, at long last, we are free to compete outside the telephone business. Compete? Oh, yes, let me sell that out for you on the chalkboard."

"The not-so-good news is that others can now compete with *us* in the telephone business, so come on fellas, eh? Let's pull our socks up before we're flooded with cordless junk from Outer Mongolia."

"The depressing news is that your board has decided to go for the big one. Yes, friends, we are going to sell computers, and whichever way you shuffle that pack, let's face it, we'll be up against IBM. Need I warn you that IBM is the most cunning, subtle force in corporate history? Take its devious reaction to our impending attack on its citadel. It had the brazen effrontery to offer us manufacturing and marketing rights to the IBM PC Jr., exclusive and free of charge! Your board, quite rightly, rejected this Trojan horse manure. No sir, we need no outside help in screwing up a product. Next, to confuse the public, it rushed out versions of our beloved UNIX."

"This ploy will fail, gentlemen, because we have developed a can't-fail promotion to bring UNIX to millions of housewives across the nation – housewives, the soft belly of the marketplace, completely ignored by IBM! In conjunction with Del Monte Foods, we are offering substantial discounts and free gifts. Open your brochures to page 12. There you'll find a delighted couple that has just clipped their 50th fruit salad label. If you read the caption, you'll find that he is screaming, 'We have won the Bourne Shell special!' while his wife coyly whispers, 'Yes, and a free weekend with Steve!' "

It was at this point that a grim-faced spy from IBM slipped out of the room.

The confrontation can be examined in broad, abstract terms as the archetypical struggle between Good and Evil, or as James E. Olson, vice chairman of AT&T might have put it, between Engineering and Marketing. Such grandiose dialectics, however, do not reveal the human face of the Second Civil War, with its countless daily glories and follies. I know...because I was there!

During the early days of the so-called Phoney War, I recall wandering round the AT&T camp one evening sensing that morale was low. The ragged, ill-equipped volunteers, known as the Ma Belligerents, seemed no match for the slick, mechanized ranks of the Big Blue Brigade massed across the river. Rumors were rife, the rifest being that the US Government's peace overtures had collapsed, that IBM had hired the entire Senate, Congress and Department of Defense, and that the President had accepted a life-long IBM Fellowship. It was David and Goliath; sheep and lions; phone jacks and F1 fighters. AT&T's supply of ammo was down to a couple of antiquated shells brought in by the Berkeley Irregulars.

High above, twinkling and mocking, glided a CML satellite looking for intelligence but finding only despair. AT&T's counter-measures, two ragged, tetrahedral kites from the Bell Museum, summed up the wide gulf in technologies.

A pale rookie was chatting with his slightly less pale Sergeant as a plaintive harmonica vamped in the distance, "All Quiet Along the Poughkeepsie."

"What will you do when it's all over, Sarge? You know, supposin' we..."

"Don't you worry now, sonny, we'll win through."

"But I hear they've recruited the whole bleedin' CIA, coverts and all."

"Recruited? That's a laugh. Why, the CIA has been an IBM subsidiary since 1936. Know your enemy, lad. Know your enemy. Anyway, it's time you was turning in. Early start tomorrow. Phone jack drill at five."

"Lord, not *again*, Sarge ...seems so useless against *that* lot."

We all looked across at the huge Big Blue encampment, ablaze with lights. We could actually see the crack T.J. Watson Senior Division lining up at the automatic time-recording stations and clocking off with their mag-stripe plastic ID cards. Again, the depressing disparity in equipment and logistical methodology stood out.

"God," whispered the Sergeant, "we could sure use some of that discipline. Take those Berkeley Irregulars, supposed to be our secret weapon. They're a real shower of starve-the-barbers, make no mistake. Bright bastards, granted, but they spend half their time arguing among themselves, echo this, echo that, day in, day out. What we need is a uniform command structure, and that takes discipline."

"Oh, I dunno, Sarge. Them Berkeley chaps have been through hell lately. Did you hear that some

Continued to Page 79

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3B2/300 UNVEILED:

UNIX REVIEW offers the first independent assessment of AT&T's supermicro

by Harry Avant and C. Andy Felong

Photos courtesy of AT&T Bell Laboratories

Many 3B2 users will have Teletype 5620s like this sitting at their workstations. The 5620 makes good use of the 3B2's bit-map capabilities.

A HANDS-ON REPORT

AT&T's announcement of its entry into the general purpose computer market at COMDEX/Winter signaled the first availability of the WE 32000 CPU to the general marketplace. The chip will make its initial appearance in several of AT&T's new computers, the low end of which is the 3B2 Model 300, billed as a "desktop supermicro."

The 3B2 is set apart from other makes by its unique CPU, its support for up to 18 users, its full integration of hardware and operating system and its petite dimensions (the 3B2 fits into a box only slightly larger than many 16-bit desktops). It's hard to believe that a computer with this much power actually only measures 22 inches in width by 17 inches in depth by 3-1/2 inches in height. Unlike many other multiuser supermicros that are too bulky to sit on a desk, the 3B2 fits comfortably.

THE 3B2 HARDWARE

For evaluation, AT&T sent us a 3B2 Model 300 equipped with 2 MB of memory, a 32 MB Winchester drive and an additional I/O card. Two Teletype terminals, a Model 5420 and a Model 5620, and a Penril/DATACOMM 300/1200 Data Modem completed the package. Bundled in with the hardware was the *UNIX System V Core Software Package* and several utilites.

When we removed the cover, we found that the 3B2 is truly simple in appearance. Its interior layout is very clean and modular in construction. While the 3B2 is indeed a complex computer, its interior is not crowded in the least. AT&T has made it possible to expand memory and add accessory cards without any major disassembly.

The 3B2 hardware consists of four major units:

1) System Board
2) Hard Disk Drive
3) Floppy Disk Drive
4) Power Supply

The system board contains the CPU, DMA controller, timers, interrupt handler, memory, memory management unit, PROM, RAM, disk controllers (for both floppy and hard disks) and connectors for I/O "feature" cards. For all that, the board only occupies a modest 8 by 15 inch space.

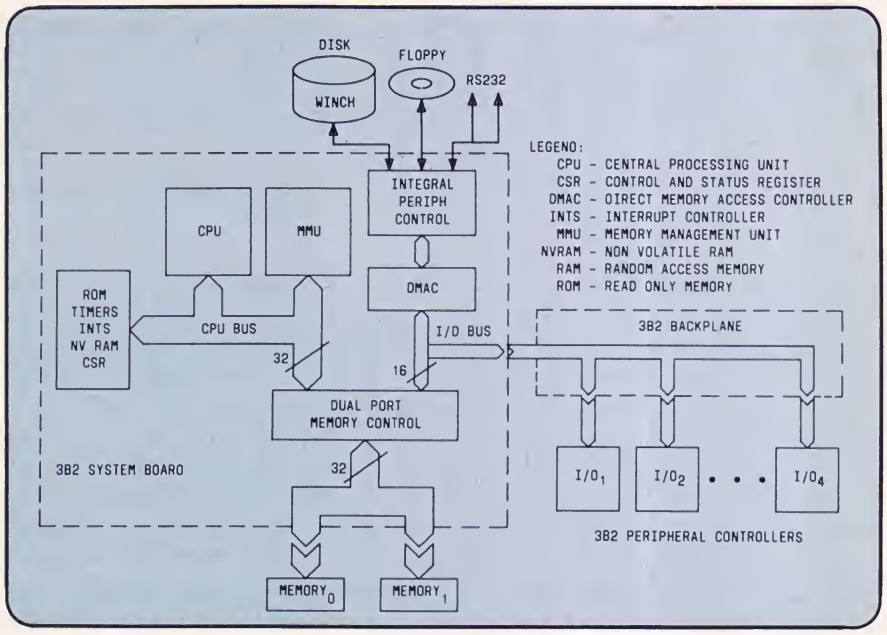
It's really hard to believe that a computer with this much power is this small.

The machine we used features a Western Electric WE 32002 Processor Module microprocessor. This is a true 32-bit CMOS CPU, with 32-bit data and address buses. The CPU, along with its associated memory management chip, bus interfacing and interface controllers, is mounted on a small sub-board, about 2 by 3-1/2 inches in size. As yet, AT&T has not released clock speed data, nor specific CPU internal architecture information. Bitwise operations of byte, halfword or word length (32 bits) are possible. Up to 4 GB of virtual memory or 2 MB of physical memory may be addressed.

Self-testing, bootstrapping and auto configuration are performed by 32K of PROM. During power-up, memory is initialized, diagnostics are started and PROMs execute what AT&T refers to as "sanity tests." After a minute or two, if all is well, the console will display a system ready message and ask for a console login. Additionally, diagnostic system checks can be run under a *Diagnostic Monitor Utility Program* supplied with the basic software set.

Random Access Memory varies from a minimum of 512K to a 2 MB maximum. The memory chips are AT&T's own 256K Dynamic Random Access Memory (DRAM) devices that use NMOS technology. These chips are organized as 256K by 1 bit and are stated to have a 105 nanosecond access time. Two memory card connector slots are provided on the system board. Memory is available in three configurations: two 256K memory cards, a single 1 MB memory card or two 1 MB memory cards. The cards are only 8 by 1-3/4 inches – pretty impressive for a megabyte!

Disk controllers for both floppy and hard disks are located on



Architecture of the 3B2/300.

the system board. The 5-1/4 inch floppy disk drive is capable of reading and writing both single and double density formats. This drive is a 96 track per inch type, resulting in a maximum storage capacity of 720K of data. The floppy disk is used for software loading and archive purposes but is not otherwise used during normal operations.

Two different 5-1/4 inch hard disks are available for the computer. The first offers 10 MB capacity while the more sensible option offers 32 MB. The *UNIX System V Core Package* occupies a megabyte or two in a minimal usable configuration, disk paging for virtual memory probably needs at least a megabyte and the C language and its associated utilities require about 2.4 MB, so it is hard to understand why a 10 MB drive is even offered – especially on a system that will support so many users.

Input and output is handled via serial ports for the console and additional terminals. The basic configuration provides two ports, each being RS-232C asynchronous, full duplex and capable of operating at up to 9600 baud. Four connectors are provided on the backplane that allow for expanding the system I/O. Each connector can accept a "feature" card. Each of these cards allows for the addition of up to four additional serial ports, as well as a single Centronics parallel printer interface port.

Each feature card contains an 80186 microprocessor, 32K of static RAM, 16K of read-only memory and uses 2681 dual UARTS. That's a lot of "horsepower" for an I/O card measuring about 6 by 7 inches. A 16-bit data bus is used by the feature card in conjunction with direct memory access for bulk data transfers. Specifications for the cards indicate a 19,200 baud maximum per serial port, with a 38,400 baud maximum per card.

Since the feature cards share a common I/O bus with the main board, some reduction in I/O speed will occur as more cards with active I/O are utilized. Each card will support simultaneous output to four serial ports at a full 9600 baud if less than 80 percent of the I/O channel's capacity is utilized. A feature card drops to 4800 baud rating with all four ports running at 100 percent of capability. Feature card physical I/O uses a standard Centronics type connector for the optional parallel printer port and an eight-pin telephone modular jack for the serial output.

A second type of feature card, used for interfacing to Ethernet, is also available. Use of this card reduces the maximum number of system users to 14.

Data is available to qualified OEMs that provide complete specifications for interfacing third-party cards. This could open up an interesting spectrum of add-on cards for such items as built-in modems, color graphics and interfaces to various non AT&T mini and mainframe computers.

The system board also contains nonvolatile RAM (with battery backup) that is used to preserve essential information, such as terminal settings in case power is accidentally lost. The normal power down for the 3B2 consists of an automatically induced "soft" power down that flushes file buffers to prevent loss of data. This same RAM stores diagnostics results that repair persons can review in the event of a system failure.

A battery-powered time-of-day clock is used to keep correct date and time even when power is off.

CRASH HISTORY

Despite the many nice features of the 3B2, our review did have its rough moments.

A typical UNIX machine is normally powered up and online 24 hours a day, seven days a week. This is the mode in which we operated the 3B2. On the sixth day of operation, while no one was logged on, the system experienced an unrecoverable kernel-related

error. The diagnostic message printed out on the console terminal was, "Panic: Kernel MMU Fault (3)" along with a note to consult the *Owner/Operator's Manual* for help. In our case it was not necessary for the computer to tell us to "Panic"!

The system was powered down and rebooted following directions in the *Owner/Operator's Manual*. This was successful and all seemed well.

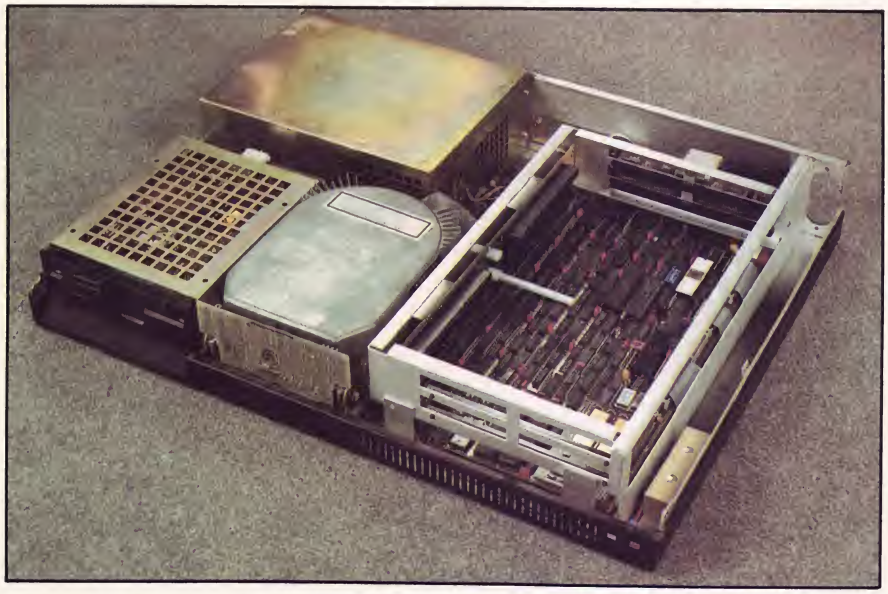
In the day and a half following the first crash, the system failed another two times. A different error message, "Panic: Kernel Alignment Fault", was displayed on the console. A frantic call to the support team at AT&T resulted in the suggestion to check RAM boards. The low memory addressed board, containing 1 MB of memory, was removed and replaced with the other megabyte RAM board. Another crash within 24 hours indicated the problem was not solved, though, so another call to AT&T was made.

This time the speculation was that the version of the UNIX System V operating system resident on our 3B2's Winchester may not have been the current release. During a midnight visit, an AT&T representative swapped out the 32 MB drive for a new drive preloaded with newer software. No system problems have been experienced since.

Upon analysis, our AT&T contacts determined that while the operating system on the original hard disk was not the latest release, the cause of our problems laid elsewhere. The fault apparently, was caused by a separately available utility package that reconfigures the UNIX System V operating system on the 3B2 for improved performance. Called the *System Reconfiguration Utilities Package*, this software was designed to allow the system to be tuned to a particular set of hardware. AT&T has fixed the problem we uncovered and the correction will be incorporated in the next utility software release.

SOFTWARE OVERVIEW

Software for the 3B2 consists of the UNIX System V operating system, standard UNIX utilities, diagnostics and optional packages. For the most part, only software supplied with the evaluation unit will be discussed here.



An inside view of the 3B2.

A *3B2 Core UNIX Package* which encompasses the system kernel and essential utilities is resident on both the hard disk and four floppy diskettes (for restoration in the event of a disk error or crash). This enables booting the system and running immediately upon "plug in." A diagnostic monitor program enables users to isolate system problems as well as perform additional utilities. Optional packages include programming languages and networking, communications and graphics utilities as well as other areas not addressed in the essential utilities package.

The *Essential Utilities Package* provides system commands that support basic computer use. One of its most important commands is the Bourne Shell command interpreter (**sh**). Most frequently used UNIX file manipulation commands such as **cat**, **cp**, **ed**, **mv** and **rm** are present. Common directory commands such as **cd**, **mkdir** and **rmdir** are also here. There are about 80 commands in all included in the "essentials."

Two areas worthy of note are the *Simplified System Administration* subcommands and restricted access commands. The **sysadm** (system administration) command invokes a menu mechanism that enables access to four sub-menus addressing: media management, machine management, system setup and user services. The media management menu allows for diskette formatting, backup and restoration of files to or from floppies and the installation of new software from floppies to hard disk. Curiously, it includes the ability to run a program resident on a diskette. One wonders if this command is pro-

The Teletype 5620 dot-mapped graphics terminal is a common companion of the 3B2/300.

vided for use in conjunction with copy-protected software. In any case, the **format** and **run** commands, among others, are not implemented in the supplied release.

Machine management and system setup menus enable a user to display disk usage, set the correct time zone, shutdown the system and set administrative passwords. A nice touch here is the ability, at the time of system setup, for a user to login to the system as "setup". This invokes an interactive program that enables the creation of user accounts, groups and associated passwords. This ability may also be gained by invoking the user service menu.

Several restricted rights commands are included in the *Essential Utilities Package*. The **rsh** shell is a restricted version of the standard shell used to set up login names and execution environments. Its capabilities are considerably more controlled than are those of **sh**. The **rsh** shell only allows files in the current directory to be edited. It prohibits execution of shell commands while in the editor. So businesses with sensitive or compartmentalized data and applications should be able to use **rsh** to create very secure user environments.

A diagnostic monitor utility program supplied with the system is used for setting the time-of-day clock, system exercising and trouble isolation. A floppy disk may also be formatted by this program. This appears to be the only way to accomplish this at the present time. To enter the diagnostic program, UNIX must be shut down. Upon program exit, UNIX may be rebooted from either hard disk or floppy disk.

In our case it was not necessary for the computer to tell us to "Panic"!

Utility packages other than the essential utilities supplied with the 3B2 range from system administration utilities to calculator utilities. Packages are included for advanced shell programming, directory and file management and text editors including **vi** from Berkeley UNIX. Over 35 commands are included in the system administration utilities package alone. These commands are intended to allow the experienced user to control and maintain the system. Typical commands include **mkfs** for the initialization of formatted floppies, **sync** for the flushing of RAM resident data to disk and **makekey** for generating cryptographic keys.

While there are literally hundreds of commands contained in the standard utilities packages, the absence of several normally associated with UNIX is perplexing. Missing from AT&T's System V are **tar** and any version of **more**, **spell**, **nroff**, **troff** or **man**. The **tar** utility is the usual method of disk backup, so its absence raises questions of how multivolume and incremental disk backups are to be performed.

It is understandable that

Continued to Page 90

INDUSTRY INSIDER

An executive view of the new AT&T

by Mark G. Sobell

In case you just tuned in, AT&T has entered the hardware marketplace with a line of machines ranging in price from $10,000 to over $300,000. It's also deep into the software marketplace with UNIX System V, the operating system driving each of the new machines. Because of AT&T's recent breakup and its history as a utility company, many people are questioning the company's ability to manufacture, market and support its hardware and software.

I spoke with several prominent Bay Area executives to get their responses to some of those questions.

Dick Murphy, Vice-President of Marketing at Relational Database Systems, manufacturers of INFORMIX database software, was very clear in his views.

"Without qualification, AT&T is a viable computer company," he said. Murphy made the point that AT&T has been manufacturing computers in quantity for 30 years. However, he sees the computer industry questioning the company's ability to market a high volume of computers – an area in which it has minimal experience.

Murphy's perspective is that of a former management consultant to utilities, including telephone companies.

"Controlled monopolies, such as AT&T before the breakup, must provide quality products and reliable services – it's part of their charters," he explained. "They have a strong corporate attitude that makes service very important. Just look at the service and product reputation of the phone company. On the downside, they are usually not proficient at marketing in a competitive environment, and are very slow to make decisions. In today's computer market, a manufacturer cannot afford to delay critical decisions."

The view of AT&T depicted by Murphy is that of a competent manufacturer venturing into a cut-throat marketplace. AT&T knows how to play ball, but it's only played in its own ballpark according to an unusual set of rules. Now it's trying to move into a new league full of seasoned teams.

Murphy thinks it's handling the transition pretty well. "AT&T has shown that it is willing to take the risks associated with moving quickly," he said. "It is trying new tactics, such as the System V Library project it's working on with Digital Research Inc. In the five months since the breakup, AT&T has repackaged and launched an entire line of computer products."

Murphy questioned, though, whether AT&T's aggressive marketing posture will carry over to its product pricing.

"AT&T may run into some problems if it succeeds in maintaining its reputation for quality and service, but prices it products at the high end of the market."

Similar reservations were expressed by Dr. Harry Garland, president of Cromemco, the long time manufacturer of diverse

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Mark G. Sobell is the author of "A Practical Guide to the UNIX System" (Benjamin/Cummings, 1984.) His 10 years in the computer industry include programming and technical writing experience. Mr. Sobell has been involved in UNIX for four years and is currently a consultant in the San Francisco Bay Area.

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microcomputer boards and systems. While enthusiastic about the effect AT&T's efforts will have for the UNIX industry as a whole, he was a bit cooler about the prospects for AT&T itself. Garland's faith in AT&T will be demonstrated at NCC when Cromemco announces it is going with the AT&T standard, System V. But when I asked Garland what he thought Cromemco could offer above and beyond the AT&T line, he compared the 3B2 to a Chevy – reliable, but lacking in features.

"The 3B2 is a solid machine designed for the mass market," he said. "It will open up this market to higher capability machines, those that can support several users and run many processes at once. AT&T's announcement also supports a standard operating system, UNIX System V, that will allow this multiuser, multitasking market to grow."

"With the mass market wide open, more users will be demanding more features in this type of system. With our 2048MSU memory board, Cromemco can provide 16 MB of RAM storage in a System V machine. Only the top-of-the-line AT&T machine, the 3B20D can provide that much memory. The 3B2 is limited to 2 MB of RAM and does not provide error correction facilities – Cromemco provides error correcting memory. The Cromemco bus structure provides expandability and flexibility that the 3B2 doesn't have. With a Cromemco system, you will be able to use our floating point hardware board or graphics board with System V. The bottom line is: we provide hardware that the user can customize to his or her needs while AT&T provides off-the-shelf systems for the mass market."

When I asked Garland about possible AT&T weaknesses, he said, "A lot of money can cover up a lot of weaknesses. With the money it is spending, AT&T will be strong in promotion. But it is a large company that is pumping out a lot of machines. It has a big mass and cannot respond to market demands as quickly as a

Illustration by Hope Epstein

smaller manufacturer."

Jim Campbell, president of Fortune Systems, had similar observations. He described AT&T as "a big guy certifying the use of a multiuser operating system on smaller machines." The use of multiuser UNIX on the 3B2 is trendsetting, deviating from single-user MS-DOS and CP/M systems. Even IBM's PC/IX is designed to support only one user.

When asked about the affect of AT&T on Fortune, Campbell said that he thought AT&T's marketing thrust would be at Fortune 1000 companies and OEMs. As a smaller company, he said Fortune would be able to take advantage of niches and respond to customer needs more quickly than AT&T. "Fortune is quicker on its feet than AT&T. It can pick and respond to its market in a more timely manner."

As far as head-to-head competition goes, Campbell said, "Although the machines (AT&T's 3B2 and Fortune's 32:16) are similar, because the 3B2 is priced higher, the 32:16 can out perform the 3B2 dollar for dollar."

Campbell said that because Fortune can supply software to AT&T on the 32:16, his company is still selling Fortune computers to AT&T.

"The place that AT&T is vulnerable is in its lack of applications software," he said. "You look at an IBM machine with its communication packages, office automation software and accounting programs, and compare it to what AT&T is offering: nothing."

It is obvious that AT&T is not unaware of this weakness. Witness the AT&T/DRI UNIX System V Library project. But it will have to move quickly to develop software that runs on its machines if it wants to sell in this marketplace.

To get the perspective of someone who might potentially use the AT&T machines, I spoke with Dave Scott, vice-president of systems development at Logisticon, a VAR manufacturing material management systems.

"We started several years ago,

knowing we wanted to build our system on UNIX," he said. "Logisticon started with a 68000 Sun board in a Forward Technology machine running UNIX and INFORMIX database software. We established a distributed processing environment, a database server and an Ethernet communications facility. Now we are bringing our system up on an HP-9000 running HP-UX."

Scott said Logisticon was taking a wait-and-see attitude to assess how AT&T does on technical support of its machines. "If you look at AT&T's marketing policy for UNIX, you'll see that it is not enlightened about how to sell to OEMs and VARs. It may come to understand the needs of this market segment; we'll have to see."

"AT&T's marketing stance contrasts sharply with that of IBM, DEC and HP. These manufacturers understand how to structure OEM pricing, that they need to be flexible in their licensing policies and that different customers desire different levels of technical support."

Also of major concern to Scott is the lack of support for networking and demand paging under System V. "Because of the size of some of our programs and our requirements for networking, Logisticon requires this Berkeley 4.2 facility – AT&T's System V just doesn't give us what we need," he explained.

SUMMARY

Everyone seems to agree that AT&T will have no problem mass-producing the machines it has promised. It also seems that AT&T will be going after the larger sales and the mass market, leaving many niches open for the smaller manufacturers. Areas that have been spotted as possible problems for AT&T are pricing, support and training. But, as Dr. Garland pointed out, "AT&T will invest what it takes. Now that it has committed to UNIX, it will use its enormous resources to solidify its place in the market." ■

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HOSTS

PDP-11	**68000**	**8086/8088**	**8080/8085/Z80**
UNIX	UNIX ports	UNIX ports	CP/M-80
		PC DOS	
		MS DOS	
		CP/M-86	

TARGETS

8086/8088	**8080/8085/Z80**	**6502/65xx**
PC DOS	CP/M-80	APPLE DOS
MS DOS	TRSDOS (12/83)	APPLE ProDOS (2/84)
CP/M-86	LDOS (12/83)	COMMODORE 64
	DOSPLUS (12/83)	

Other host and target environments will be released in early 1984.

NATIVE COMPILERS

The AZTEC C native 8080 compiler was first released in 1981. Since that time it has been acquired by more than 300 colleges and universities, thousands of corporations, small business, and government agencies. The compiler has been ported to the 6502 and 8086. Plans for future ports include the 68000, 16032, and IBM 370. All native versions are source compatible. Source developed in one environment can therefore be transferred to another environment and compiled, linked and executed.

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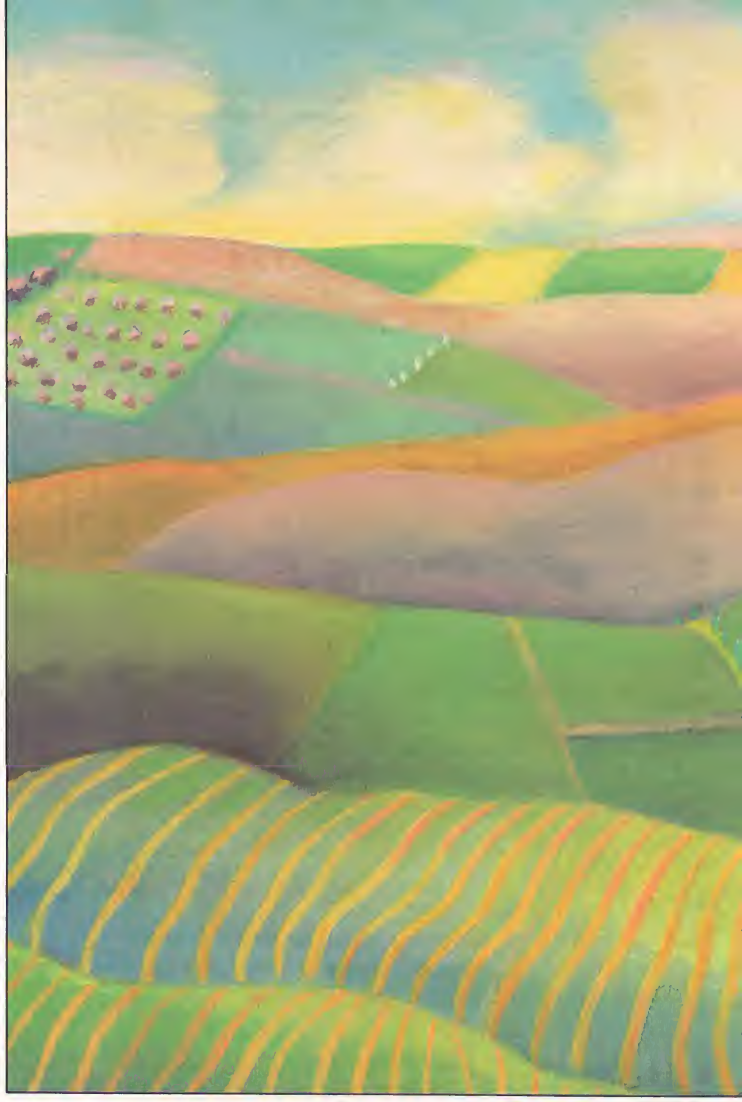
A NEW DAY DAWNING

AT&T tells its own story

by Don Anselmo
and
Tom Arnold



When you want information, it's best to go straight to the source. We wanted to find out more about how the 3B line evolved and what AT&T means to do to market it, so we went to Don Anselmo, director of product management for AT&T's Computer Division. Here's his response:

A new era opened for AT&T on March 27 with the announcement that it would be entering the commercial computer business. That culminated a series of events which began in January, 1983, with the company's announcement of its commitment to establish UNIX System V as an industry standard.

AT&T's commitment to support System V, announced at UniForum 1983, was one step in that direction. Later in the year, we took several more by signing agreements with Intel, Motorola, National Semiconductor and Zilog to produce and support System V for their next generation of microprocessors.

A further commitment came with the announcement of the AT&T/DRI UNIX System V Library at UniForum '84 in Washington, D.C.

The library was our first major step towards insuring that a large base of applications software would be available for computers running System V. The Independent Software Vendor (ISV) Support Program announced at COMDEX/Spring in Atlanta is another step in that direction.

The signal AT&T is sending is clear: we mean to be a major player in the commercial computing arena. AT&T brings several strengths to this new endeavor: (1) communications (2) silicon (3) software (4) quality and reliability and (5) staying power. AT&T's creation of the best telecommunications network in the world has shown our communications capability. We also plan to set new standards for reliability and uptime in the computer business.

AT&T software strengths come from long-established dependence on an efficient systems development environment capable of meeting the needs of our extensive telecommuncations network. Software reliability and use of high-level languages and operating systems were driven by a need to bring order to the development of very large software systems. The UNIX operating system was developed in that environment.

AT&T quality and reliability standards stem from stringent requirements we place on ourselves to keep the telephone system working at all times. Meeting this standard requires built-in quality and reliability from the chip all the way through service and support. In computer design, it means achieving downtime objectives measured in minutes per year.

MARKETS FOR THE 3B COMPUTER FAMILY

The market for AT&T's 3B computer family has been created over the last decade. We paved the way

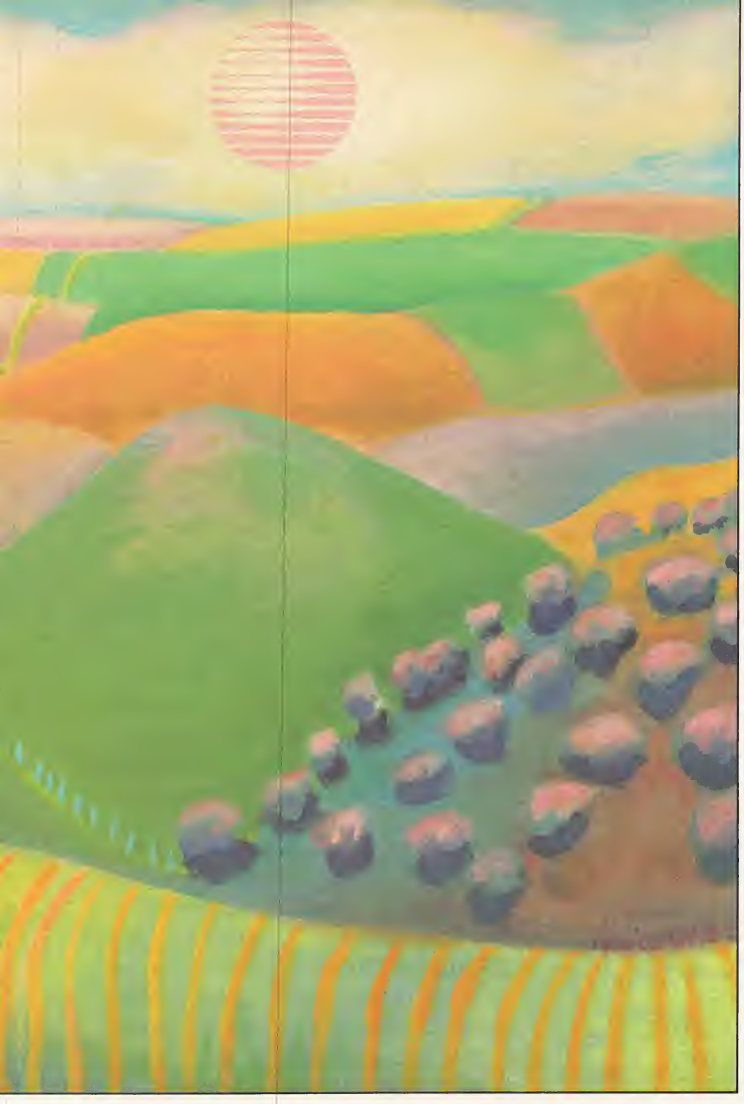


Illustration by Marianna Amicarella

with the UNIX operating system. It was developed in the late 1960s by AT&T Bell Laboratories for use within the Bell System – one of the world's largest markets. During those years of internal use, it was continually improved and enhanced. In the mid-70s, UNIX software was made available to educational and corporate licensees. This widespread licensing activity moved the UNIX software culture outside AT&T and started a new approach to developing software.

UNIX software was designed to be easily ported to a variety of hardware. The portability that helped protect AT&T's software investment from hardware obsolescense is now generally available – from micros to mainframes. At least 100 different computers in all run on UNIX systems.

Before January, 1983, AT&T was a passive participant in the UNIX systems marketplace due to regulatory constraints. While we licensed the product, we did not guarantee future releases nor offer support. Companies and educational institutions produced their own version of the UNIX operating system (XENIX and Berkeley are two examples). While these activities helped commercialize UNIX, they also introduced a new problem: loss of portability through lack of a standard. Even AT&T was not immune, as several variants materialized internally. UNIX System V evolved as an answer to the need for a standard.

Today, we estimate that more than 70,000 computers run the UNIX operating system and that this number will at least double by year's end. More than 6000 installations have been issued UNIX systems source licenses.

There are more than 100,000 UNIX programmers today, thanks in large measure to the educational licensing program of the past decade. These programmers and the companies they work for, want hardware that supports UNIX software for their system solutions. This is the market AT&T has created and now serves with a family of compatible computers.

AT&T HARDWARE ENTRIES

AT&T entered the commercial marketplace with six computers and two local-area network products. The UNIX software marketplace that AT&T created covers such a broad range of computer products that only a major introduction could adequtely serve it. With industry analysts now projecting a UNIX system-related market of $7 billion annually by 1986, it's important that AT&T have as wide a coverage as possible. AT&T's product line starts under $10,000 for a 32-bit multiuser desktop system and extends up to large superminis capable of supporting more than 150 users.

Such a launch could not be made by a start-up company. Before entering the commercial market, AT&T was using its computers widely throughout

the corporation and in its now-divested operating companies. At the time of announcement, more than 1500 computers had already been deployed. That experience has brought us face to face with all kinds of customers and applications. They, in turn, have helped us tune our ability to sell, order, make, deliver, install, service, repair and consult all over the United States. AT&T enters this part of the marketplace well prepared.

AT&T experience in hardware and software brings much to the customer. First, AT&T assures that its hardware and software products will be optimized for UNIX System V and that it will offer support. Also, AT&T promises to apply its considerable strength to meet two emerging market needs. First, it will look for better solutions to customer problems by attacking *both* computing and communications requirements simultaneously. Secondly, it will address the need for better reliability. AT&T will set new standards for reliability as technology allows us to produce – at a reasonable cost – machines that never go out of service.

The roll-out of AT&T computers is proceeding in two steps. A large number of applications that can be ported to 3B computers have already been developed within the UNIX systems industry. Software companies are now acquiring 3B computers and beginning to port this software. Of course, AT&T is also bringing out applications of its own. During this early phase, AT&T's emphasis is on companies that can bring their software quickly to 3B computers: OEMs, VARs, ISVs and large corporations with internal programming staffs. The second phase consists of marketing AT&T's computers broadly to all potential users, backed by a large volume of internal and third-party software.

In planning this roll-out, AT&T has paid careful attention to different distribution channels and ways to best support them. Direct sales are generally handled by the AT&T Information Systems sales force. Exceptions to this rule occur where AT&T has an existing sales force for a specialized customer group, like the AT&T Network Systems group that sells products to AT&T's divested operating companies, and the Federal Systems Division that sells to the US Government.

We plan to set new standards for reliability and uptime in the computer business.

Indirect sales (OEMs and VARS) are handled by both AT&T's Computer Systems Division and AT&T Information Systems. A comprehensive program supports VARs in their needs for marketing assistance, technical support, service and financial programs. Through an ISV program, AT&T offers development support, software publishing and software reference catalogs to help vendors develop UNIX System V applications software. AT&T is also entering the international arena. In Europe, 3B sales and support are already provided by AT&T's partner, C. Ing. Olivetti. AT&T is studying how best to sell its computers in other foreign markets.

Additional distribution channels will be added to meet market needs and the introduction of new products.

THE 3B LINE

The AT&T 3B family of 32-bit computers range from desktop single-user/multiuser supermicros to high performance superminis. Networking products provide communication links among computers and between computers and such expensive computing resources as disks and printers.

The 3B family includes the low-end desktop 3B2 series, the mid-range 3B5 series and the high-end 3B20 series. In the 3B2 series, there is one announced product – the 3B2/300. The 3B5 series offers two models, the 3B5/100 and the 3B5/200; and the 3B20 series spans three products, the 3B20S, the 3B20A and the 3B20D. All 3B computers share a common operating system, robust environmental tolerances, quiet machinery, energy efficiency and ease in use and maintenance. All are true 32-bit machines. Leading edge silicon technology provides an important foundation for the 3B family. Using this technology, 3B designers were able to shape the products around the operating system – UNIX System V – and ultimately achieve an optimized marriage of software and hardware. For example, the CPU in the 3B2 and 3B5 is based on the WE 32000 microprocessor, a full 32-bit microprocessor designed specifically for the UNIX operating system. Future generations of the WE 32000 family will be used to enhance performance and functionality and maintain compatibility within the family.

The 32-bit memory management unit (MMU), the 256K dymanic RAM memory chip and customer VLSI devices such as the X.25 protocol control chip are further examples of devices used in 3B computers.

The 3B2/300 is compact, easy to install, easy to operate, quiet

and suitable for desktop placement or vertical mounting. It has been designed to achieve a high degree of flexibility in functionality and number of users.

The 3B2 computer offers more processing power than any other machine of its size and weight. A single cabinet – only 22 inches wide, 17 inches long and 3.5 inches high – houses the entire computer, all its standard peripherals and four feature-card slots.

Typical applications include packages dedicated to professional engineering and scientific use, office automation, software development and small business functions. Like other members of the 3B family, the 3B2/300 is expandable. Its flexibility is heightened by several optional add-on features that allow users to customize the system.

The 3B2/300 operates a half million instructions per second and has up to 2 MB of main memory. In addition, the 3B2 supports a 720K byte, 5-1/4 inch floppy disk drive and either a 10 or 32 MB hard disk.

Add-on components include AT&T Teletype terminals, automatic dial/answer facilities, printers and feature cards (plug-in circuit boards). The options currently available include a high-performance 3BNET interface card, an intelligent RS232C serial port and a parallel port for connecting the 3B2 to peripherals. Other option cards are being developed and will be available soon.

A MID-RANGE MINICOMPUTER

AT&T offers two models of the 3B5, a mid-range minicomputer that's ideal for office, business information processing, operations support and communications applications.

The 3B5/100 provides a range of small-to-medium capacity versions for up to 30 users. It operates at 0.6 million instructions per second, and has 1 to 8 MB of main memory and 48 to 640 MB of disk memory capacity. The 3B5/200 provides a range of medium-to-large capacity versions for up to 60 users. Intended primarily for high-throughput applications, the 3B5/200 operates at 0.8 million instructions per second and has 2 to 8 MB of main memory and disk capacity of 48 to 1280 MB. Both models have cache memory capable of storing sixty-five 32-bit words.

The 3B5 computer is easy to operate and maintain. The computer diagnoses its own faults through an off-line diagnostics system.

When the 3B5 is powered up, the system's low-level maintenance feature automatically determines what equipment is attached to the computer. This provides self-configuring capabilities that enable UNIX System V to respond differently to different devices connected to the computer.

Photo courtesy of AT&T

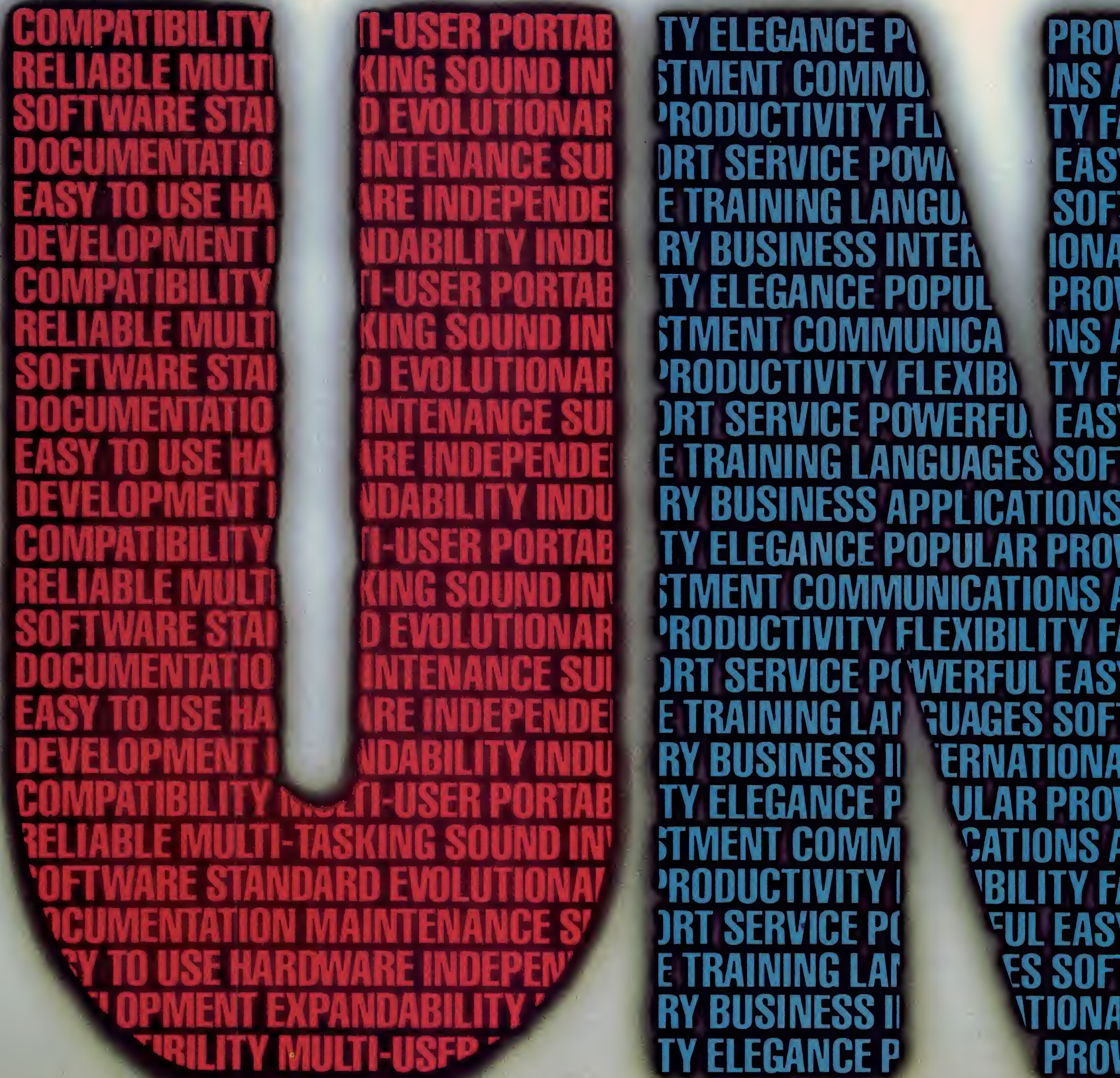
The 3B20D represents the top of the AT&T line.

TOP-OF-THE-LINE SUPERMINIS

The three 3B20 systems can each accomodate up to 150 users. They're distinguished by varying amounts of duplicated hardware, processing capacity and software fault tolerance. As a result, they offer varying degrees of performance and system availability.

The 3B20S is a supermini that meets the high-capacity needs of data centers, office-serving organizations and manufacturing locations. Its microprogrammable CPU is based on 32-bit architecture with a 24-bit address and supports up to 16 MB of main memory. In addition, the CPU operates at about one million instructions per second and has 8K bytes of 250-nanosecond data cache.

The 3B20A is a 3B20S with a second processor using parallel processing. It operates at between 1.5 and 1.9 million instructions per second and has an I/O capability equivalent to the 3B20S. The 3B20A comes as a complete



UNIX™ SYSTEM V. FROM AT&T. FROM

Marketability. Serviceability. Portability. UNIX System V has the ability to open a lot of new business doors. That's why it has emerged as an industry standard.

And that's why good business decisions are based on UNIX System V.

For hardware vendors. For OEMs and VARs. For software houses.

UNIX System V from AT&T provides a wealth of new business opportunities. Because UNIX System V is the operating system capable of realizing the full potential of the expanding multi-user and multi-tasking business computer market.

The profits of standardization

For software houses, the portability of UNIX System V software means that it can be run on hardware from many different vendors. So you can sell the same applications packages for a wide variety of computers. From micros to mainframes. Without expensive rewriting.

And UNIX System V allows your customers to update their hardware. Without making all their software obsolete.

Hardware vendors can profit from UNIX System V's built-in nonobsolescence, too. Because your customers won't need to invest in new software every time they buy a new computer, they'll be more receptive to the new hardware technology you offer for sale.

It's not hard to sell programmers on UNIX System V. A large pool of programmers is already familiar with its advanced programming capabilities, high-level "C" language, and modular design. You'll enjoy increased programmer productivity. And a high return on investment.

Small wonder that so many companies are jumping on the bandwagon—with hardware and software products based on UNIX System V from AT&T.

Service that goes on and on

AT&T is backing up its commitment to UNIX System V with a program of

system, or can grow on-site with the addition of one cabinet to a 3B20S.

The 3B20D, a duplex version of the 3B20S, has duplicates of all I/O units as well as the CPU. Automatic switching between the redundant units virtually eliminates computer downtime resulting from hardware failures. The 3B20D offers the UNIX RTR operating system, which adds new real-time and fault-tolerant features. The 3B20's distributed I/O architecture is based on a central I/O processor and specialized microprocessor-based peripheral controllers. Its disk I/O subsystem uses up to eight intelligent disk-file controllers, each supporting from one to eight 300 MB removable disks or 675 MB nonremovable disks.

The 3B20's I/O system also supports a full line of smart peripheral devices such as medium and fast-speed tape drives, low and high-speed data links and medium to high-speed printers.

A major design feature of the 3B20 computers is high reliability – demonstrated by the 3B20s already in use in AT&T and other telecommunications companies. The 3B20S and 3B20A, for example, should run reliably 99.7 percent of the time. The 3B20D's record is even more remarkable; system downtime resulting from any sort of hardware, software or procedural error averages less than 10 minutes per year.

By design, the 3B20 is especially resilient, adapts easily to any business environment and has a wide range of environmental tolerances. The computer operates reliably in ambient temperature ranging from 32 degrees to 120 degrees Fahrenheit and relative humidity from 20 to 80 percent.

As a contingency against commercial power failure, the 3B20 computers also include built-in battery backup.

The 3B computer family is already used extensively in the telecommunications network. The many different telecommunications applications of these computers have required a range of local and wide area networking capabilities.

The 3BNET high-speed local data network connects 3B computers to the industry-standard Ethernet network. It also provides centralized administration with automatic backup, enabling users to monitor and define their own network conveniently from a single terminal.

The signal AT&T is sending is clear: we mean to be a major player in the commercial computing arena.

The 3BNET offers such features as improved reliability, UNIX System compatibility, easy administration and maintenance that doesn't interfere with operation. Its hardware is based on the WE 32000 microprocessor and supports a bandwidth of 10 megabits per second. Its intelligent DMA interface also minimizes CPU cycles spent at the host computer for networking. And the 3BNET controller features self-diagnostics and fault isolation.

In addition, 3BNET is highly flexible. The entire network is interconnected by coaxial cable. 3BNET supports up to 65 logical channels and permits selectable packet sizes up to 4K bytes.

Furthermore, 3BNET's UNIX software integrates a complete package of network services. Using UNIX systems commands, a user can send a message to users on other computers, transfer data files among different machines or gain secure access to the network.

The AT&T PC Interface interconnects the 3B2 microcomputer with IBM-compatible personal computers, providing UNIX System V service to PC owners.

The PC Interface gives PC users the opportunity to share expensive peripherals – such as hard disks and line printers – connected to the 3B2/300. In linking 3B2s and PCs, the PC Interface effectively joins the two most popular operating systems on the market today: MS-DOS and UNIX.

With PC Interface, a user can move files transparently between machines that use either operating system. Normally, a user would have to make changes to files before moving them, but PC Interface makes the translation automatically. The user can also work on either machine, with PC Interface doing all necessary translations. PC Interface was developed by the Locus Computing Corporation of Santa Monica in cooperation with AT&T.

In addition, several members of the 3B computer family offer an X.25-compatible, long distance interface that can connect to the NSC Hyperchannel Network.

3B SUPPORT AND SERVICE

Responsive support and high quality service are as important to many customers as the products they buy.

AT&T offers a variety of support agreements, with the level of support and number of coverage hours negotiable. An 800 telephone number allows customers to call in problems. Service is provided from about 150 locations nationwide. For smaller machines

Continued to Page 94

SCO is proud to announce the release of the XENIX™ Operating System and a comprehensive line of compatible applications software for the IBM Personal Computer and the Apple Lisa 2.

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XENIX from SCO has more features, better documentation and higher quality support than any other version of AT&T's UNIX™ Operating System for the personal computer.

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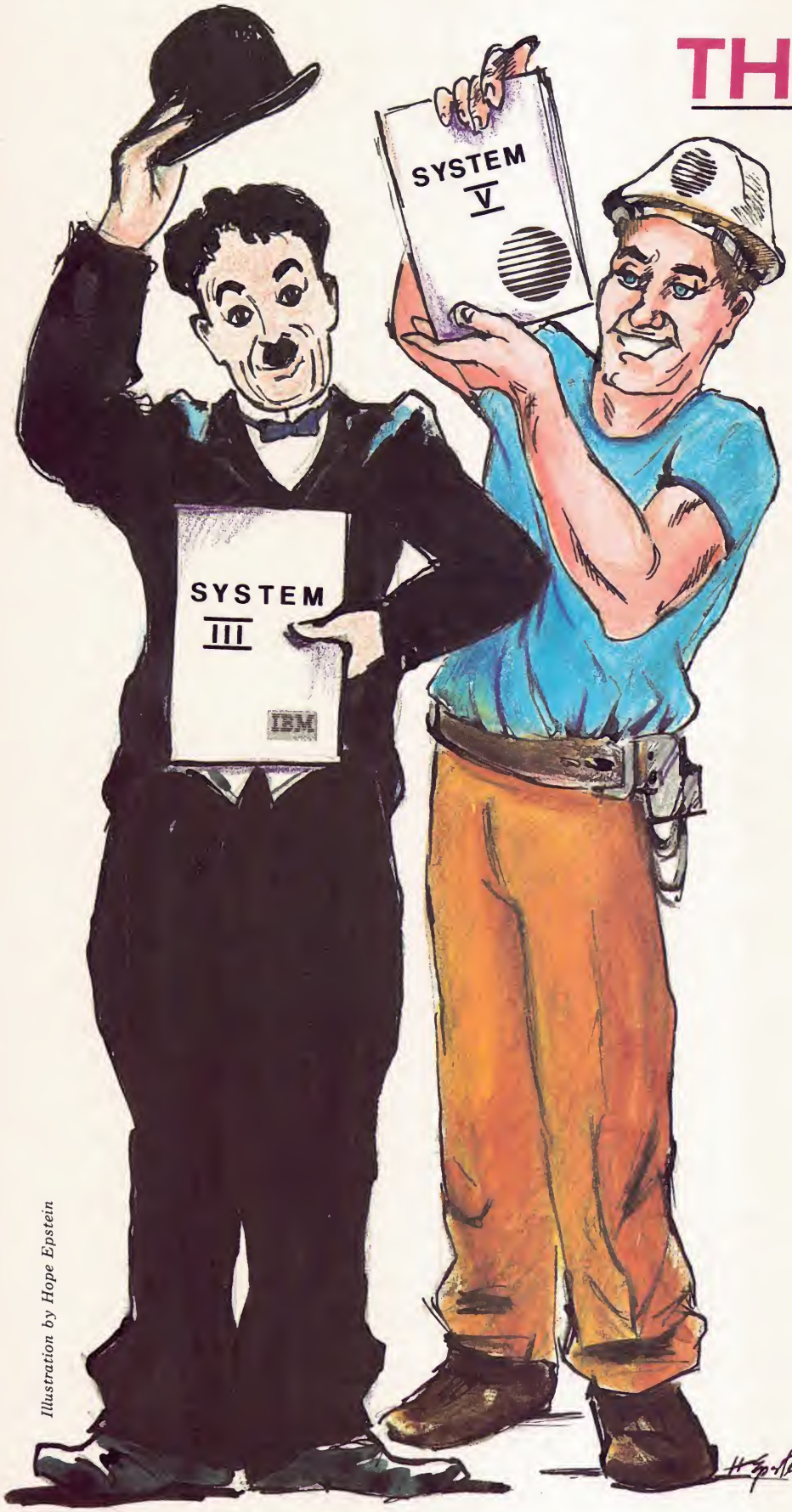

Illustration by Hope Epstein

by Ned Peirce

Some observers might regard IBM's decision to base its recently released PC/IX software on System III as an effort to undercut AT&T's System V as the defacto UNIX industry standard. But it will take more than a disagreement over "standards" to slow the growth of UNIX.

Commercial packaging and distribution of software that is already developed and used will drive the market onto spiraling heights – and push the standards issue well into the background. Many applications are now ready to go to market with only a minor investment in documentation development.

The System III vs System V debate is irrelevant to this market explosion because UNIX was specifically designed for compatibility. Unless you happen to be part of an organization developing applications requiring special "hooks" into the kernel or are actually in the business of supporting the operating system itself, it really makes very little difference which version of UNIX your machine is running. Naturally, tools will differ from version to version, but an even greater variation among the tools available for personal computers has not impeded growth in that realm. Likewise, the change in options for certain commands from System III to System V Release 2 is really a minor distraction. PC/IX, in any event, is generally distributed

Ned Peirce is a systems analyst working as a consultant at Bell Laboratories in Summit, NJ. He supports AT&T's UNIX development organization as part of the Dedicated Facilities Management Group.

VERSION GAP DEBATE

Is System III vs System V really an issue?

without source so it is unlikely that users will be tinkering with the operating system itself, except perhaps to write device drivers.

SETTING THE RECORD STRAIGHT

While IBM's entry into AT&T's UNIX domain has conjured up visions of clashing titans, the reality is somewhat different.

In one sense, IBM's UNIX announcement can only help AT&T market the system. UNIX, until only recently, had the reputation of being an unwieldy non-production operating system for "egg head" software developers. AT&T can only benefit in the long run from the credibility IBM's entry affords, especially as UNIX begins to expand into the Fortune 1000 market.

AT&T is not yet treading on Big Blue's consumer turf since it is marketing solely to OEMs and VARs as it eases into the computer hardware business. IBM's corporate strategy is much more focused on end users.

AT&T's support of OEMs and VARs is not likely to be greatly affected by any debate of System III vs System V either. It is not inconceivable that many of these application developers will actually use both System III and System V to develop packages. By so doing, they can take advantage of the improvements incorporated in the newest UNIX version while still retaining the ability to support kernels already in their customer base.

MARKET IMPACT

IBM is providing AT&T with useful marketing lessons by its foray into UNIX. AT&T can be expected to hang in the background until it's more certain of the direction and strategies involved in selling outside the telecommunications realm.

AT&T can also be expected to land with both feet solidly planted and take a large share of the market. Remember that each piece of the Bell system is a Fortune 500 company many times over.

It should be very interesting to watch what happens when AT&T finally starts selling to the end user market. IBM's introduction of PC/IX is an indication of its regard for the market potential of UNIX. In this respect, Big Blue might feel AT&T has a significant edge. Based on previous experience, though, IBM can be expected to be very effective in eroding AT&T's advantage. The debate over standard UNIX versions is a red herring in this unraveling mystery.

AT&T is widely expected to lose money as new markets are developed before it blossoms into an industry leader. This perception provides the opportunity to use a variety of strategies not available to IBM. If gambles lose money, so be it – people expect it anyway. But if AT&T makes money from computers soon, IBM has much to fear from the newcomer.

PORTABILITY OF SOFTWARE

The UNIX environment supports just about any language or language-like tool imaginable, but C and assembly language are the two most commonly found. Scripts for the Bourne shell, C shell and **awk** are also widely used.

There is an enormous amount of code available for the UNIX environment. Applications which adhere to the "standard" Bell compatible syntax of System III or later can take advantage of this to increase the value of their packages without incurring development overhead.

Nevertheless, software vendors will often arbitrarily depart from standard syntax. Les Hancock's positive review of COHERENT in the April/May issue of *UNIX REVIEW* pointed out an incompatibility in **ed** command syntax. Mark Williams Company, the makers of COHERENT, appears to have decided to add functionality without preserving compatibility. Software vendors will find that UNIX tools have plenty of room for improvement but they will have to demonstrate concern for compatibility to avoid disenfranchising their market. Programs requiring people to unlearn procedures and alter existing code will not be encouraged in the increasingly competitive UNIX world. Shell scripts offer great portability. In tandem with increasingly powerful CPUs, they also achieve satisfactory performance. Writing a program in C, FORTRAN or some other fast executing language will usually improve performance, but often only at the sacrifice of portability.

Bell Laboratory's Murray Hill Computer Center uses shell scripts for most housekeeping utilities because they can be transported without modification

to the center's multitude of UNIX systems. This is particularly important since the MHCC runs UNIX on AT&T, DEC, IBM and CRAY hardware. No language could offer the same convenience. And execution speed on the large systems is rarely an issue.

SYSTEM V's C COMPILER

The C compiler provided with System V recognizes variables of any length. Previous compilers used only the first eight characters and ignored the extras that programmers frequently used to increase readability. There is much code from many sources, including Bell Laboratories and UC Berkeley containing variable names longer than eight characters. Much of this code cannot be compiled as before without first correcting typos in the suffixes of long variable names.

In this case, it is obvious that longer names are desirable and incompatibility with earlier work is inevitable. The new compiler also offers the option of treating variable names in the same manner as before, which makes for a good compromise.

DISTRIBUTION FORMATS

With the introduction of System V, UNIX has become an AT&T "product." For the first time, it comes with support and is aggressively marketed.

Part of that marketing effort revolves around a new bundling concept. UNIX used to come complete with compilers, text processing software, graphics and documentation tools. UNIX look-alikes, though, have been unbundling their offerings for years. Perhaps AT&T is following their lead.

The repackaging of UNIX in separate bundles may actually help the average user since even "core UNIX" typically offers more than 10 MB of executables and contains more useful utilities than most other operating systems. Packaging the application software in small chunks allows users to buy only what they want.

SYSTEM ADMINISTRATION AS A STANDARDIZATION ISSUE

It is well to recall that UNIX grew up on small 16-bit DEC machines in university environments populated with computer "gurus." Much of what UNIX evolved into over those years is inappropriate to the business and personal environments the system is now entering. Changes taking new users into account need to be made. Incremental backups, file system repairs and software installations will have to be made a lot easier. System administration will become a standardization issue.

UNIX suffers from the lack of standard repositories for "add-on" software. Commands added by software developers are often placed in the system according to whim. Many users might disagree, but I submit that this makes system administration unduly aggravating.

The lack of a standardized location for "add-on" software in the UNIX tree creates two general problems. First, finding a command can be difficult. A tree directory structure quite literally creates a forest of places for hiding commands. Second, system updates are made more difficult since it is often hard to separate the wheat from the chaff.

OFFICE AUTOMATION AND UNIX STANDARDIZATION

System administrators have no monopoly on confusion. Business users, too, could be greatly aided by standards in the form of an office automation interface. That way, everyone using an OAS system could be unconcerned with operating system issues and competition among vendors could focus on features. Interchange media formats and interprocessor communication standards would continue to be contested but operating system choices would become less important. The choice of which UNIX version to base OAS systems on will not, therefore, be much affected by debate over the standard office automation interface.

THE BOTTOM LINE

IBM may not have disturbed AT&T in the least by introducing a UNIX operating system for its PC. The IBM name is synonymous with off-the-shelf software. Recall also that market research drives the IBM product line. IBM clearly thinks UNIX's time is near.

IBM's product line spans the entire range of computing muscle – from the PC Jr. to an assortment of mainframes. AT&T is basing its 3B line on its "super" 32-bit micros and has announced that it intends to extend its range both upward and downward.

UNIX seems well suited to the midrange VAX-power computers offered by AT&T, and IBM obviously also thinks it is a useful system for micros. It will be interesting to see how far up the power spectrum UNIX can go.

UNIX has historically thrived because of its ability to do useful things that were not easy to do in other environments. It owes very little of its current widespread use to marketing or commercialization in general.

If application developers, UNIX look-alike vendors and AT&T itself can stay in touch with what is intrinsically good and useful about the operating system, UNIX will be with us for a long time. It's doubtful that any amount of arguing over what constitutes "real" UNIX will negate the system's "Horatio Alger" success story. ■

In microcomputers today, UniSoft sets the standard.

AT&T has recently been advertising that their UNIX™ operating system will be the standard OS for microcomputers. That's true. But if you want AT&T's UNIX software on micros today, talk to UniSoft Systems.

UniSoft has been delivering AT&T's UNIX adapted for 68000-based microcomputers for two years. More than 75 different computer systems run the UniSoft software, UniPlus+.™ At each Bell release level, all these systems are object code compatible. This means that applications software developed on any UniPlus+ system will work on any other. This is where software portability pays off.

UniSoft enhances Bell's vanilla UNIX with the best features from the Berkeley BSD research version of the UNIX operating system. IP/TCP networking, record and file locking, and virtual memory from UniSoft turn UNIX into a commercial product. All this added value is still Bell-compatible.

Don't wait six months to get System V running on your hardware. UniSoft's customers can ship it now.

If you're building or selling a 68000-based UNIX system, your operating system should come from UniSoft Systems, the UNIX experts.

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INTERVIEW WITH LARRY CRUME

The title on Larry Crume's business card reads: Department Head, UNIX Systems Engineering and Planning. Behind the title is the man influencing the course of UNIX.

Before assuming this mantle, Crume was Project Manager of System V development and microports efforts. Other projects he has been associated with during his 17 years at Bell Laboratories have run the full gamut of software research and development.

UNIX REVIEW sent Mark Compton to Crume's Summit, NJ, office to find what sort of software support is in store for the 3B family of computers and to inquire about where UNIX in general is headed.

REVIEW: *The first area I want to go into is applications. What can you tell me about the Digital Research Library?*

CRUME: The Digital Research Library provides an opportunity for a number of independent software vendors. In order for the industry to meet the needs of the masses, you've got to get a lot of people writing software. It's not cheap to write software. It can be a good investment, but in order to get a return on that investment you need high volume sales.

So you can't take every one of these independent software vendors and have them set up their own marketing and publishing organizations. What the library provides is a mechanism for these suppliers or writers of applications software to distribute their software to the masses. It's a publishing business in a sense.

REVIEW: Do you envision Digital Research getting ahold of packages developed by companies with enough muscle to actually go to market themselves?

CRUME: That's a debatable thing. In other words, The Library will have to make a business choice about how much they want to go

after those. Again, they have to see the benefit they would get for paying for those kinds of packages. Nothing would exclude them from doing that, however.

REVIEW: *When is the end user actually going to actually see something of the library?*

CRUME: I believe by the end of this year.

REVIEW: *Is that roughly the same timeframe in which end users will be seeing the 3B computers?*

CRUME: Yes.

REVIEW: *What application needs do you see being addressed first?*

CRUME: I don't have the data to say exactly how they'll pick but here's a thought taken from the industry point of view: the industry is actually moving through what I would call utilities. Some people would call a graphics package an application, but I call a graphics package a utility that's needed. Some people might call a database management system an application, but I call a database management system a utility. So I would imagine that the first wave of products in the library will include the kinds of primitive utilities that people will need in order to write more and more applications.

REVIEW: *Does that also include compilers?*

CRUME: I would imagine you will see compilers because that is one way to get additional languages with the UNIX system. But again, I don't call those applications because I think of them as utilities that are needed on a system.

REVIEW: *Isn't it also true that some applications must appear before others can come in their wake?*

CRUME: Sure, some must clear the way or actually provide the environment that allows us to go on to other things. One of the things I frequently hear about is that the

"We still talk about computers talking to other computers. But we've got to start talking about people talking to each other."

UNIX system distributed out of AT&T licensing does not have menus or windowing systems apart from those on the 5620 package. So some of the things that I think you will see appearing in that library are menu and window packaging. Now, that is one of the areas we need to move to so that people can start writing their applications to a consistent interface for the UNIX system.

REVIEW: *So will those menu and windowing packages be developed by AT&T?*

CRUME: I think AT&T has to come up with a package it can support as a standard. It has to be one that we want to ship with the UNIX system that will move people to build a more consistent user interface. I mean, in the UNIX system we have today, there are some 400 commands. There are very few people I know of that can keep track of 400 commands. I think that what people do is they subset that into a small set of commands they use regularly. But the beauty of the UNIX system that is shipped is that it gives access to all the commands, which is exactly what the experts want. So when a new command comes out, the experts have access to it and can choose to use it or not.

They can also choose to envelope it with applications software or not. But that doesn't work for the novice person. My secretary, for instance, uses the UNIX system. But when a new release comes out, she doesn't go searching through to see what new commands or options were added. She tends to stay with the functions she already knows.

REVIEW: *Chances are she'll be upset if her favorite command was altered.*

CRUME: That's right. She will at least ask what happened. You can't make those sorts of changes as you go forward. That's why the user interface has to set a consistent framework. Furthermore, since the UNIX system provides a basis for many of the interfaces we're moving to, it makes sense to have standard menus, windows and icons so that people will have a consistent interface for all the packages they get. A good analogy would be the standard plugs at the back of the headlights on your car. Now, most of us don't see those plugs, but anybody who wants to manufacture headlights has to match them. Since there's a consistent interface, almost anyone can manufacture something to work with that system. That's also very key in our business, especially when you have an operating system that runs across the broad range of computers that the UNIX system does. With a standard interface, you get the added dimension of being able to move your

software and applications across the whole spectrum of computing.

REVIEW: *Do you see an evolution in the development of applications?*

CRUME: I think the evolution will occur the following way: there will be a number of what I would call horizontal packages, spreadsheet calculators, graphics packages and the like. Many of these will probably be written with no specific business customer segment in mind. Although I'm just guessing, I think you will probably see marketing people encouraging more and more vendors to go out and find special markets they can build end-to-end systems solutions for.

I think that the whole vertical package phenonenon will probably come in very quickly over the next few years. The reason I say that is because of the horizontal package growth of the past couple of years. It's been phenomenal.

That growth will continue to occur rapidly but I think at the same time adjustments must be made so that computing power can become more accessible. First, the user interface must be made simpler for the masses. Secondly, we need to offer a means for sharing resources without having to share logic. To see what I mean, take a look at the minicomputers of today. In a time-sharing environment, users not only share resources but computer logic. After a time, though, people don't want to share with anybody else. It's just too slow and it's against our nature to want to share something like that. But we've got to share data. If you and I work for the same company, you will have some data that I need and I will have some data you need. It doesn't make any sense for us to ship data back and forth because it will probably be changing at a good clip. But what does make sense is for your machine to come over into my computer and grab data as it's needed – without disturbing my work. Then your machine can work with the data and put it back when it's done. That makes all the sense in the world. You can't continue to do that in the clumsy way that it's done today.

REVIEW: *So you're advocating transparent networking?*

CRUME: You've got to have transparent networking because people need to share information. We still talk about computers talking to other computers. But we've got to start talking about people talking to each other. That's what happens in an office, after all. People pass paper between each other. That's how they make something happen in a company. Now you need to have these same people talking to each other via that computer and it can't be painful. When people want information, they don't need to know all the steps the computer has to go through to get it. They just want the data so they can do their job. A lot of people, though, still think they need to pull information off the company mainframe, work with it and then put it back when they're done. That all fits in with the image of the corporation. But people will quickly move to where they want to talk *through* the mainframe to other people. They are going to find out that the number of other people they need to intercommunicate with requires a network that will allow them to talk very easily. It needs to be transparent.

REVIEW: *There's always been a lot of software inside of AT&T that has not been available to non-AT&T people. Do you see some of that now being refined for general distribution? If so, what areas of need will be served first?*

CRUME: There are several varieties of software that have been developed at Bell Labs. One type includes the tools that support software development. There are also tools that we use for administering the telephone network called *Operations Support Systems*. We are still a heavy user of UNIX software text processing, so we have some software available for that. And we have a number of analysts and systems engineers who have built an assortment of tools to help them do their jobs. Exactly which of those we'll take outside is not clear yet. Some we'll bring forward and license. For instance, we just recently announced a 68000 C compiler. We were using that inside but we took it out to help the industry do its work.

We have people investigating our internal software to see whether it will be economical to package some for outside sale. You have to remember that these tools were created for many of our people with Masters and Ph.D.s in

"Novices who've never used a computer may very well accept it as something that can be thrown away."

Computer Science. Not all of that is going to be appropriate for public distribution.

REVIEW: *Do you feel as though most of the AT&T software products will be in the software development arena?*

CRUME: Yes, I'd say they'll be mostly in that arena. That's not to exclude others, though. We have a number of tools in the CAD area but no decisions have been made about whether we should take those out. Furthermore, a lot of tools that are in the software development area could also be easily classified in the office automation area because of the many refinements that occur within Bell Laboratories. I think one of the things that people outside the Labs overlook is that we have a mini-market within our own company. We build and develop the UNIX system and then give it over to other AT&T development organizations. The computing centers of AT&T Bell Laboratories contain a broad customer segment of people who have purchased general time-sharing systems to do software development. Many of these people add some value to the system. People in the operations support area also add some value. It is actually like dealing with a group of Value Added Resellers. So if you look at the UNIX system, you can see why it's built the way it is, assuming that we always build it for Value-added resale, even inside.

REVIEW: *Before we leave the arena of applications, I want to ask about the Olivetti connection. Since Olivetti offers 16-bit products that run MS-DOS, and AT&T now owns a healthy chunk of Olivetti, is it right to assume there might soon be an AT&T MS-DOS bridge?*

CRUME: The AT&T PC Interface that was announced earlier this year and has been shown at COMDEX in both Los Angeles and Atlanta is an MS-DOS bridge. It works with machines that run MS-DOS. There is a software package you have to license that runs on the MS-DOS based machine and you clearly need the hardware connections. But there are three that have been announced – RS-232, Omninet and 3BNET.

REVIEW: *Do you see 3B products containing 8088 chips and running MS-DOS applications?*

CRUME: Are you asking if AT&T means to make its machines adaptable to the raft of products developed for the 8088?

REVIEW: *Right, exactly. Is MS-DOS software going to become part of the off-the-shelf matrix that AT&T offers?*

CRUME: I believe it was announced in New York that we would have more announcements coming throughout the year. You will have to wait for those announcements to see.

REVIEW: *Then let's turn to the unbundling of UNIX under System V. You said at the recent UNIX Market Forum show in San Francisco that this was due to the hue and outcry of OEMs and VARs complaining that UNIX was too unwieldy. Obviously, I think there is some benefit to AT&T as well. One analogy might be that of selling a car with nothing more than an engine, steering column and four wheels.*

CRUME: I don't buy that. I mean, if you look at the automobile industry, I don't think you'll find anybody that buys that basic an automobile. People buy the package. I think (William) Agee (chairman of Uniform Software) is the one who said that there's a synergy and a competitiveness between the parts suppliers and the manufacturers of automobiles. They need each other in order to survive.

Now if you look at it from an unbundling point of view, there are a number of people in the business who have said, "Hey, I really need just the operating system." There are several reasons why they are saying that's all they need. Perhaps they just want to envelope it with an application and sell a solution – a turnkey system. They don't want to include all the other utilities because it would just complicate their products and end up costing them more in service down the road.

"Some people might call a graphics package an application, but I call a graphics package a necessary utility."

There is also another area of need that is showing up. If you look at computer systems, you'll find there are many intelligent subsystems. I/O processors now are basically small computers. There are people coming after us who want to run their I/O processors with the UNIX operating system only. They don't want all

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of the commands. It's not necessarily economical for them if they have to license the whole package. So they just want access to a smaller piece.

REVIEW: *These pieces are not the sort of thing users are going to see. Does that suggest that UNIX is going to disappear from end user view?*

CRUME: Yes, I think the operating system is going to disappear. I think it should disappear. It will be hidden from the end user. I mean, people don't buy operating systems. People buy applications to solve problems. If you look at

"I think the operating system is going to disappear. I think it should disappear."

the history of computing, you'll see it's been run by what I call high knowledge professional workers. In many universities, you can't even get into real computer science until you're into a master's program. The whole concept until now has been to train people like myself about operating systems. We were trained how to use the available tools, so when we came out that was our focus.

But the masses don't want to know about the operating system. They may not even want to know about the processor, if you really get down to it. What they want is some capability. Marketing people have learned that there are certain buzzwords that can draw attention to your product. UNIX is just one of those words for now.

REVIEW: *With the unbundling of UNIX, it seems as though you might inadvertently throw a lot of third-party software off your trail. That is, when a user tries to install a program written for a fully implemented UNIX system on an unbundled UNIX system, it's likely that program is going to want to make use of utilities that just aren't there anymore. Isn't that going to offend some of your customers?*

CRUME: Yes, there is that potential. But I think there are two different possible responses. One is that options may need to be sold with software packages. In other words, when a customer buys a software package, it may well be that there are also separate bundles of utilities that must be purchased with it. The other possibility is that the optional utility bundles and software packages appropriate to the customer's needs can be packaged in with the system when it's sold.

We're already at the point where if you buy a software package, it's not likely that someone is going to send you updates. In fact, it might even be likely that you don't care if you ever get an update so long as the software keeps doing what you want it to do. Ultimately, though, somebody is going to come along and try to convince you to buy a new package. It's much like the obsolescence of automobiles.

REVIEW: *Still, when users of unbundled UNIX look about for software, won't they need to exhibit special care to insure that the utilities necessary to support the software they're looking at are at their disposal?*

CRUME: The consumer may not have to do it at all. Much of that responsibility will fall to systems manufacturers and software suppliers.

REVIEW: *Do you think VARs will also be able to take care of ignorant consumers who, say, might buy into* **vi** *but not know that* **nroff** *would make a good mate?*

CRUME: There's a possibility that those kinds of things could happen. How that will play out, I don't know.

One of the things that concerns us is this problem of dependency of consumers on vendors. It can cause a great deal of confusion for both alike. Resolving that is a problem that will occupy us for the next few years. But we will do it. I think we have to.

Let me give you another example, though, of things happening in the marketplace that will have an effect on this. Right now, there are a good number of people out buying spreadsheet calculators, word processing systems and database management systems. Have I missed any? Those are certainly the three most popular. Before very long, people are going to want those integrated into a single package. How are they going to get integrated? Are you going to sell applications that require those utilities and then sell the utilities separately or will you bundle the applications and utilities together? It's not clear. I don't know how that's going to be sold yet. But that kind of a situation will occur.

Now maybe what will happen

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is that we will make some software obsolete by simply encouraging people to throw out what they've got so that they can replace it with a whole new package fully integrated from top to bottom.

And I don't think it will be just software that this approach is adopted with. I think you will find that the industry will move through work stations quickly as well. There's even a question of how long system lifetimes will be.

I know the analogy I'm searching for: the calculator. Remember the calculator? There are people who still use calculators they bought when they first came out. Those calculators work fine for them. They don't need new ones. But, boy, there must still be a lot of people buying calculators because when I was in Japan, I couldn't believe the number of calculator manufacturing lines I was shown. Clearly, people are buying new calculators and roaring through them as new ones appear with more functionality.

REVIEW: *So far, we've talked mostly about the end user. But now I want to shift our focus to the software development community, which, after all, has been the traditional environment UNIX has run in. What do you anticipate the response to unbundling will be in that community?*

CRUME: If we package the system the way we should, they won't feel it. What that means is that you can take all of these packages, put them on a machine and ship the machine to them just like we've done all along.

REVIEW: *What was the key impetus behind unbundling UNIX? Was it OEM and VAR pressure only?*

CRUME: There's been a strong demand from manufacturers who want the UNIX system packaged for I/O processors or want a smaller subset of the system for any number of reasons. Fortune Systems pushed this concept a few years ago and I thought they had a nice package.

REVIEW: *Let's go onto some other fields, then. Tell me about the robustness features that AT&T intends to offer on System V.2.*

CRUME: There are some things already done in System V Release 2 that went into the file system for doing writes of directories and inodes. It's a matter of the order in which you create and remove directories and inodes.

For instance, let's say you create a new file and you write the directory entry first but something happens to the system before the inode entry gets written. Then you've got this file hanging off your directory that doesn't exist. If you write the inode first and then write the directory, it makes a lot more sense. The same applies when you go to remove the file. You erase it out of the directory first and then you erase the inode. If you don't use care like that, you can leave the file system in a messy state that can cause a lot of confusion. It's that kind of stuff that we've gone after in the last several releases.

At the same time, we've also developed tools to help people check the file system faster. Remember, we were still pretty much focused on site administrators and traditional users.

Now, in future releases, you'll see see us focusing on things like record and file locking. Some people may not regard that as a robustness feature but I treat it as one because two users can clobber each other if they're accessing the same file at the same time.

REVIEW: *Not very robust.*

CRUME: I'm a little concerned about possible performance hits with record and file locking but we're experimenting right now with the /usr/group standards to understand the full impact of that.

REVIEW: *I was just about to ask you whether you intended to adopt the /usr/group record locking standards.*

CRUME: We are using /usr/group standards. But we're finding some things that are causing us difficulty. We have a view of UNIX software and how it should go together but those people that put together the /usr/group standards are very smart. We're committed to going after the /usr/group standards. But as we've started to put in record locking, we've come up against some issues. There are some areas where they've chosen System III as a basis but we've already added some capabilities in System V.

REVIEW: *Does that mean you're going to backslide so as to be in agreement?*

CRUME: It doesn't make any sense to backslide. But it didn't make any sense for /usr/group at the time to go with other standards. They had started off with Version 7 as the standard, but then we announced System III so they decided to go with System III. But then System V was announced and they had to make a choice to get a proposed applications standard out. Remember, they were focusing on an application interface. I think they made the right choice. They can go forward from there. They will see capabilities in System V that they will like and ultimately add.

REVIEW: *Just like IBM?*

CRUME: I don't know. We have PC/IX running right over here in one of my people's offices. It's got some System V on it. IBM can do it. They have a System V license. That's their choice.

It's a nice system. I hope they sell a lot of them. I'm serious about

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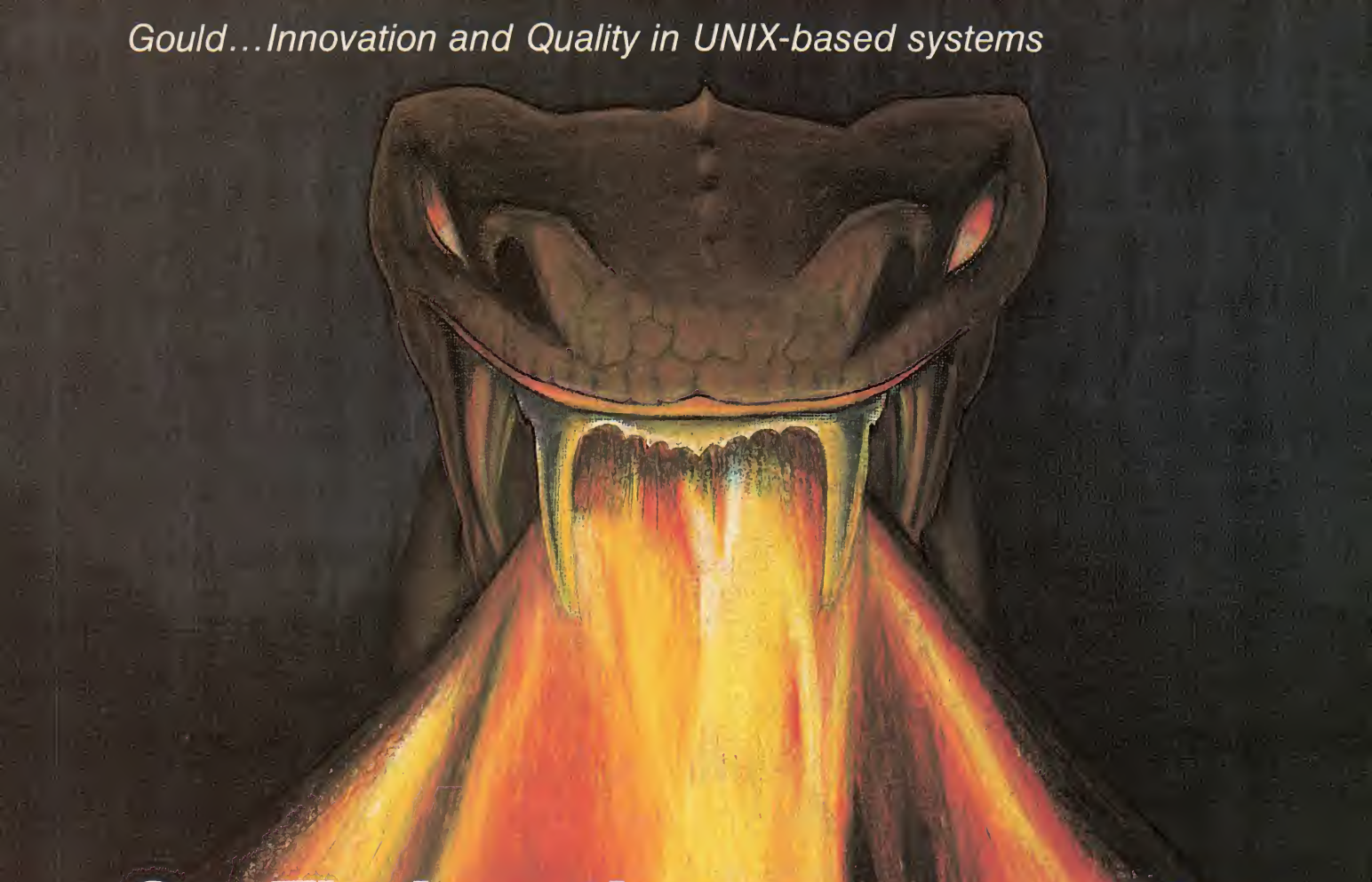

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that. I have this philosophy that the growth curve on the UNIX operating system is going to be longer than the growth curve on things like MS-DOS. It didn't have a sharp spike of growth; it had a continuous growth curve – 15 years of it, in fact. I doubt that it's going to come down quickly. Based on things that I'm seeing in industry, I think that steady growth pattern is going to continue.

REVIEW: *Well, I think the 15 years of development time has certainly discouraged some other people from trying to come up with alternatives. UNIX has been kicked around in a lot of different environments for a very long time. You're not going to come up with something in very quick order that is going to be as bug-free as UNIX.*

"The masses don't want to know about the operating system. They may not even want to know about the processor, if you get right down to it."

CRUME: I like to look at it another way. I like to think people chose to go to the UNIX operating system because they realized that they've got to get to a basis where applications are the focus. If they spend time writing other operating systems, that's an expense they don't need. These proprietary operating systems are not maintained for free. They cost money.

REVIEW: *Getting back to system management matters, what measures do you foresee for handling bad blocks of data?*

CRUME: There are two things you can do for bad block handling. One is that it can be put into a device driver which resides on the CPU. Or it can be put into the I/O processor. There are a number of systems that have intelligent input/output processors that control the devices. So you could hide bad block handling from the UNIX operating system totally if you wanted to by putting it into the I/O processor. There have been a number of customers I know of that have handled it that way.

The other dimension is that there is what I call the generic part of bad block handling and the device-specific part of bad block handling. What I mean by generic is if you choose to go the device driver route, there is a part where you can format disks to detect bad blocks and obtain a list such that you can map around them. There is a part that's got to be specific about the device, though. The device may want those bad blocks to be in some particular place, like on the disk.

So what does the driver do when a bad block is hit? For instance, if you're out reading data that's been written and a bad block is found, what happens? The interface back to the system is generic. The fact that a bad block was found is device specific, so it has to pass it back to the generic part of the software saying it has found a bad block.

The way I like to look at bad block handling is that our computer systems will have to provide both the generic and the device-specific approaches. At this point, I think we do bad block handling in the input/output processor on the 3B20. But we're not doing it there on the 3B2. There will be a generic part we want to provide to the industry so it shows an interface to bad block handling.

I think the thing the industry has come after us for most is to point the way to what that generic part is. They know they have to do the specific part because they have their own devices. But they would like to see a consistent interface for the generic part. That's not consistent right now across the industry. The generic part can get pretty tricky too. It can be gotten around dynamically. It may mean a message to the user asking what to do. It may mean the machine will advise the user to run a particular program. That's pretty touch and go for a novice customer. I'm not too keen on that but I think we've got to start providing the tools and then start working with novice customers to find a way through that satisfies them.

That gets at another issue I didn't have much luck getting across at the UNIX Market Forum. It's something I call "system administration."

Let me use my automobile analogy again. I've got to put

gasoline in the silly thing. I've got to fill up the windshield washer. I've got make sure there's water and oil. I may even change my own oil and, if I'm smart enough, I may even change my own tires and stuff like that. But typically there's a lot of people who don't want to do any of that so they may have somebody do it for them — at a service station or something. There at least are some sensors in the car to tell you when you need a fillup or are running low on oil. We may have to adopt those kinds of measures for bad block handling. Clearly, we've got to search for the system administration capabilities we want to provide people with.

REVIEW: *So you want system administration to be machine-operated to some extent?*

CRUME: Yes. There are some fairly nice ways to get through it. For instance, in a multitasking environment like the UNIX system, you can kick off a process in background that goes through the system and prints out files that haven't been touched in so many days.

Since we've licensed UNIX software and it's been so heavily used inside of AT&T, there are an awful lot of administration programs that people have built locally for their systems. That's another thing to draw from in providing this administration capability on future systems.

REVIEW: *Actually, this touches on exactly the area I wanted to go into next. That is, the hardened file system you alluded to. You've already touched on some of the components of that. Maybe you can give an overview.*

CRUME: As far as I'm concerned, a hardened file system consists of the following: power can go up and then you can slam it off by jerking the cord out of the wall. And when that thing comes back up, I don't want to find that something's been dropped. Neither do I want to find that I have to do something in order to get my files back online. I want the machine to come back up and be ready for me to start using it again.

REVIEW: *So wouldn't hardening also apply to other administration functions, like the ones we were just talking about?*

CRUME: Well, I think hardening is a combination of the capabilities you put in and the person who administers the machine. How do you balance those? Hardening is a different kind of issue in computer centers where you have professional operators and operations support people who have been handling system administration for years. But what do we do for a novice who has a very powerful computer that's sitting on the desktop? We'll clearly have to automate. That's another capability that will consume horsepower. But we'll have to do it. We, as users, cannot take the pain associated with that going down and coming up again. You can't repair stuff — most of us wouldn't know how to repair it.

REVIEW: *Are you talking about automatic* ***fsck*** *and* ***fsdb*** *functions?*

CRUME: You can do those but you've got to make some intelligent choices in order to repair a system too. We've been doing a lot of work on that with our 3B2, where we will take it off line and do all kinds of crazy things to it, plug a floppy in, start to write something, jerk the floppy out, put it back in and see what it does. Those are all file hardening measures. We want the system to survive.

REVIEW: *I'd like to get back to* ***fsck****, though. I know from experience that the 3B2 has a* ***fsck-y*** *default. Don't you think that's a bit dangerous?*

CRUME: You can change that.

REVIEW: *But will novice users know to change that?*

CRUME: They may not want to even know about it. Remember, now, novice users are a little different...

REVIEW: *But if the user is going to lose his file, don't you think he might want to be advised about that?*

CRUME: Absolutely. But there will also be some people who will be quite happy that it's just gone.

REVIEW: *That depends on what's in the file!*

CRUME: I agree with you. That's why it's hard to make these kinds of choices. You can't sell an end user a computer system that has 500 options that must be decided among before using the machine. In that situation, you lose. You can't do it.

So far, we've made computers for computer people who want lots of flexibility and power. But remember, novice people who've never used a computer may very well accept it as something that can be thrown away. For instance, my kids definitely expect something different from a computer than I do. We have to take the novice into account. But we can't just throw away the experts who have gotten computing to the place it's at. You have to provide them with the capabilities they want. So where is the happy ground?

We're moving through such a transition. The UNIX system was built for experts to use and build other systems on top of. It was designed as a software development system, plain and simple. But now it has moved very, very rapidly into the hands of a different set of users. These new

Continued to Page 96

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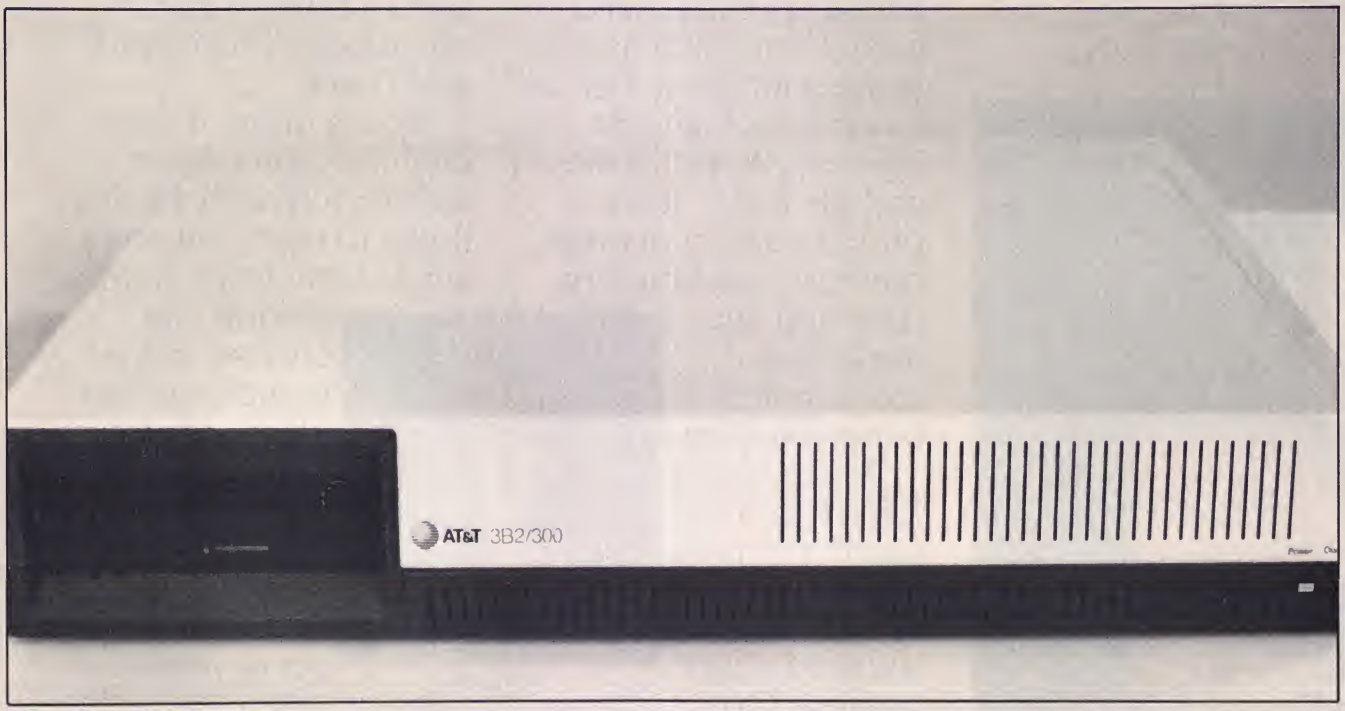

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SOFTWARE

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- Optional UNIX System V utilities

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- Frequency: 60 Hz
- Power Consumption: less than 200 Watts

PHYSICAL SIZE

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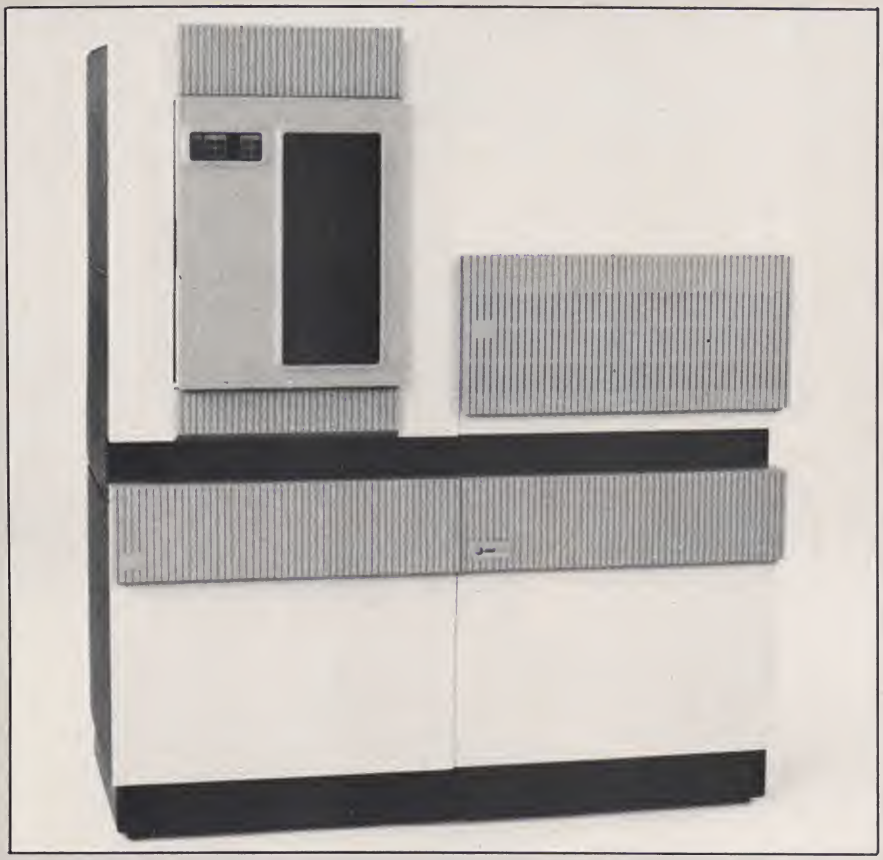

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COMMUNICATIONS

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- Ethernet (10 Mbit/second) standard interface

SOFTWARE

- UNIX System V
- C and FORTRAN

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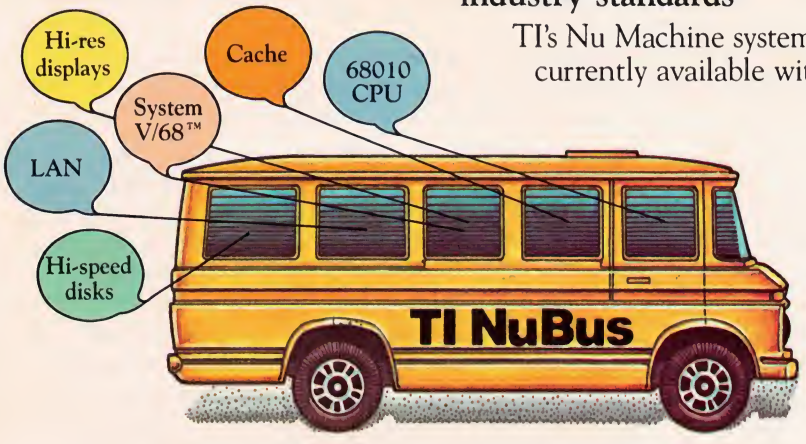

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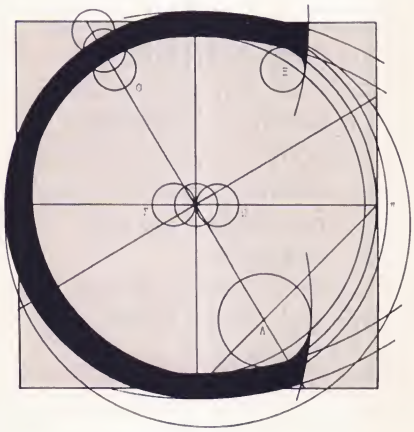
Terminal interface manipulations

by Bill Tuthill

Changes are often made for good reason. One example is the System III terminal driver, which differs so much from its Version 7 predecessor that some source code is incompatible across versions. Though we might quibble with some of the particulars the new driver represents a significant step forward.

System V's terminal driver is almost identical to the one found on System III, so programmers using one of AT&T's recently released 3B computers will benefit from the improvements.



The System V terminal driver provides the following advantages over the "old" Version 7 and the "new" Berkeley terminal drivers:

- Input modes, output modes, control modes and local modes can all be controlled separately. However, different input/output baud rates are not supported.
- The programming interface is more elegant. Naming is more consistent, and everything is together in one structure. On 4.1 BSD there are three separate structures!
- There is support for synchronous terminals, which are common on IBM mainframes. There is also support for the KMC-11, a DEC line driver that helps reduce system load.
- The command set is orthogonal. You can, for example, send and receive 8-bit wide data, without having to resort to RAW mode.

Despite these System V advantages, it is only fair to mention that the "new" tty driver on Berkeley UNIX has a much better user interface. Here are some advantages of the Berkeley interface:

- Line erase (i.e. **kill**) and word erase (^**W**) remove characters as they are erased. On System V, only character erase does this.
- Control characters are displayed as they are entered to help naive users identify typing errors. Erasing of tabs and control characters is done properly, whereas on System V column alignment is not attempted.
- The new terminal driver gives the user access to job control facilities, so that processes may be suspended (^**Z**), placed in background or brought back into foreground.
- Separate input/output baud rates are theoretically possible, although it doesn't work in practice because of device limitations.

As a programmer, I prefer the USG (UNIX Support Group) terminal driver, but as a user, I like the Berkeley interface and find it hard to work without. Note that what is called "job control" on System V.2 is not really job control at all but a half-hearted implementation of windowing.

To show how to perform some common operations on the terminal interface, let's turn to a sampl-

---

Bill Tuthill was a leading UNIX and C consultant at UC Berkeley for four years prior to becoming a systems software analyst at Imagen Corporation. He enjoys a solid reputation in the UNIX community earned as part of the Berkeley team that enhanced Version 7 (BSD 4.0, 4.1 and 4.2).

ing of programs. All the programs shown here will compile on either Berkeley UNIX or AT&T UNIX, since they have the appropriate **#ifdef** statements for the C preprocessor. This header file (placed in a file called **term.h**) will be used in each of the examples:

```
# include <whoami.h>
#ifdef USG
# include <termio.h>
# include <fcntl.h>
#else
# include <sgtty.h>
# define O_RDONLY 0                    /* would be in fcntl.h */
#endif
```

The initials USG stand for UNIX Support Group, the arm of AT&T charged with maintaining Systems III and V. The Version 7 header file for terminal control, **sgtty.h**, has been replaced by **termio.h**. The System III and V header file **fcntl.h** gives definitions for controlling open files; 4.2 BSD provides the same facilities and **include** file, but earlier Berkeley UNIX systems did not. The initials BSD, by the way, stand for Berkeley Software Distribution. These initials are used below to delimit code that will function only on Berkeley UNIX.

One general remark about the four programs included below: they are ugly, hard to read and they were hard to write and test. However, ugliness is necessary if you want software to run on all current versions of UNIX. Until a better terminal driver comes along or until everyone agrees on a standard, programs will have to look bad.

These programs were written and tested on a VAX running 4.2 BSD and Doug Gwyn's System V compatibility package. The Berkeley features were tested with **/bin/cc** while the System V features were tested with **/usr/5bin/cc**. It is a comment on the relative merits of these two systems that 4.2 BSD can emulate System V, whereas the reverse would be nearly impossible.

Over noisy transmission lines, the **DEL** character, which is the default UNIX interrupt character, looks too much like a string of ones (line closed). If you work over phone lines during a storm, for example, you may find your work getting interrupted by transmission errors, which generate extraneous **DEL** characters. One solution might be to change your interrupt character to something else, such as CTRL-C. That's what this program does:

```
#include "term.h"

main()          /* set interrupt to control-C, if possible */
{
#ifdef BSD
        struct tchars ctls;

        ioctl(0, TIOCGETC, &ctls);
        ctls.t_intrc = 003;             /* should use argv[1] */
        ioctl(0, TIOCSETC, &ctls);
#endif
#ifdef USG
        struct termio term;

        ioctl(0, TCGETA, &term);
        term.c_cc[VINTR] = 003;         /* should use argv[1] */
        ioctl(0, TCSETA, &term);
#endif
        exit(0);
}
```

There is no way to reset your interrupt character on vanilla Version 7 systems, so this program does nothing on Version 7. On Berkeley UNIX, the **tchars** structure contains the actual interrupt character, along with the quit signal, the start and stop characters and the end-of-file character. On AT&T UNIX, these characters (with the exception of start and stop) are part of an array in the **termio** structure. This arrangement is far superior to having two structures, **sgttyb** and **tchars**. However, System V provides no way to reset the stop (^S) and start (^Q) characters.

READ WITHOUT WAITING

When writing interactive software and packet-based communications packages, it is often necessary to perform a read to look for input, returning immediately if there is nothing to be read. On USG UNIX, this is called read-no-delay. On Berkeley UNIX, there is a special **ioctl** call that tells how many characters are waiting in the input queue. The following program sleeps two seconds, reads a line without hanging if there's nothing to read and prints what has been entered before exiting:

```
#include <stdio.h>
#include "term.h"

main(argc, argv)        /* read from terminal without waiting */
int argc;
char *argv[];
{
        char buf[BUFSIZ];
        long n = 0;             /* so on v7 sure to read nothing */
        int fd;

        puts("You have 2 seconds to type a line:");
        sleep(2);
        fd = open("/dev/tty", O_RDONLY);
#ifdef BSD
        ioctl(fd, FIONREAD, &n);
#else if USG
        fcntl(fd, F_SETFL, O_NDELAY);
        n = (long)read(fd, buf, sizeof(buf));
#endif
        if (n == 0)
                puts("You didn't type anything.");
        else {
#ifdef BSD
                read(fd, buf, sizeof(buf));
#endif
                printf("You typed: %s", buf);
        }
        exit(0);
}
```

On Berkeley UNIX, you call **ioctl(FIONREAD)** to check if there are characters waiting to be read; if there are, you read them. On AT&T UNIX, you call **fcntl(O_NDELAY)** to specify that further reads should be done without waiting. This can also be accomplished from the **open** call, but then your code wouldn't work on Berkeley UNIX. Vanilla Version 7 systems provide no features for doing non-blocking

reads, so on V7 systems, the above program will always say, "You didn't type anything."

TWO-WAY CONTROL FLOW

The following program causes the terminal driver to send a CTRL-S when its buffer is half full, and a CTRL-Q when it is ready to receive data again. The terminal driver does not normally do control flow. This is helpful when you are uploading data from a microcomputer onto a larger UNIX system. Unless two-way control flow is enabled, data will probably be lost when buffers overflow. You can set this mode from the shell simply by typing **stty tandem** on Berkeley UNIX, or **stty ixoff** on System V UNIX. However, for writing file transfer software, it would be best to set this mode from within a C program for the sake of efficiency, as in the following:

```
#include <stdio.h>
#include "term.h"

main(argc, argv)        /* enable two-way XON/XOFF control flow */
int argc;
char *argv[];
{
#ifdef USG
        struct termio term;
#else
        struct sgttyb term;
#endif

        if (argc == 1) {
                fprintf(stderr, "Usage: %s [on|off]\n", argv[0]);
                exit(1);
        }
        if (strcmp(argv[1], "on") == 0) {
#ifdef USG
                ioctl(0, TCGETA, &term);
                term.c_iflag |= IXOFF;
                ioctl(0, TCSETA, &term);
#else
                ioctl(0, TIOCGETP, &term);
                term.sg_flags |= TANDEM;
                ioctl(0, TIOCSETP, &term);
#endif
        }
        if (strcmp(argv[1], "off") == 0) {
#ifdef USG
                ioctl(0, TCGETA, &term);
                term.c_iflag &= ~IXOFF;
                ioctl(0, TCSETA, &term);
#else
                ioctl(0, TIOCGETP, &term);
                term.sg_flags &= ~TANDEM;
                ioctl(0, TIOCSETP, &term);
#endif
        }
        exit(0);
}
```

On Version 7, the terminal control structure was called **sgttyb**; on System III and V it is called **termio**. Most of the differences here are matters of name only. What used to be called **TANDEM** is now called **IXOFF**. The Version 7 field **sg_flags** was separated into **c_iflag** for input, and **c_oflag** for output. The arguments to **ioctl** are now **TCGETA** and **TCSETA** rather than **TIOCGETP** and **TIOCSETP**. Note that we could have used **gtty** and **stty** instead of the **ioctl** calls for non-USG systems; **ioctl** is used merely to show the similarity between the old way and the new way.

When writing screen-oriented software such as editors, database forms editors and visual games, it's best to use a terminal control state somewhere between cooked and raw mode. This half-baked mode is sometimes called "rare" mode. On Version 7 and BSD systems, you set **CBREAK** mode. On USG systems, you disable canonical input processing.

The following program sets the terminal line to rare mode, after saving the original **tty** state. It then calls a function that would ordinarily handle the screen. In this example, however, it just executes the **stty** command, to show the terminal line settings. Finally, it resets the terminal to its original state and exits. The screen function would normally be filled in with code to handle screen input and output. Note that for most programming applications, however, it would be better to use **curses**, if this package is available at your site:

```
#include <stdio.h>
#include "term.h"

main(argc, argv)        /* set tty to rare mode for screen work */
int argc;
char *argv[];
{
#ifdef USG
        struct termio tty, save;
#else
        struct sgttyb tty, save;
#endif

#ifdef USG
        ioctl(0, TCGETA, &save);
        ioctl(0, TCGETA, &tty);
        tty.c_iflag &= ~ICRNL;
        tty.c_oflag &= ~(TAB3|ONLCR);
        tty.c_lflag &= ~(ECHO|ICANON);
        ioctl(0, TCSETA, &tty);
#else
        gtty(0, &save);
        gtty(0, &tty);
        tty.sg_flags |= CBREAK;
        tty.sg_flags &= ~(ECHO|XTABS|CRMOD);
        stty(0, &tty);
#endif
        screen();
#ifdef USG
        ioctl(0, TCSETA, &save);
#else
        stty(0, &save);
#endif
        exit(0);
}

screen()                /* handle screen-oriented functions */
{
        system("stty");         /* just test for now */
}
```

On USG systems, you turn off the input mapping of carriage return to newline by doing a bitwise **and** into the input flags of the one's complement of **ICRNL**. You turn off the output mapping of tab to spaces, and the output mapping of carriage return to newline, by doing likewise with **TAB3** and **OCRNL**, into the output flags. Finally, you turn off local echoing and canonical input processing by doing the same thing with **ECHO** and **ICANON**, into the local flags.

On Version 7 and Berkeley systems, input and

Continued to Page 95

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THE HUMAN FACTOR

Visions of automated expertise

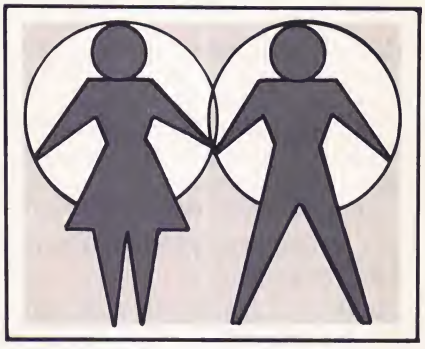
by Richard Morin

The goal of the UNIX Consultant expert system is to provide a natural language help facility that allows new users to learn operating systems conventions in a relatively painless way. UC is not meant to be a substitute for a good operating system command interpreter, but rather an additional tool at the disposal of the new user, to be used in conjunction with other operating system components.

Robert Wilensky
The AI Magazine
(Spring 1984)

UNIX, because of its pervasive usage in academia and its ability to adapt to changing requirements, has become a favored research environment for studies of computer-related human factors questions. Occasionally we see the results of such research entering the mainstream of UNIX use. This column reviews a particularly promising research effort and fantasizes on how it might become, or at least inspire, a valuable UNIX tool.

Last month's column alluded to the lack of gurus, useful documentation, helpful error messages and other aids for novice UNIX users – particularly in the now prevalent binary



license environment. It is a nontrivial task for beginners to understand baffling bits of operating system behavior or to discover how to use new commands. Novice system administrators are in even worse shape due to the extreme lack of UNIX system management literature.

UNIX help facilities are of little use to users needing to perform tasks but unfamiliar with the specific UNIX command names they need. The **man** facility offers no help because it requires that the user specify the name of the desired command. The **apropos** command (now integrated into the **man** command as option **-k**) is somewhat more helpful in that it will search for relevant keywords. Still, it is only useful when the "correct" keyword is given.

Similarly, the permuted index for BSD 4.2, with over 3000 lines of text, is of no utility to someone unaware of which synonym to use. A programmer wishing to cause a 10-second delay, for instance, would find no helpful references under either "second" or "delay".

This lack of useful documentation and help facilities could be made less painful by a mass cloning of gurus. Genetic engineering is not yet up to the task, but an automated approximation may be on the way.

THE UNIX CONSULTANT EXPERT SYSTEM

Dr. Robert Wilensky's UNIX Consultant (UC) is an expert system on UNIX coupled with a natural language interface. It can converse with humans in a reasonable facsimile of natural English and can provide useful assistance even when given inexact or elliptical questions. If a user inputs, "How do I delete a file?" followed by "A directory?", UC will infer that a request has been made for information on how to delete a directory.

Richard Morin is an independent computer consultant specializing in the design, development and documentation of software for engineering, scientific and operating systems applications. He currently operates the Canta Forda Computer Lab in Ft. Washington, Maryland.

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The program is currently able to answer, albeit slowly, the kinds of questions typically posed by naive users. An average query is now answered in perhaps a minute of VAX time, which in most cases is acceptable, if tedious. Dr. Wilensky feels that the speed problems can be solved, however, and says that a fast demo system should exist within a couple of months.

UC can even show a degree of "common sense." The request, "I'm trying to get some more disk space", should not, for instance, generate the response, "Type rm *", since there is an unstated but vital desire to retain important current files. As Dr. Wilensky notes: "...the answer lacks a certain cooperative spirit. A more felicitous answer might be 'Delete all the files you don't need' or 'Ask the systems manager for more storage".

It is a non-trivial task for beginners to understand baffling bits of operating system behavior or to discover how to use new commands.

Perhaps some notes on expert systems should be interjected here. Expert systems are programs that act as though they were expert in some discipline requiring a substantial amount of knowledge. They are generally not used in situations where an algorithm can be used to calculate the desired information. UC is a typical expert system in that it acts as a consultant, assisting humans by means of dialogue.

An expert system is made up of facts, rules and an "inference engine." When presented with a problem situation, an expert system tries to find a path from the problem to a solution through a chain of logic.

As these systems work by means of heuristic "rules of thumb" rather than by means of algorithms, there is no guarantee that the optimal solution to a given problem will be found – or, for that matter, that any solution whatsoever will be produced.

Since the expert system's chain of reasoning is not known in advance, and may even be faulty, some check on the system is very much in order. Generally, an expert system is able to indicate the form of reasoning it takes to reach its conclusion(s). This is useful to both users and designers, and keeps the system from seeming like a mysterious oracle.

THE ARTIFICIAL INTELLIGENCE CONNECTION

Expert systems originated as a means of exploring artificial intelligence (AI) questions. They are now being produced by a number of companies, both for sale and internal use. Their applications are diverse and growing, including medical diagnosis, computer system configuration and oil well drilling. Since expert systems are expensive to produce, they are generally used in fields where expertise is both valuable and scarce.

Natural language interfaces also had their start in AI, and are in fact still an area of active research. Techniques for understanding natural language have matured enough to allow for commercial use, with some products already being sold. UC is largely a research effort into natural language and common sense reasoning, as opposed to expert systems, per se. It allows abbreviated queries, using conversational context and a simple model of perceived goals to assist in the understanding process.

This lack of useful documentation and help facilities could be made less painful by a mass cloning of gurus.

Is UC a first step toward the desired "cloning" of UNIX gurus? Let's "blue sky" a little about this, but first, a disclaimer: since UC is an *experimental* system at this time, the reader should be careful not to confuse the following mixture of facts and columnist fancy with either present reality or Dr. Wilensky's intended goals.

UC is written in FRANZ LISP and PEARL, and so should be reasonably portable. Given this portability, sufficient effort could turn UC into a common UNIX utility. It may well be, though, that UC itself is not the appropriate basis for an expanded system.

Let us talk, therefore, about "GURU: a UNIX Reference Utility" – that's GURU, as in a "Garrulous UNIX Reference Utility," or perhaps a "Generally Useful Reference on UNIX." In any case, GURU is hereby proposed as a collaborative effort by the AI and UNIX research communities.

GURU, like UC, must be able

to handle a wide and expanding range of UNIX questions. This would allow GURU to form the basis for a help facility for the entire UNIX community. Not limited to the simple questions posed by novices, it could assist programmers, system administrators and other souls drowning in the turbulent C of UNIX usage. GURU might even know about the use of some common languages or some of the more difficult utilities.

To be most useful, GURU would need to have an idea of the context in which the user is working. It could derive this from the current machine state and from a log of recent user commands. A user faced with an incomprehensible system message would thus be able to enter, "Huh?" and get a sympathetic or even informative explanation from the resident GURU.

Since the members of the UNIX community have varying levels of sophistication, GURU should be able to converse at a level that is neither patronizing nor confusing. Advice that is at the level of a systems programmer will baffle a novice, and novice-level advice will infuriate a systems programmer.

GURU will need to collect information both on UNIX and the types of problems most commonly faced by UNIX users. If GURU is to adapt to the needs of its users, it must be able to keep track of both its successes and its failures. Resident human experts should also be able to add to GURU's store of knowledge without being familiar with GURU's internal workings. Finally, GURUs at all participating UNIX sites should be able to share their knowledge in some automated way.

The collection and organization of the large body of UNIX lore into a single knowledge base would be an immensely valuable accomplishment, but it is not a trivial task. Knowledge communication, storage and integration are difficult problems. The problem of communication is made somewhat more tractable by UNIX's networking facilities. A bit of database magic, at the very least, though, would be involved in storing the raw UNIX lore.

THE BIG CHALLENGE

The integration of knowledge acquired from multiple individuals is perhaps the most difficult problem. The AI field does not yet have a fully automated solution to the problem of integrating knowledge from disparate sources. In all probability, however, a semi-automated system of some sort could be developed to assist in knowledge base integration and maintenance. With this assistance, a staff of human gurus would be able to integrate the arriving lore into GURU.

"But who would pay for it?" I seem to hear. Well, UC was funded in part by the Office of Naval Research (a long-standing supporter of AI), the National Science Foundation and the Defense Advanced Research Projects Administration, which funded both ARPANET and Berkeley UNIX. These same folks might be interested in exploring the development of a system like GURU.

DARPA, in particular, has good reason to support such an effort since it seems to be grooming a BSD version as a replacement for the TENEX/DEC-10 systems it currently uses. If and when DARPA changes systems, it faces a monumental retraining task. If a GURU is around to help, DARPA's job might be made considerably easier.

All sorts of nice things can be made to happen when money, technology and the efforts of a supportive user community come together. Is anybody interested?

■

RULES OF THE GAME

Setting the groundrules for copyright law

by Glenn Groenewold

We call this monthly feature *Rules of the Game* not only to have a catchy title, but to reflect the game-like quality of our topic. Software law certainly can be a test of wits worthy of any games enthusiast, but there's little risk of it being mistaken for a Parker Brothers creation, which we would assume would at least include a comprehensive set of instructions.

Games are often valued by the extent to which their rules allow for variety while still anticipating all possible situations. There are very real differences, though, between the rules devised for recreational pursuits and those that have been developed to govern business activity. This is particularly true whenever new technology is involved, since the rules tend to evolve as the game is being played. Participants, therefore, find themselves in the disconcerting position of guessing in advance what the rules will be, knowing that wrong guesses could be disastrous.

This, pretty much, has been the situation in the computer industry since its inception. Recently, though, some high-stakes play has resulted in a court decision which is generally thought to go a long way toward establishing rules for the software game. But it doesn't go all the way: the decision may raise as many questions as it answers.

THE PLAYERS

The players in this instance are Franklin Computer Corporation and Apple Computer, Inc. Franklin copied 14 Apple II operating programs and incorporated them in its ACE 100 computer, making it compatible with software designed to run on the Apple II.

Apple called foul and hauled Franklin into court, where Franklin's activity was at first held legal. Apple then took the case up a notch to the United States Court of Appeals in Philadelphia.

Franklin claimed it was not feasible to write its own equivalents to the Apple operating programs and contended that it was allowable to copy Apple's programs since they were not capable of being copyrighted. Apple, having spent an estimated $740,000 on the programs, felt differently, claiming copyright protection for its efforts.

In making its defense, Franklin relied on a fundamental contradiction running through the American set of rules for business activity. On the one hand, our society claims dedication to the ideals of full competition and free exchange of ideas. But on the other, we also claim to believe in the protection of private property, including intellectual property. With respect to the latter, these concepts run counter to each other.

The law itself embodies this contradiction. Anti trust laws standing for the first concept and laws providing for copyright, patent and trade secret protection representing the second.

HISTORICAL PERSPECTIVE

Of course, computer technology has presented special pro-

Glenn Groenewold is a California attorney who divides his time between computer law and service as an administrative law judge. He has been active in trial and appellate work and has argued cases before the state Supreme Court.

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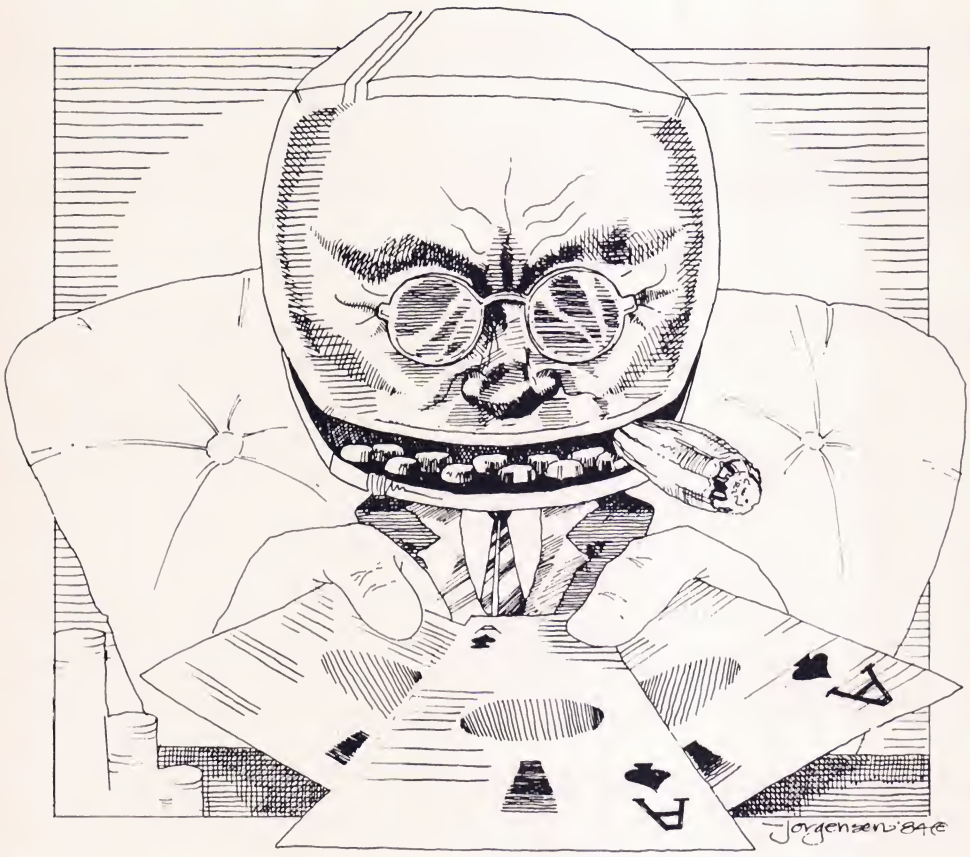


blems since it doesn't fall neatly into the law's traditional categories. Early in the 19th century, it was easy to tell the difference between a literary work, which could only be copyrighted, and an invention which could only be patented. But the law has had to decide which category computer programs fit into. At various times they've been held to be either both or neither.

In copying Apple's programs, Franklin was betting that the courts would come down squarely on the side of competition. Franklin argued that an operating system is analogous to an accounting system, which the courts have ruled to be ineligible for copyrighting. In essence, Franklin claimed that an operating program is a process or system, which really means that it is an idea. Franklin followed this line of reasoning because the law dictates that *ideas* cannot be copyrighted.

The Court of Appeals did not agree with Franklin's view. It determined that Apple's operating programs constituted a copyrightable *expression* of an idea. Moreover, the court found that, whether permanently embedded in ROM or not, an operating program is not merely part of a machine – it is a literary work eligible for copyrighting.

Beyond the Court of Appeals, there is only the United States Supreme Court. Though Franklin hastened there, the Supreme Court declined to hear its appeal, so the Court of Appeals decision is the last word on the subject for the time being.

The story isn't over yet, though. The Court of Appeals sent the lawsuit back to the lower court with instructions to consider some of the matters not covered in the original decision favoring Franklin. One of the most important of these is whether it would be possible to write other operating programs capable of achieving the same result as Apple's. If the answer is yes, Apple's copyrights are valid. But if the answer is no, so that as a practical matter there is no other way of expressing the idea underlying an Apple program, copyrighting will not be possible.

Under the last scenario, it could be said that a "merger" of an idea and its expression has occurred. When this happens, all bets are off for copyrighting. If the notion of merger seems confusing to you, take comfort in the fact that platoons of lawyers and judges have been puzzled as well.

ALTERNATIVES TO COPYRIGHTS

Even where such mergers have taken place, program owners may still find protection. There is the possibility that the programs might be *patentable*, on the theory that they constitute part of the machine operating process. This serves to illustrate why people in the field of computer technology are well advised to always remain aware of the three basic types of protection for intellectual property: copyrights, patents and trade secrets.

With the Apple vs. Franklin decision now final, we should at least have a good grasp on the rules for copyright protection, right? Unfortunately, not entirely.

To begin with, the Court of Appeals located in Philadelphia is only one of several such courts scattered over the United States. Another lawsuit involving exactly the same question could come before one of the other courts of

appeal and produce different results. If this should happen, the United States Supreme Court could then be expected to resolve the inconsistent holdings.

Congress, moreover, is under pressure to change the copyright laws. While this has been the case ever since the present law was enacted, pressure has intensified in the wake of the Supreme Court's recent Betamax decision. That, you'll remember, was when the court ruled that people could tape television broadcasts on home VCR units, copyright or no. While the changes being pushed by people unhappy with the Betamax decision won't be aimed at software, it's impossible to predict where the horsetrading in Congress will stop once it's underway. Sometimes even innocuous changes in the law can have unanticipated results.

Finally there's the question of exactly how far a copyright on computer software will actually extend. How completely need a program be rewritten in order to be considered a new expression of an underlying idea? Adam Osborne, for one, has taken the dim view that software copyrights serve to do little apart from preventing outright ripoffs. He points out that if the specifications for a particular objective are given to 100 programmers, there will be virtually no recognizable similarity among the programs they come up with.

"If you cannot copyright the way a keyboard is being used, you have a problem," Osborne asserts. In his view, as soon as the retail cost of a software package drops to about $50, economic considerations alone will minimize copying problems since it simply won't be worth the trouble to copy any longer.

But stay tuned. There are sure to be exciting developments to come. ■

/usr/lib

One book that passes muster – and two that don't

by Jim Joyce

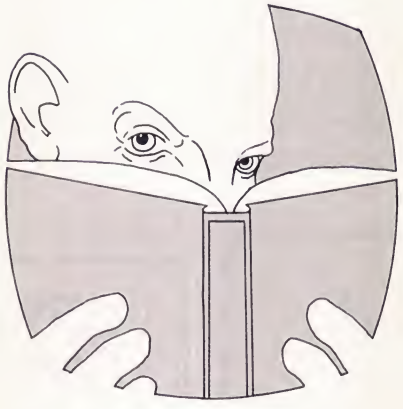
COMPARING AND ASSESSING PROGRAMMING LANGUAGES

In *Comparing and Assessing Programming Languages* (Prentice-Hall, 1984, 271pp, $16.95) Alan Feuer and Narain Gehani have teamed up to edit a splendid collection of papers comparing Ada, Pascal and C. But the book does not stop there – the last section, "Methodology for Comparing and Assessing Languages," provides four thought-provoking essays that those interested in programming languages will find essential reading.

The classic paper by Brian Kernighan, "Why Pascal Is Not My Favorite Programming Language," is among the collection, and its venom is as fresh today as when a copy of the original technical report from Bell Labs came to my attention in 1981.

The editors' own "A Comparison of the Programming Languages C and Pascal" is reprinted from *Computing Surveys*, and is a fair enough comparison of the two languages' capabilities.

Not surprisingly, Pascal comes out a bad second to C. Yet nowhere do the authors acknowledge that one of the two principles on which Pascal is based, according to Wirth himself, is "to make available a language suitable to teach programming." Seen in this light, comparing Pascal



with C is like putting a bicycle with training wheels in competition with a ten-speed racing cycle.

It is true that Pascal has been used for a variety of applications beyond teaching, and thus is a worthy language for comparison with C, but it still seems unfair not to acknowledge Pascal's origin before making the comparison.

TABLE OF CONTENTS FOR COMPARING AND ASSESSING PROGRAMMING LANGUAGES

1. A Comparison of the Programming Languages C and Pascal (29) Alan R. Feuer and Narain H. Gehani
2. Pascal versus C: A Subjective Comparison (23) Prabhaker Mateti
3. A Comparison of Pascal and Ada (11) B. A. Wichmann
4. A Comparison of Programming Languages: Ada, Pascal, C (29) Arthur Evans, Jr.
5. An Assessment of the Programming Language Pascal (13) Niklaus Wirth
6. UNIX Time-Sharing System: The C Programming Language (6) D. M. Ritchie, S. C. Johnson, M. E. Lesk and B. W. Kernighan
7. An Early Assessment of the Ada Programming Language (26) Narain H. Gehani
8. Critical Comments on the Programming Language Pascal (12) A. N. Habermann
9. More Comments on the Programming Language Pascal (13) O. Lecarme and P. Desjardins
10. Why Pascal is Not My Favorite Programming Language (17) Brian W. Kernighan
11. Type Syntax in the Language C: An Object Lesson in Syntax Innovation (7) Bruce Anderson
12. A Methodology for Comparing Programming Languages (12) Alan R. Feuer and Narain H. Gehani
13. A Comparison of Programming Languages for Software Engineering (17) Mary Shaw,

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While an instructor at UC Berkeley in the mid-1970s, Jim Joyce became the first person to teach UNIX outside of Bell Laboratories. He is now President of International Technical Seminars, Inc., and The Independent UNIX Bookstore. For more information about UNIX and C books, call 415/621-1593.

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Guy T. Almes, Joseph M. Newcomer, Brian K. Reid and William Wulf
14. A Critical Comparison of Several Programming Language Implementations (19) H. J. Boom and E. De Jong
15. Programming Languages: What to Demand and How to Assess Them (17) Niklaus Wirth

Bibliography (8)

STARTING WITH UNIX

P. J. Brown makes his entry into the "I, too, have a UNIX book" field with this effort, which makes the reader wander through 38 pages of cerebral introduction before getting down to cases. The publisher, Addison-Wesley, already has a perfectly good UNIX book in Steve Bourne's *The UNIX System*, so I really wonder why it bothered. Brown does touch on the writing tools **diction** and **style**, but that scarcely justifies

I really wonder why the publisher bothered.

the effort. To make matters worse, he chooses to treat the **ed** text editor instead of **vi**, despite AT&T's own endorsement of the latter. (Addison-Wesley, 1984, 221pp, $12.95)

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THE BUSINESS GUIDE TO THE UNIX SYSTEM

Am I the only one who finds the use of "The" in the title to this book somewhat presumptuous? One wonders who decided on the title: authors Jean Yates and Sandra Emerson or an editorial director at Addison-Wesley. But let's press on to the book itself.

The Business Guide to the UNIX System (Addison-Wesley, 1984, 474pp, $19.95) by Yates and Emerson is a good book with just a few too many production flaws. To their credit, the authors have used non-sexist system user names in their examples. The examples also look realistic enough. But when the output of the **date** command is garbled beyond recognition, as on page 29, one's trust in the book is a bit shaken.

Given that the book is written for business users of UNIX who are presumed to know little about computers or UNIX, details such as hyphenating a filename in a discussion of the example on page 149 seem destined to mislead and confuse. Why they did not set off the command:

```
cat se_jc25aug.mem
```

as a display seems a curious bit of carelessness.

On the plus side, pages 195-208 do have a good discussion of how to organize files in directories. And, the authors do discuss the **vi** editor, though not as well as Sobell in *A Practical Guide to the UNIX System* (See the April/May issue of *UNIX REVIEW*). The examples are displayed with a line drawing suggesting the top of a screen, much as the earlier *A User Guide to the UNIX System* by Rebecca Thomas and Jean L. Yates (Osborne-McGraw-Hill, 1982). The display encourages the reader to feel the examples have been lifted from the screen of a CRT. The dot-matrix type face for the examples is less objectionable than most and is at least legible! It still seems odd that a typewriter font is not used.

One interesting part of the book is the chapter on system administration. The information

Comparing Pascal with C is like putting a bicycle with training wheels in competition with a ten-speed racing cycle.

seems rather incomplete, as though work on it was interrupted rather than concluded. The discussions of **dump** and **restor** are without the examples they need to make them meaningful. There are several **tar** examples, though there is no statement of backup policy to guide the novice. The notion of groups is touched on, but the treatment is so sparse

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as to be misleading. Again, it seems the writing of this chapter was broken off prematurely.

Yet another curiosity can be found in the example of logging in where the first letter of the login name is typed in upper case. If my knowledge about various flavors of UNIX is accurate, the typed login:

login: Chris

should elicit:

PASSWORD:

if UNIX decides the user is on an upper case only terminal. Otherwise, the login will succeed as it does on several UniSoft ports of UNIX to Motorola 68000-based systems. The example of incorrect login cited by Yates and Emerson on page 33 seems incorrect itself.

My notes include a long list of typos that apparently eluded reviewers of the original manuscript. Perhaps there were too many people involved in the project to allow for proper product control. In any event, I hope the typos are corrrected by the next printing.

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1. The UNIX System for Business Users (13pp)
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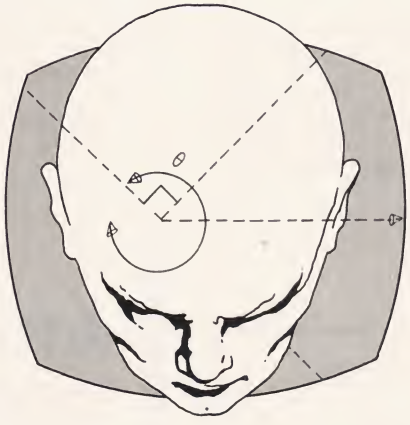
PROBLEM SOLVER

Shell environment settings that make life easier

by Bob Toxen

Greetings from *The Problem Solver*. I specialize in finding handy UNIX solutions to vexing data processing problems – and I mean to pass them on to you. Anything from shell scripts to kernel enhancements on any common UNIX version and hardware is fair game.



This month, my focus is on shell environments, with an emphasis on how you can specify your terminal type so that programs such as **vi** and **rogue** work correctly. By "shell environments" I mean the information you give the system regarding the type of terminal you are using, the place you want your programs kept, the style you want for programs such as **vi** and the abbreviations you prefer for commonly used long commands.

With a bit of effort up front, you can avoid specifying your terminal type each and every time you login. One way to specify your terminal type is to enter:

```
% setenv TERM type
```

(if you typically use the C shell) or:

```
$ TERM = type
$ export TERM
```

(if you prefer the Bourne shell) each time you login. (You should, of course, enter the appropriate **termcap** description in the place of the word "type.")

This is rather repetitive, though, and is best done automatically. Each time you login, the shell can automatically invoke commands stored in a file in your directory called **.login** if you use **csh**, or **.profile** if you use **sh**. If such a file does not already exist, create it and enter the lines given in the example above.

This will work great if you *always* use the same terminal, but most of us are not so static! U. C. Berkeley has solved this problem by creating a database called **/etc/ttytype** that contains the name of the terminal connected to each port of the computer. The Berkeley people also supplied a program to interpret this database called **tset**. Almost all UNIX implementations have **/etc/ttytype** and **tset**.

The file **/etc/ttytype** may be edited with any text editor. It consists of one entry per line. Each entry has the name of the terminal followed by the port it's connected to. These items must be separated by a tab. One can then put a line in **.login** or **.profile** that will allow **tset** to find the correct entry in **/etc/ttytype** and set the appropriate environment variable **TERM**. This can be done by entering:

```
tset -Q -s > /tmp/$$
source /tmp/$$
/bin/rm -f /tmp/$$
```

in your **.login** file or by entering:

```
eval `tset -Q -s`
```

in your **.profile** file.

Bob Toxen is a member of the technical staff at Silicon Graphics, Inc. He has gained a reputation as a leading **uucp** *expert and is responsible for ports of System V for the Zilog 8000 and System III for the Motorola 68000.*

The **-s** option causes **tset** not to print the message, "Erase is Control-H" or "Kill is delete" (these messages may vary slightly depending on what your erase and kill characters are). The **-Q** option causes **tset** to generate the shell commands needed to set the **TERM** and **TERMCAP** variables. Since **tset** knows which shell you are using, it tailors the commands it generates to be appropriate.

One must get the shell to read and process these commands. For **csh** (the first example) we do this by directing **tset** output into the file **/tmp/$$** and ordering **csh** to read it with the **source** command. We then remove the temporary file with the **rm** command. The **$$** in **/tmp/$$** is converted to a different number (process ID) each time you login and is unique among all current users, so as to guard against two users accessing the same file simultaneously.

The Bourne shell **tset** command shown above is surrounded by back primes (`) in order to invoke the command inside and supply its output as parameters to **eval**, which in turn causes the shell to treat the parameters as though they were from standard input. In effect, the shell processes **tset** output as a command.

There are several things besides setting the terminal type that can be done automatically by **.login** or **.profile** at login time. For example, the addition of the line:

```
msgs -f -p
```

to **.login** will automatically give you a listing of office messages when you login under **csh**. The **-f** option causes **msgs** to give the message "No new messages" if there aren't any. The **-p** option causes **msgs** to filter long messages through **more** so they won't fly off the screen.

Since different terminals have screens holding different numbers of lines (mine displays 40), **more** must be informed how many lines it should display before stopping. You can do this by specifying your terminal type in **.login** or **.profile**. That is why **msgs** should be executed only after one's terminal type has been specified with **tset**.

To check news, use the command:

```
news -n
```

to list all current news items. Certain terminal characteristics such as the erase and kill (line delete) characters may be set with **stty** in **.login** or **.profile**. To set your erase character to CNTL-H and your kill character to CNTL-U, give the command:

```
stty erase ^H kill ^U
```

In some UNIX implementations, one can enter a ^ character followed by an H character. In others, you have to enter an actual CTRL-H (by holding down the CTRL key and pressing H). If you have to enter an actual CTRL-H, you will probably have to precede it with a backslash (\ ). Likewise for CTRL-U. If you are using **vi** to edit, you can precede either CTRL-H or CTRL-U (or any other special character) with a CTRL-V to be certain it is entered correctly.

Another common command to issue is the **umask** command. This will determine the access permissions of any files you subsequently create. To allow anyone to read, write or execute your programs and shell scripts, issue the command:

```
umask 000
```

To prevent others from writing to your files, enter the command:

```
umask 022
```

The command:

```
umask 077
```

will prevent others from accessing any file you subsequently create in any way whatsoever.

There are also a number of environment variables, like our friend **TERM**, that can be set so as to save you legwork when writing programs. One such variable is **EXINIT**, which can be set to make **ex** and **vi** act according to your preferences. For example, a C programmer at a company called Silicon Graphics might want to give the command:

```
setenv EXINIT 'set ai aw|:ab sg Silicon Graphics'
```

if she is using **csh** and:

```
EXINIT='set ai aw|:ab sg Silicon Graphics'
export EXINIT
```

if she is using **sh**. This will set **a**uto **i**ndent so that when she enters program source, the current indent level will be maintained (although she can also reduce it by entering a CNTRL-D on a new line). This en-

try will also set **auto write** mode to automatically write out an edited file whenever she wants to start editing another file. Finally, it will also set up **sg** to be an abbreviation for **"Silicon Graphics"** that will be expanded during text entry when followed by a space, punctuation or carriage return (this feature is only available on System III **vi** and later versions).

Rogue players may set their desired options by defining an environment variable called **ROGUEOPTS.** I use:

```
setenv ROGUEOPTS "fruit Orange, (
jump, askme, flush, name Bobby"
```

USEFUL COMMAND ABBREVIATIONS

The C shell allows one to create abbreviations for commonly used long commands (this is also possible under **sh** in System V.2, though with different syntax). Some abbreviations are useful to almost everyone and some are useful only in particular applications. The C shell has a **history** capability that can remember recently invoked commands. This history list can be displayed and particular commands can be re-invoked (even with changes). To set **history** to keep track of the most recent 20 commands, give the command:

```
set history = 20
```

This can be put in one's **.cshrc** file (or entered at the keyboard). It is also useful to give the command:

```
alias h history
```

to create an abbreviation for the **history** command itself. Thus to have **csh** display the last 20 commands invoked, you can enter:

```
h
```

Each command is numbered, so to re-invoke any of them you can simply refer to the desired one by preceding the appropriate number with a ! character such as:

```
!17
```

To avoid having to issue the **history** (or **h**) command frequently, you can have **csh** put the **history** number into the prompt itself by issuing the command:

```
set prompt = '%'
```

This will cause the screen to look like this:

```
1% who
2% mail itsjim
What time is the party?
```

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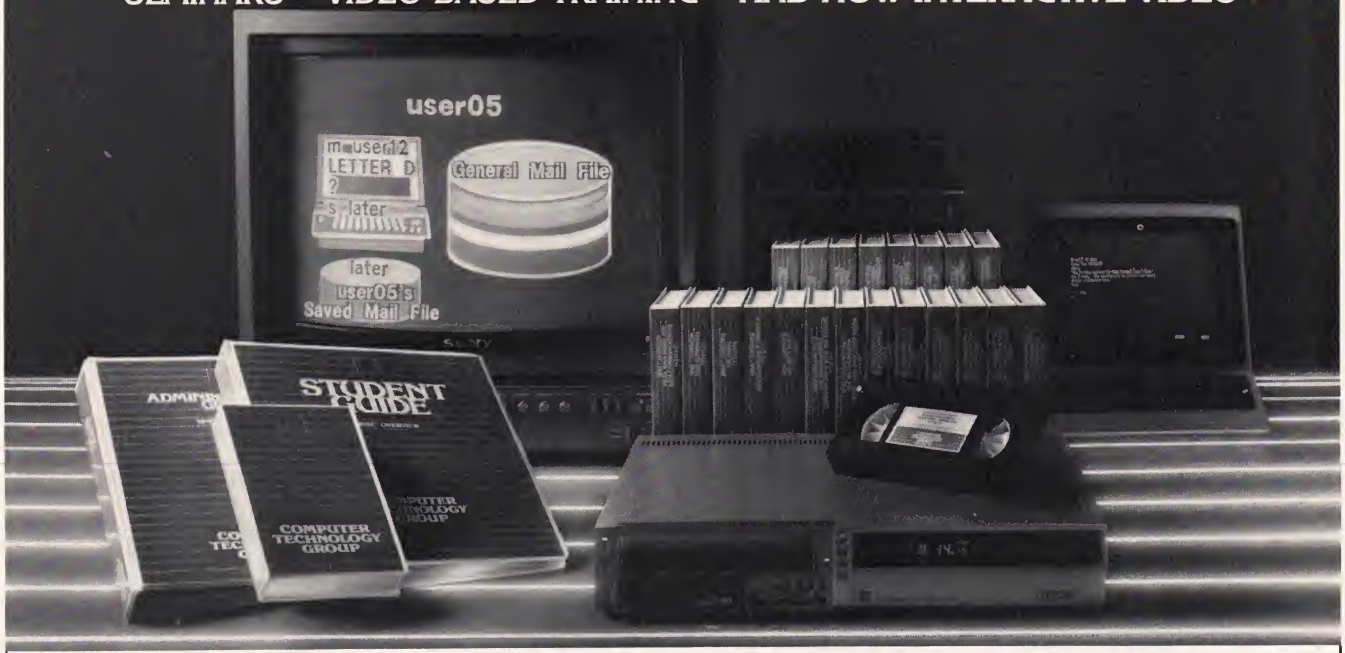

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```
-Bob
^D
3% vi mousetrap.c
<editing stuff>
4% cc -o mousetrap mousetrap.c -lgl -lm
<compiler errors>
5 % !3
<more editing stuff>
6 % !4
<more compiler errors>
...
```

Still another feature that can be utilized is the terminal bell. Since I can often do desk work during long compiles, I have setup my environment such that my terminal's bell is rung when my compile is done. I've done this by putting the line:

```
alias G echo ^G
```

in my **.cshrc** file and when I want to compile a program, I'll enter the command:

```
cc -o mousetrap mousetrap.c -lgl -lm ; G
```

to cause a CTRL-G to be sent to my terminal when the **cc** is done. Printing a CTRL-G on almost any terminal will cause its bell to be rung. I'll cover the **history** facility, including editing, in more depth in a later issue.

Another useful feature to put into your **.login** and **.profile** file is the command:

```
set mail = (5 /usr/spool/mail/name)
```

(substituting your login name for "name," of course). This will cause **csh** to check for new mail belonging to you every five minutes. System III and System V users, however, should use the command:

```
set mail = (5 /usr/mail/name)
```

When one logs out, **csh** will invoke any commands stored in a file called **.logout**. One common set of commands is:

```
/usr/games/fortune -w
clear
```

The first command delivers a random fortune message at logout while the **-w** flag causes **fortune** to wait for you to read the message before finishing (using the **ESP** feature). The **clear** command will then clear the screen in case you have displayed confidential information (or in case you also gave the **-a** or **-o** flags to **fortune**). The **clear** program and the enhanced **fortune** program are from Berkeley.

Readers are encouraged to write in with questions and suggestions to:

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c/o ITS
520 Waller Street
San Francisco, CA 94117
ucbvax!Shasta!olympus!bob

■

DEVIL'S ADV.

Continued from Page 12

of them was captured, tortured, then released? I met one of them – he was a vegetable, Sarge, a walkin' vegetable. He'd given them his name and account number, but they wanted his password. They turned real nasty, 12 hours of OS360, JCL and all – the devils – and reduced him to a zombie."

We shivered and fell silent. The rookie started sobbing.

"I never told you, Sarge, but I've got a...brother in...IBM. God, it could be him over there, third from the left, the big guy with a Mark III TNW on his shoulder. I tried to warn him. It broke my poor mother's heart. She used to tell him, 'Harry,' she'd say, 'there's more to life that making quota in the General Systems Division.' Know what he said? 'I *know* that, Mum,' he said, 'but it's easier than making quota in the Data Processing Division.' And off he goes."

The Sergeant put a comforting arm around the rookie.

"There, there, lad. Don't fret. I know how you feel. I've got a sister with Intel...almost as bad, the way things are going."

As I moved on, the loudspeakers from across the river started up their nightly propaganda onslaught. It was the same strident performance, night after night, planned with all the precision of a new product launch.

"We are your friends," boomed the voice of Billy Graham, "We are your brothers. Lay down your phone jacks lest the Lord smiteth thee and tumbleth down thine telegraph poles... Opel three, verse four..."

And then the silky, siren voice of Armonk Rose arose, crooning, "Reach Out, Reach Out and Touch My Body! Just Cross the Line and I'm Your Gal!"

So the war of nerves continued until dawn, when the IBM bombers swept in with impunity, dropping millions of PC-DOS floppies and forged Del Monte labels. It was a truly awe-inspiring display.

Next month: The Tide Turns ■

THE UNIX GLOSSARY

A boost for beginners

by Steve Rosenthal

This is the first installment in a series devoted to alleviating language barriers to UNIX. The focus this month is on the terms new users must first acquaint themselves with.

Please note that where terms have multiple meanings, only the ones relevant to starting off with UNIX are given here:

– in the standard UNIX shell (the Bourne shell), the "#" is used as the default character meaning "delete the previous character" on the command line. Successive entries of "#"s delete successive characters going back towards the start of the line. Many systems have changed the default from "#" to the backspace (CTRL-H) or the DELETE key (also called RUBOUT). You can set your own choice with **stty**.

$ – as a system prompt, this is the common character used by the Bourne shell when it it waiting for user input. The prompt can be changed and in fact appears as different characters, words or phrases in other shells, such as the Berkeley C shell.

% – as a system prompt, the character used by most installations running the C shell to indicate the system is waiting for input. In many implementations, the "%" is followed by a number

indicating the sequence number of that input line during the current session.

***** – in filename specifications for the shell, the "*" is a wildcard standing for any sequence of characters. Thus ******name* matches *thisname*, *thatname*, or *anyname*. Read aloud, it's usually pronounced as "star" rather than "asterisk."

. – in a directory listing or pathname, the "." stands for the name of the current directory. When read aloud, it's usually pronounced as "dot".

.. – in directory listings and pathname descriptions, the ".." stands for the parent directory (the directory that includes the current directory as one of its entries).

/ – commonly called "slash," this character separates directories in pathnames, and stands for the root directory if first in path. It is often called "root" for that reason.

> – the "greater than" sign or right angle bracket. When placed after a command name in a command line for the shell, it tells the interpreter to redirect output that normally would have gone to the standard output device for that command (usually to screen). The output will go to whatever device or file is specified following the ">" on the command line.

>> – used in a command line to the shell, the ">>" says to redirect the output produced by the command on its left to the file named on its right. The new material is appended to the end of the receiving file.

? – as part of a file specification for the shell, the "?" matches any single character. Thus *?file* would match *ofile*, *ifile or afile*.

@ – called the "at" sign, this character is used in the standard (Bourne) shell as a request to

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Steve Rosenthal is a lexicographer and writer living in Berkeley. His columns regularly appear in six microcomputer magazines.

cancel all characters entered on the current line (many installations, however, have changed to CTRL-X and CTRL-U for this purpose, and you can set your own choice with **stty**).

argument – in a command line to the shell, a string, value, filename or other piece of information that is used as data or input by the program invoked by the command. A command may also accept one or more options as well as arguments.

at sign – as used in UNIX documentation, the character @. See "@" for more details.

baud rate – in the context of configuring terminals or setting terminal characteristics, the rate at which the terminal communicates (it is often referred to as "terminal speed" as a result). For connections of this sort, the baud rate is generally 10 times the number of characters transmitted per second. The usual baud rates are 300 or 1200 baud for dial-up telephone links, and 9600 or 19,200 for hardwired (directly connected) terminals. At many installations, **login** will attempt to recognize baud rate, and you can set the baud rate with **stty**.

block – as applied to system statistics, a unit of disk storage. Blocks were 512 characters until System V, which uses 1024-byte blocks. Berkeley releases use 4096-byte long blocks. Some systems limit the number of blocks that a user can claim and commercial systems often charge users a fee based on average and number of maximum blocks used.

break – a special signal sent from a terminal to indicate that it wants to interrupt the normal functioning of the system. At most installations, if the system isn't set for the correct baud rate (transmission speed) for your terminal and you attempt to login, you get garbage characters back. If you hit BREAK and then RETURN, the system will attempt to set itself to your baud rate. BREAK also interrupts running programs and brings you back to the shell. Not all terminals produce the break signal. At many installations, CTRL-P or DEL will also interrupt a running program, but often is useless in resetting the baud rate.

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cat – the concatenate files command. The theoretical purpose of this command is to combine several files, but its most common use is to list file contents to screen. It still accomplishes its official purpose, however, and it can also be used to create a new file from standard input.

cd – the change directory command. This command sets the current directory (the one used as a starting point for partial or relative pathnames). A new directory must first be created before you can make it your working directory.

command – at the shell level, an instruction to do something. A command is made of one or more words, with the first word being the name of a program that the system can invoke to carry out the command (often that first word itself is referred to as the command). Many commands allow or require one or more options (preceded by a "–" or "+" sign) and a parameter list of expressions, filenames or other data values. At least one space must separate each of these elements.

cp – the command to copy files. This file makes duplicates of the specified files, leaving the originals where they were. It can also used to create files by copying from **/dev/tty**.

date – the command used to display date and time. The superuser can also use this command to set the date and time.

del – one of the names for the ASCII delete character (code value 127 decimal). At some installations, the DEL key is used to delete the last character on the current input line. It's also used to interrupt a program in progress.

end of file character – the character that says that this is the logical end of file, even though there may or may not be more characters before the physical end of file. For the shell, the character is CTRL-D (ASCII code 4). Many programs that accept multiple lines or free-form input from the console require the CTRL-D to be followed by a RETURN for it to be understood as end of file.

erase – the parameter that you use with the **stty** program to set a new value for the erase character (the one that deletes the last character on the current input line). The syntax is:

stty erase x

where "x" is the new erase character.

erase character – the metacharacter that the shell takes as an instruction to erase the last character on the current input line. Originally, this was the "#", but most installations now accept BACKSPACE (ASCII 8 decimal) or DEL (ASCII 127 decimal). See "erase" for how to set this value with **stty**.

/etc/motd – the file containing the message-of-the-day, the short news bulletin from the system administrator displayed during login.

filter – a program that takes input from a single file, applies some transformational rule to it and then outputs the result to a single file. Many of the UNIX utilities and commands are filters since the UNIX pipe facility makes it easy to combine filters in pipelines to combine the effects of several transformations. Filters are most often applied to text files, but you can also filter other types of files.

finger – a command provided in the Berkeley enhancements that tells more information about other logged-in users than is provided by the standard system **who** command. At most installations, **finger** shows the real name (in addition to login name), address and office phone number where the user can be reached.

full duplex – a connection between terminal and computer that allows data to be transmitted both ways at once. Even more importantly, characters entered at a terminal are not displayed until they are echoed back by the system (which can change them before sending them back, act on them or swallow them to hide what was entered – as during the password routine). Older printing terminals often ran in half duplex (where the character was printed without being echoed back from the system). If you get doubled characters on the screen when you type but not when the system is outputting, it means that your terminal or modem is set for half duplex. To change the duplex setting of the system as it talks to you, use **stty**.

group – a collection of users that can share ownership or rights to files. The system administrator assigns users to groups when the user's account is created.

half duplex – as applied to connections between terminals and the system, this refers to data transmissions that go only one direction at a time. See "full duplex" for details.

home directory – the default directory for a particular user. On most systems, it is assigned by the system administrator and then automatically selected by **login**.

kill – 1) the command to delete the current line. The shell takes a specified character as the instruction to kill the current line. In the original shell, the kill character was the "@" sign, but many in-

stallations have changed it to CTRL-X or CTRL-U. You can select your own kill character with **stty**. 2) to remove a running process (program) from the system. See a later installment for more details.

kill character – the character that the shell interprets as an instruction to delete the current input line. The original kill character was the "@" sign, but most installations now accept CTRL-X and CTRL-U. You can change your kill character with **stty**.

learn – used both as the name of a general CAI (computer-assisted instruction) program and the name of a program running a set of lessons about UNIX.

login – 1) the command to let a user begin a session with UNIX. The command invokes the utility program that checks the user name and password, and sets initial user-specific parameters such as home directory. It's normally invoked after **getty**, and finishes by running the shell scripts **/etc/profile** (for system initialization and messages) and the users own **.profile** (for user-specific initialization). 2) a common term for the login name, the name by which the system knows each user. 3) (usually as login:), the common prompt from the **login** utility requesting that the user enter a login name. On some systems, if the login name is entered starting with an upper case letter, the system assumes the user has an upper case only terminal.

login incorrect – a message that some UNIX installations provide when the entered login name is not found or the password is incorrect. Some installations provide no hint of what is wrong in order to make it more difficult to crack the system.

login name – the name that a user gives to sign on to the system. It's usually assigned by the system administrator, and may be a form of the user's real name, a symbolic name or something completely fanciful.

logout – 1) the command to leave the system (you can also

enter "login", or a CTRL-D and return to the prompt on most systems) 2) the act of leaving the system.

man – the command to display sections from an online copy of the UNIX manual. It shows sections of the actual manual, along with page references to the printed version. If **man** is followed by a command name (e.g. man cat), it displays the section of the manual explaining that command.

message-of-the-day – the system identification and news from the system administrator presented by **login** after the user name and password have been accepted.

metacharacters – characters that are presumed to be commands or arguments for the shell. Typically, the list includes:

< > * ? & @ and #

In order to be entered as normal characters, they must be "escaped" or "quoted" by a preceding "\" character.

mode – the collection of permissions attached to a file. The owner of a file (and, of course, the superuser) can change the file's mode. See "permissions" for more details.

motd – 1) the file containing the "message of the day," the news bulletin from the system administrator displayed for users during the login process. Its full name is usually **/etc/motd**.

newline – the characters that end lines for the shell. It is normally RETURN (ASCII 13 decimal) for input, and RETURN followed by LINEFEED (ASCII 10 decimal) for output. These defaults can be changed by using **stty**.

parity – an extra check bit that can be added to characters for data communications or in storage. For terminals, parity can be odd, even, mark (1) or space (0). At most installations, the **login** utility attempts to set the system to match your terminal, but if this doesn't work or you want to change the setting you can use **stty**.

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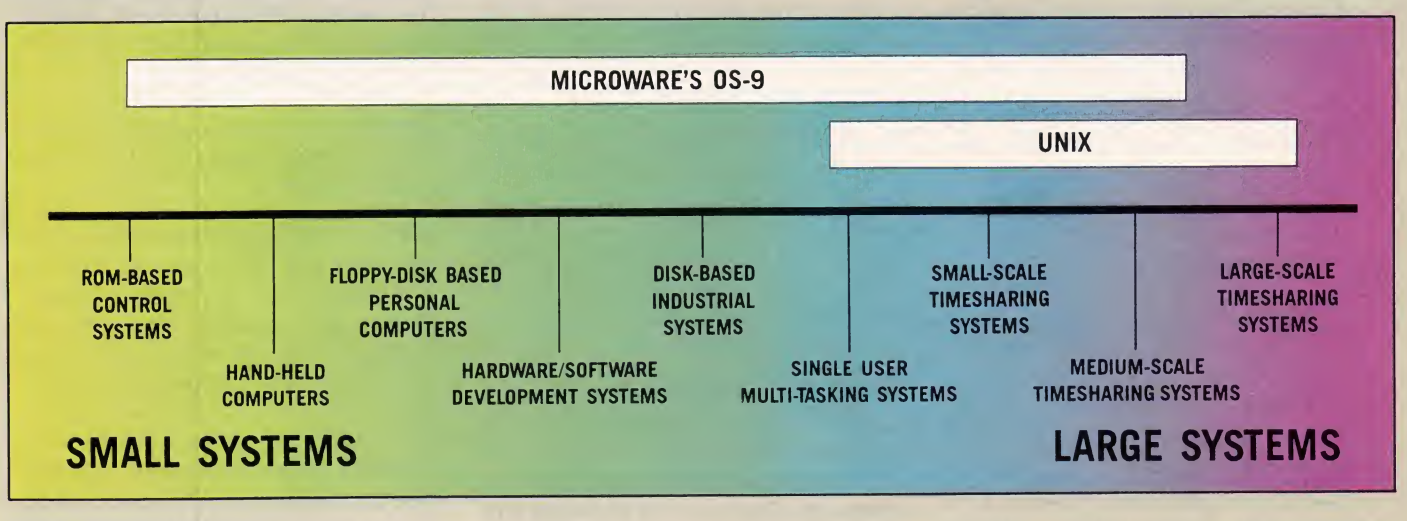

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partial pathname – a pathname (description of where a file is to be found) that starts from the current directory instead of from root. It therefore starts with a directory name rather than with the "/" character.

password – a character sequence that the user enters to confirm his or her identity. When a new account is set up by the the system administrator, it may have no password or system-assigned password. Users are responsible for picking a password and activating it for their account with the **passwd** command. Some systems enforce rules that passwords must be at least six characters long (and usually less than 12). Most people, unfortunately, pick a familiar word, name or birthday as their password, making it easy for others to access their accounts.

permission – the rights to read, write to or execute a file. Each of these three can be granted or withheld to the file owner, the owner's group and the public (all other users). Permissions are set by the file's creator and changed with the **chmod** (change mode) command. The combination of the read, write and execute rights plus two specialized file attributes (the **setuserid** and **sticky bit**) jointly make up the mode.

prompt – a message that a program is awaiting input. The normal shell prompt is "$" or "%", with the latter optionally followed by number, but most systems allow either administrators or ordinary users to change their prompt.

pwd – the command to print wrking directory, or display the full pathname from root to the user's current directory. This command should be used to ascertain your location in the file system when in doubt, especially before deleting files.

rm – the command to remove files. It will not remove directories unless used with the **-r** option. File with multiple links (more than one name or alias) are not lost until the last link is removed.

rmdir – the command to remove directories. It will only remove empty directories (because otherwise there would be no path to the files the deleted directories included).

root – 1) the source of the file system (the root directory). All other directories are located relative to root. 2) in frequent usage, the character "/" (which stands for the root directory when located first in a pathname).

.profile – a file used to set user interface characteristics. It's executed as a shell script just after login.

rubout – an older name for the character now called DEL or DELETE on most terminals. It is the control character with ASCII value 127 decimal. See "delete" for more details.

sharp – a name used in some UNIX documentation for the character "#".

stty – the command used to set the system to your terminal's characteristics. At most installations, the system will try to deduce what settings it can from your login (such as baud rate, parity and so on). A common use is to change the default characters used for delete character and kill line to your particular choices, and to set on or off the conversion of tabs to spaces.

userid – an integer value that corresponds to a user name, and is used internally by many UNIX system programs to identify a user.

who – the command to list who is currently logged into the system. The default display on most systems shows user name, terminal and the date and time logged in.

\ – a metacharacter (a character that has special meaning to the command interpreter) used as the escape character, changing the meaning of the character after it. It means, "take the next character literally, ignoring any special meaning." The "\" is itself a metacharacter, so to enter it into a shell line it must be entered as "\\".

| – the symbol used to indicate to the shell that a pipe should be set up, sending the output produced by a program to the left of the "|" to the standard input of the program on the right.

If you have comments, please send them to Rosenthal's UNIX Glossary, Box 9291, Berkeley, CA 94709. ■

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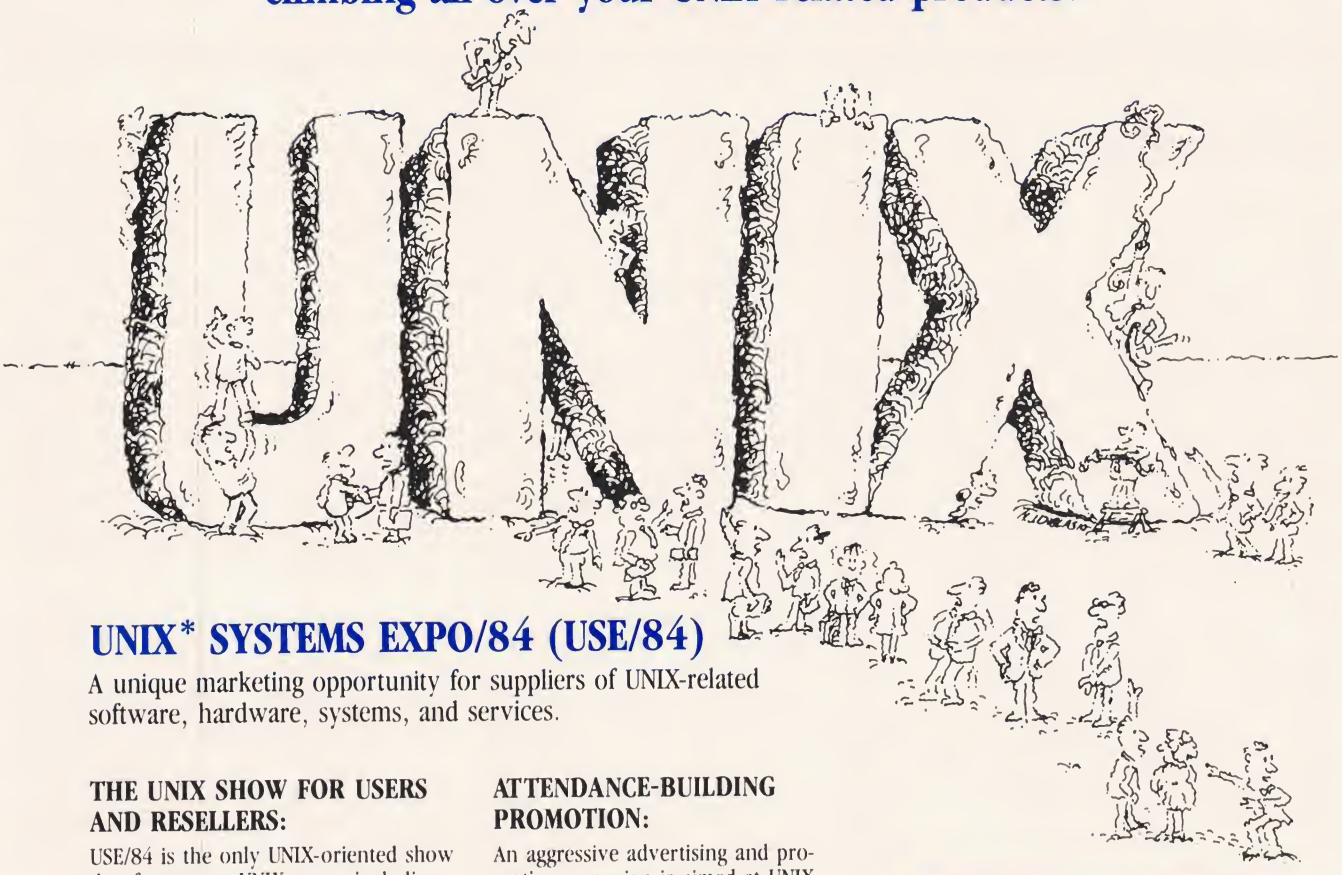

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3B2 REVIEW

Continued from Page 19

AT&T would want to push its highly respected (separately available) Writer's Workbench software for spelling, punctuation and style checks on text files, but one cannot help but miss the usual spelling checker (**spell**) and text output formatters (**nroff** and **troff**) on the core package.

The ability to view a text file a screenful at a time is also missing on the 3B2. While one could generate a shell script to perform this function, the addition of **more** or **page** would be appreciated.

Another missing feature is the online manual, though this is understandable on a limited disk storage machine (if one considers 32 MB to be limited).

C PROGRAMMING LANGUAGE AND UTILITIES

The optional C programming utilities package is supplied on five floppy diskettes and is divided into three subpackages. Two floppies contain the C language and associated library files and commands, while another two contain the *Software Generation Utilities Package* and the remaining one supplies the *Extended Software Generation Package*. The amount of hard disk storage needed to hold this software is approximately 2.4 MB.

The C language package provides commands that are used to generate and maintain C language programs. Commands present are **cc** (C compiler), **cb** (C beautifier), **cflow** (C flowgraph generator) and **lint**.

The **cc** command has the usual dozen or so options which allow for specifying output object code filenames, library search order, object-code optimizer invocation and preprocessor result retention. It is not flawless. We encountered a very frustrating experience when we attempted to compile C programs utilizing floating point operations. The **cc** command produced no error messages upon compilation, but programs would nevertheless abort with an illegal instruction error message. The compiler's default condition, it turns out, is for hardware floating point support. As the 3B2 does not support a hardware floating point unit presently, this seems strange. One must invoke compilation with:

```
cc -f sourcefile
```

This is fine except that the C compiler general utilities section of the C manual makes no mention of the **-f** option. Examination of the standard UNIX manual page for **cc** does describe its usage, however. Also noteworthy is mention of an **OA** (optimize assembler code) option under general information but not on the manual page. In actual use, **-OA** produced a usage error message.

The **cflow** command is an extremely useful one that analyzes a collection of C and – optionally – **lex**, **yacc**, assembler source and object files to build a graph charting external references. This graph is in the form of an outline style invocation tree. Its use is in multiple and single program logic debugging.

The **lint** program, considered to be a standard C utility, is a program checker that attempts to detect features that are either bugs, non-portable or wasteful. Type usage is also checked more strictly than by **cc**. Errors detected include infinite loops, unreachable statements, variables that are declared but not used and logical expressions that never vary (i.e. $1 <= 2$).

The *Software Generation Utilities Package* supplied with the C language provides commands that are used to write, maintain and debug programs in various languages. Typical commands include: **ar**, an archive and library maintainer; **as**, a WE 32000 assembler; **dis**, an object code disassembler; and **m4**, a macro processor. Additional commands found in the *Extended Software Generation Package* include **lex**, **yacc** and **make**.

DOCUMENTATION

Documentation for the 3B2 consists of four 8 by 10 inch looseleaf binders prepared by Western Electric. The first that should be read is the *Owner/Operator Manual*, which covers installation of hardware and setting up the operating system for your specific situation. In our case, the computer was delivered and set up by an AT&T Technologies technician familiar with the system.

The *Owner/Operator Manual* is written to allow even first-time computer users to get the system up and running in a few hours. While the bulk of the software is pre-loaded on the hard disk, some material will have to be loaded from floppy disks by the user. The manual walks through the numerous steps in a gentle manner, but someone unfamiliar with

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a computer in general and UNIX specifically, may find getting all of the setup parameters correct, assigning passwords and so on a bit bewildering.

One of the items missing in this manual is a good overview of just what the system is. Perhaps this type of information will be made available at the retail level, since 3B2 purchases are probably not going to be quite as casual as purchases of some other micros.

The User Guide and Essential Utilities Manual, supplied as part of the standard 3B2 system, is unusually well written and organized. That is, it's well written for a UNIX manual. It comes divided into two main sections: a UNIX introduction and an actual utility commands reference.

An overview of UNIX including file structure and security features, is presented in the documentation before discussions of system login and command invocation. Fundamental commands for changing directories, listing or printing text files and user communication are explained in clear non-technical terms with many examples.

The command summary portion of the manual is presented in a normal UNIX manner – by name, syntax synopsis, description of usage and references to associated files or commands. Also present, where appropriate, are bug descriptions and diagnostic message explanations.

The UNIX System Utilities Manual format is similar in nature to the second half of the *User's Guide*. Commands are described in the normal UNIX documentation manner but are grouped into packages. While commands are alphabetized within packages, a separate appendix must be consulted for a complete, alphabetized command listing. A reader is then referred to the appropriate package. In use, this makes sense from a learning perspective but it is a hindrance as a reference guide.

Typical chapters in the utilities manual include "Editing," "Shell Programming" and "User Environment." The user environment chapter contains explanations of **banner** (large letter printing), **cal** (monthly calendar listing) and **calendar** (an event reminder utility). Also contained are sections associated with C programming. Subroutines which may included in a user's source program are detailed as well as C program-invokable UNIX system calls.

While the manual is generally thorough at over 400 pages, the lack of any type of index is both frustrating and perplexing.

The *C Programming Language Manual* describes C programming commands, system calls, subroutines and libraries. It does not purport to be, and is not, a C language tutorial. Topics that are discussed in depth are C grammar, functions and lexical conventions. Another section is devoted to C-associated utility programs. The **lint** program checker and **sdb**, a symbolic debugging program, are covered with many examples. Appendixes contain UNIX manual pages that provide references for commands relating to the C language, libraries or utilities. While the manual is generally thorough at over 400 pages, the lack of any type of index is both frustrating and perplexing.

INTERIM CONCLUSIONS

So far we feel that the 3B2 Model 300 is an example of a well designed and implemented computer. From our experience the machine is supported by a knowledgeable and enthusiastic group at AT&T Technologies. It will be interesting to see how this computer compares to other UNIX systems in respect to performance. We have started benchmark testing and will report results in the second part of this review. We are also looking forward to evaluating the Teletype Model 5620 dot-mapped graphics display as part of that same effort.

Harry Avant's work at Jet Propulsion Laboratory involves the evaluation of microcomputer hardware and software. His articles have appeared in several publications concerned with microcomputers.

C. Andy Felong is a member of the technical staff at Jet Propulsion Laboratory specializing in graphics and system support. He is a long standing member of USENIX and has contributed articles to several computer-related publications. Mr. Felong also co-authored LNWBASIC, a graphics-oriented BASIC interpreter. ■

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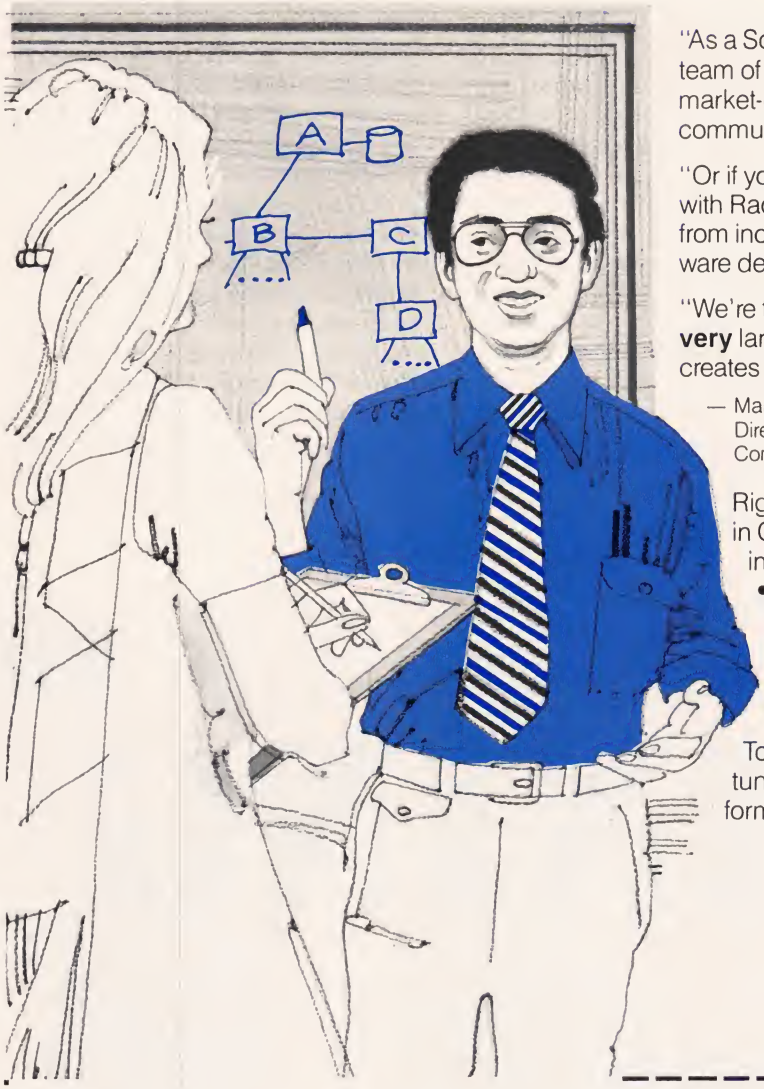

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NEW DAY

Continued from Page 32

like the 3B2, carry-in service will also be provided from these locations. End users can negotiate support agreements directly with AT&T, or if an OEM or other reseller prefers to provide direct support, AT&T has services to backup the reseller.

AT&T's Computer Systems Division customers also have access to a team of technical specialists who consult on specific applications and recommend the 3B hardware, software, configurations and approaches most appropriate to customers' circumstances.

Documentation for end users and technical and promotional documentation for resellers are available. Training courses and support newsletters are also offered.

AT&T has entered the computer business, broadening the scope of its environment and enhancing the synergy among all of its product and service offerings. Its goal to be profitable and be a major force in the industry.

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Don Anselmo is AT&T's Director of Product Management and Development, Computer Systems. He holds a bachelor of science degree from Virginia Poly Tech and a master of science degree in Electrical Engineering from New York University. He has been with AT&T for 27 years, with specific assignments including military electronics, space vehicle guidance and navigation, electronics technology and computer development and design.

Tom Arnold is AT&T's Manager of Marketing, Computer Systems, at its Naperville, IL, facility. He holds bachelor of science and master of science degrees from the Massachusetts Institute of Technology and a doctorate in engineering science from Columbia University. His background includes 18 years with AT&T Bell Laboratories in the switching and processor area.

C ADVISOR

Continued from Page 58

output modes are together, so turning off **CRMOD** accomplishes the same thing as turning off **ICRNL** and **OCRNL**. Echoing is turned off by twiddling the bit for **ECHO**, and the mapping of tab to spaces is turned off by using **EXTABS**, which is a slightly better name for this than **TAB3**. On the other hand, **CBREAK** has to be turned on, so you should bitwise **or** it into the **tty** flags. As a parenthetical note, Version 6 did not have **CBREAK** mode, so you had to use **RAW** mode instead. But it's hardly worth worrying about Version 6, anyway.

Next month's article will show how to use the routines documented in **termcap(3)**of the *Unix Programmer's Manual*. These library functions allow you to control any terminal described in the **/etc/termcap** database in a hardware-independent way. For elementary programming problems, it is easier to use **termcap(3)** than **curses(3)**, although for more complex screen-oriented tasks, the opposite would be true. ■

YOU'VE JUST REACHED AND TOUCHED A COMPUTER.

LARRY CRUME

Continued from Page 49

users have altogether different expectations. How those will play out and what we will do with the system is something we're all kind of guessing about. We're spending time with end users, though, trying to find out.

REVIEW: *What user friendly system administration features have you been able to implement? You made reference to backups a little earlier. Do you foresee automated backups, given that the 3B2 is only equipped with a floppy disk drive for archiving?*

CRUME: That could be handled in a number of ways. The system could be made to tell you when to mount a floppy so that it could save some information for you. In that way, it can operate much like the gasoline meter on your car. That may be annoying, but we can learn to live with it. Now, you may get into trouble if the system decides to save something onto a floppy for you but you don't know where to go to access the floppy. The system is going to have to tell you where the archived information is at. If it's on a floppy, you may have to be told to load that floppy. If it's somewhere else in your network – if there was a file server that did the storing – it may tell you to wait because that data was saved in a backup space. It will then have to go through the network, get it off the file server and bring it to you. There are many different options, depending on the configuration.

REVIEW: *In a similar vein, you indicated that AT&T would be offering driver interfaces that place a premium on ease of use.*

CRUME: The 3B5 offers loads of drivers at boot time. When you boot up the system, firmware goes out and reads which hardware devices are there. According to what it finds, it then decides which device drivers to load in. This is an extremely important concept because no one company can build all of the peripherals that are needed. You've got to get to a place where each of the peripheral manufacturers can supply drivers with their peripherals. All they need is a guide for writing drivers for a particular system.

Now it's key to remember that the UNIX system and C language make an approach like this possible because they provide a common basis. The same thing applies to the terminal information database we've included in System V Release 2. We haven't moved as far as I'd like to see us move with that.

The terminal information database, of course, is based on the concept started by Berkeley with **termcap**. It's a very nice concept. There's a database that describes the characteristics of terminals and then there's a library of routines that gets compiled into the code that accesses that database. In this way, the machine decides how to interface with the terminal you're using.

We've named the database where we compile this information **terminfo**. It's the next generation of **termcap**, which was one large database – one large file. The **terminfo** database is broken into a number of files under a directory.

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What we need to do is to help manufacturers put together the terminal information that will be needed for interfacing to one of our systems. This then could be supplied to their customers as part of the purchase of a terminal. I think you'll find the terminal manufacturers enthusiastic about taking advantage of that because they will then be able to use that database to really make the most of all the characteristics of their terminals.

REVIEW: *Let's talk about the guy who doesn't have source. He buys a new whizbang terminal and...*

CRUME: He doesn't need the source. This is just a terminal database.

REVIEW: *How is that database updated?*

CRUME: I would like to get it to the point where terminal manufacturers could provide their customers with the data that needs to be entered at the time of purchase. It would be nice if they provided floppies containing their terminal characteristics that could be simply loaded into their machines.

REVIEW: *But if end users were knowledgeable, then could they do that themselves?*

CRUME: Yes, but the idea is to get to the point where the user doesn't have to be knowledgeable. I'd like to think that when you add a terminal, the machine will tell you to plug in a floppy that has terminal information. At that point, the system would take over and do everything it needs. We can get there, but it's a matter of providing the tools needed for planning a new system.

People use **termcap** now. The only difference between **termcap** and **terminfo**, though, is that **termcap** was a database of ASCII characters while **terminfo** is a compiled version that runs faster and offers more capabilities.

REVIEW: *But the entry point is still essentially the same? You can still make new entries at the keyboard?*

CRUME: The **termcap** and **terminfo** databases are incompatible. If you have a program that has the **curses** routine for **termcap**, then you've got to have the **termcap** database. If you have a program that has the **curses** routine for **terminfo**, then you have to have the **terminfo** database.

REVIEW: *But does the information go in the same way?*

CRUME: Yes.

REVIEW: *Let's move on to some other hardware considerations. Do you see other backup options appearing shortly for the 3B2, so that users with 32 MB Winchesters don't end up spending six hours backing up onto floppies?*

CRUME: There are several concepts here. If a 3B2 is in a local area network, you can always back it up through a file server. You can look at cartridge streamer drives or something like that. There are options.

REVIEW: *How many of the user friendly features that we've discussed will be available on System V.2? How much will come after that?*

CRUME: You'll see — it will unfold. There are some things that will show up at different times because of the development cycle. We can't release everything simultaneously. For instance, the **help** facility that we're creating has two components. One component is just for the user to get help. That is a generic help that we're coming out with across the board. The other component of the **help** facility is that it will allow software developers to include entries describing the use of their applications. That **help** facility will come out for the 3B line this year.

The improved user interface incorporates a lot of things. We've already talked about system administration, and there's also the **help** facility, menus, windows and command syntax. There's documentation...

REVIEW: *About documentation – has it been substantially changed? Lord knows that every time a new system or a new standard is adopted, new documentation comes out. But typically it has a new cover on it and looks a bit slicker, but is essentially still the same documentation. What can we expect with System V.2?*

CRUME: It's essentially the same. There are seven new documents added. There's also a System V documentation catalog.

REVIEW: *What's the bottom line on the direction AT&T UNIX is taking?*

CRUME: We're expanding on the original UNIX strengths. In other words, we're not trying to change the things that the UNIX system brought to the marketplace. Things like continued emphasis on portability are extremely important to us. We want to get more portability associated with terminals. We're headed that same way with networking so that you can bring in many different networking media. Another thing to bear in mind is that we're working with a UNIX system that was built to provide productivity for the kinds of workers that have been at AT&T. We'll continue to look at more and more productivity tools appropriate to other sorts of users. That will steer us as we try to determine what internal AT&T software to take to market. ■

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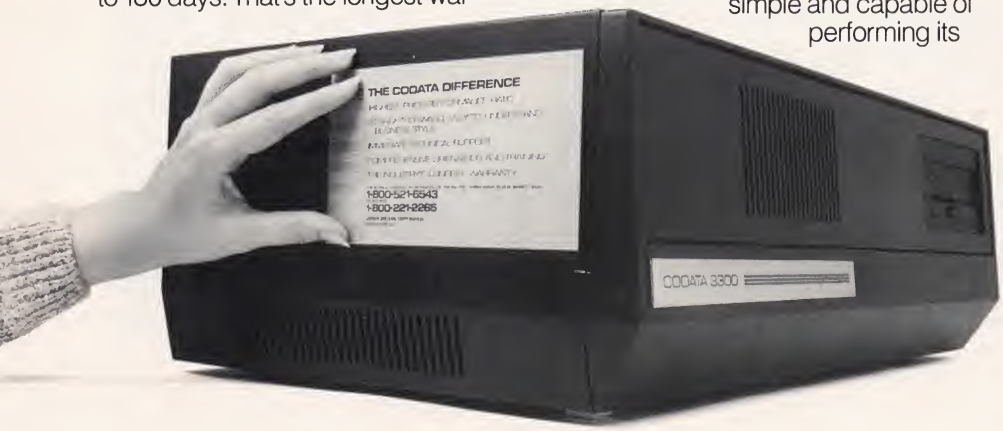
An expanded CODATA 3300, with 84 megabytes of disc storage, is priced at $13,500. The 3300 is also available as a 12-megabyte system for as low as $7,800.



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RECENT RELEASES

SYSTEM V MICROPORT FOR MC68000

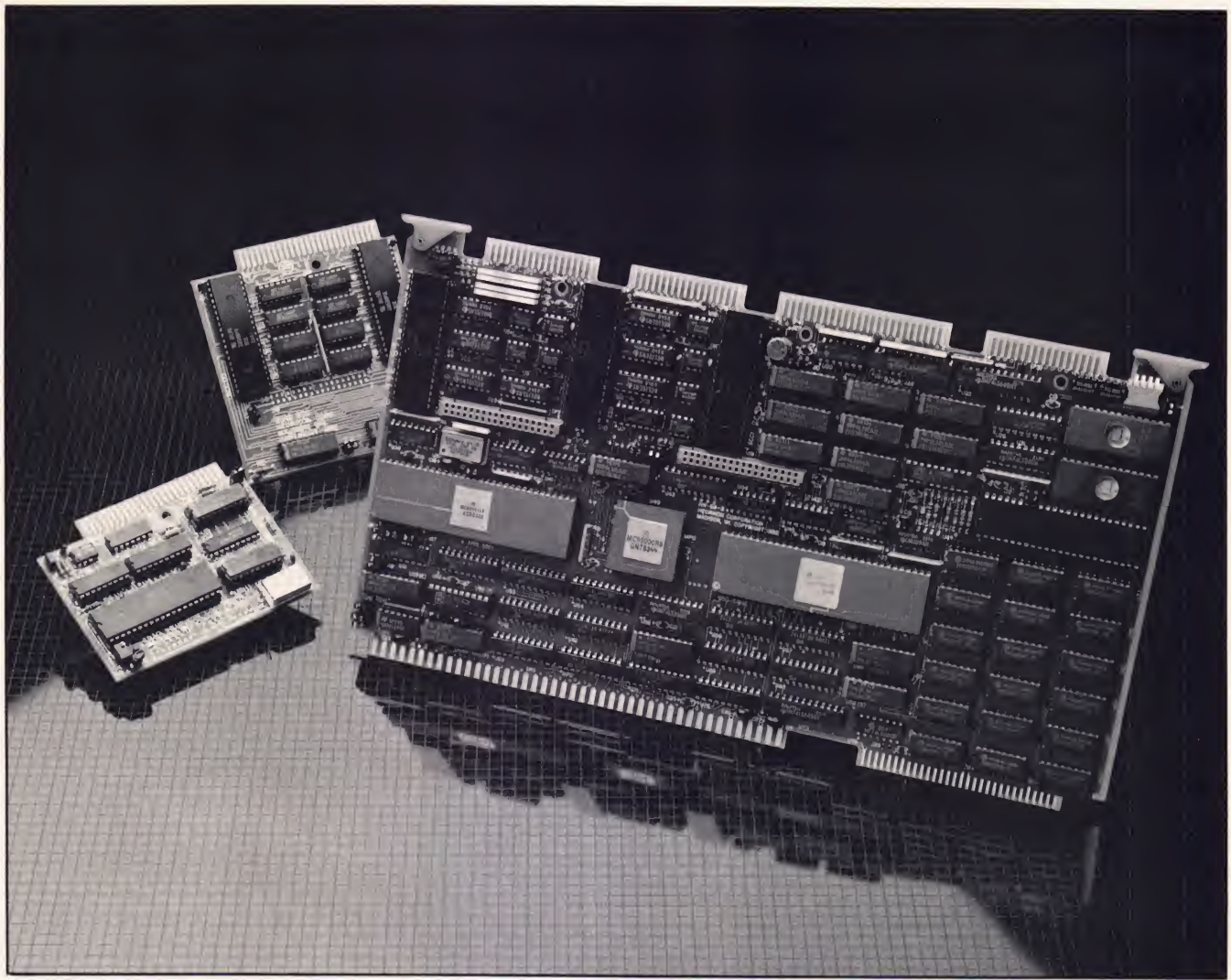
AT&T has announced UNIX System V/M68000, a "port" for the Motorola 68000 microprocessor.

The product stems from an agreement announced in May, 1983, between AT&T and four domestic microprocessor manufacturers – Motorola, National Semiconductor, Intel and Zilog. Under that agreement, each company is to develop a port of UNIX System V, with the goal of providing software portability across the four implementations. Motorola is the first to complete its version.

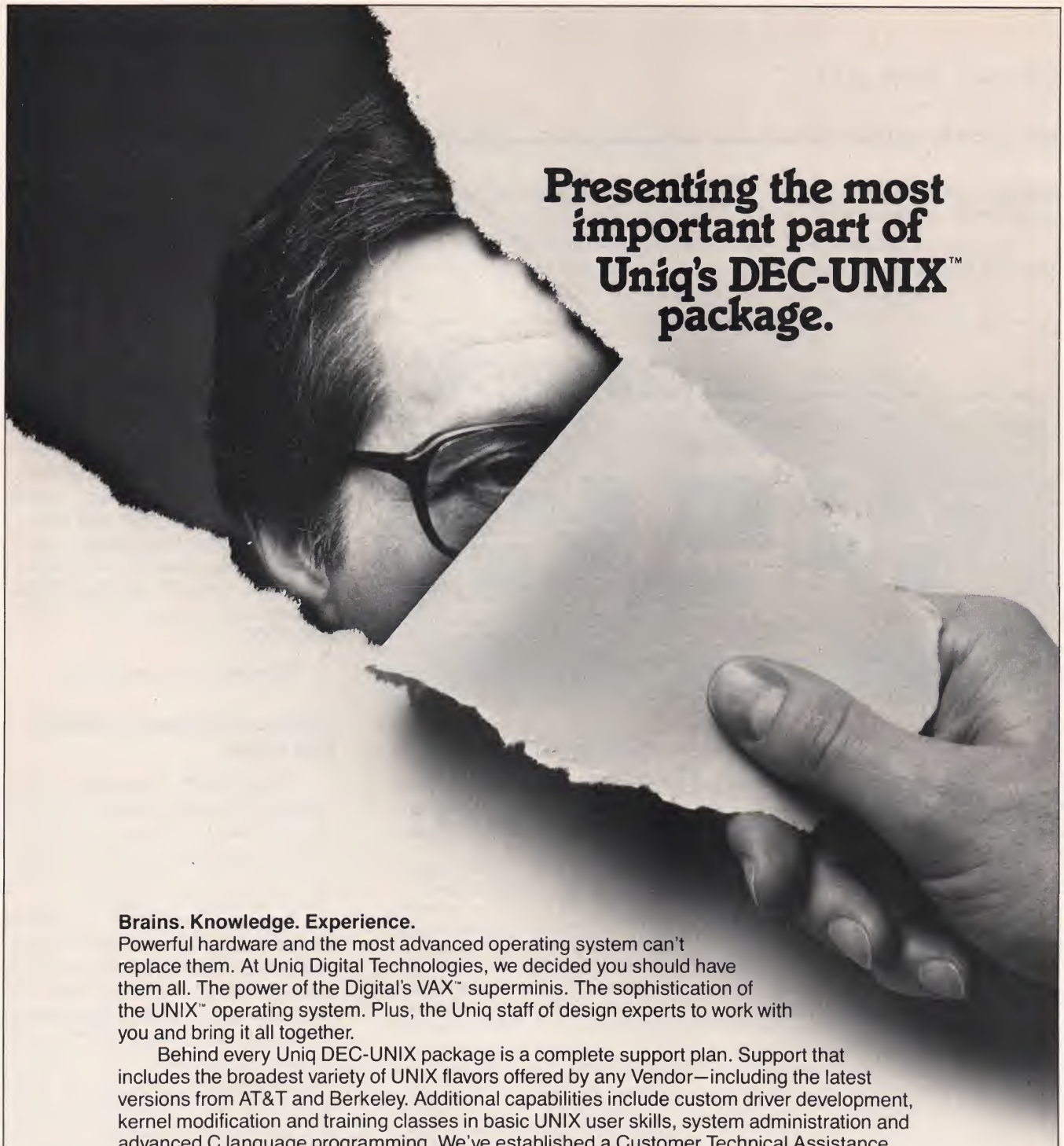
The product, available in source code under license agreement from AT&T, is targeted to the growing number of resellers who are building hardware and software products around UNIX System V. Priced at $43,000 for the initial central processing unit (CPU) and $16,000 for each additional CPU, the software is already available for general distribution.

UNIX System V/M68000 will be available on a hard disk cartridge for Motorola's ExorMacs microcomputer. The product will also be available on nine-track tapes for AT&T's own 3B20 computers.

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



The HK68A microcomputer board has been announced by Heurikon Corporation. With either a half or full MB of RAM, Winchester and tape I/F, four to eight serial ports, two iSBX I/O expansion plugs, quad channel DMA, MMU, 32K bytes of EPROM, user programmable LEDs and dipswitches, and three programmable 16-bit counter/timer channels, the HK68A has been billed as a complete single-board UNIX system. For more information, contact Heurikon Corporation at 3125 Latham Drive, Madison, WI, 53713, 800/356-9602.



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OFFICE AUTOMATION CONTRACT WITH AT&T

Computer Concepts, Ltd., announced a contract with AT&T for use of the XED Document Processing System on AT&T's 3B computers, running UNIX System V.

"XED is a sophisticated full screen 'what you see is what you get' word processor which appeals to the so-called power user", said Ted Ferguson, CCL's national sales manager. "Extensive on-line help and liberal use of function keys allows a novice user to be productive quickly."

XED was written in C language for multiuser UNIX systems and has achieved acceptance in federal government departments such as the IRS, FCC, Justice, Labor, and Agriculture; US Army and Navy.

For further information, contact Mr. Ferguson at Computer Concepts, Ltd., P. O. Box 3938, Chatsworth, CA, 91311, 818/884-2000.

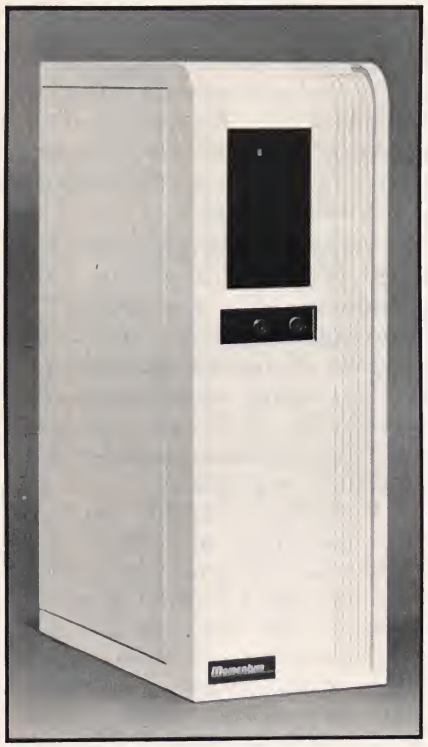
Circle No. 274 on Inquiry Card

MOMENTUM ENHANCEMENTS FOR OEMs

Momentum Computer Systems International has enhanced its Momentum 32 family of supermicrocomputers by using more cost-effective peripherals and reconfiguring the systems.

Momentum's 32/4, a UNIX-based intelligent workstation, now features a video board operating system which allows users to develop their own applications utilizing multi-windowing and graphics capabilities. Other enhancements include the implementation of the UNIX System III operating system and MC 68010 dual processor support.

The 32/4 also comes standard



with an external disk subsystem that can be configured with a variety of Winchesters, a streaming tape drive or floppy disk drive.

The 32/E is a 16-user supermicro that provides near minicomputer performance. Now featuring the UNIX System III operating system and an MC 68010 processor, the 32/E also includes up to 2 MB of RAM in half, full or double megabyte configurations. An RS232 port is available to support terminals at long distances (up to 4000 feet) without degradation in speed.

A single-user 32/4, with a half megabyte of RAM, UNIX, an 800K byte floppy disk drive and a 10 MB hard disk subsystem, is priced at $8270 in quantity. A low-end, single user 32/E featuring a half megabyte of RAM, UNIX, an 800K byte disk drive a 10 MB Winchester disk and two serial ports, is priced at $5330 in quantity. A top-end, multiuser 32/E, featuring 2 MB of RAM, UNIX, a 20 MB tape drive, a 130 MB hard disk subsystem and 16 serial ports, is priced at $13,200 in quantity. The 32/4 and 32/E in their enhanced versions will be available in the next few months.

Contact Momentum Computer Systems International, 2730 Junction Avenue, San Jose, CA, 408/942-0638.

Circle No. 277 on Inquiry Card

NEW GKS GRAPHICS SOFTWARE FOR UNIX SYSTEMS

Visual Engineering has announced the first family of business and engineering graphics software packages for UNIX systems based on the industry standard Graphical Kernel System (GKS). All the products are written specifically for the UNIX environment in C.

Two of the products, VISUAL: GKS and VISUAL:C-CHART, offer systems and applications programmers graphics functions for simplifying the development of programs incorporating graphics. VISUAL:PRO-CHART provides graphics software for business endusers who need to produce presentation graphics.

Visual Engineering's VISUAL: GKS provides systems programmers with the ability of creating multiple graphics windows on multiple workstations in developing applications for CAD/CAM, process control, mapping, simulation analysis and presentation graphics.

VISUAL-C-CHART extends the capabilities of GKS to the applications programmer writing business and scientific graphics software. The package contains features not found on many minicomputer or mainframe graphics packages, such as filled fonts, automatic axis and legend scaling, shadowing, multiple graphs per picture and user-defined markers.

The third product, VISUAL: PRO-CHART, is an easy-to-use, presentation-quality graphics package designed for first-time graphics users. The novice can enter, format and display data for graphics such as pie and bar charts, and can generate hardcopy using a variety of printers and plotters. The package is designed to be fully integrated with the UNIX operating system, using automatic interactive screen formatting, standard editors and the UNIX shell. It also contains an extensive help facility to insure ease of use for novices.

VISUAL:GKS, C-CHART and PRO-CHART are all written in C for optimal performance under UNIX. The products currently support System V and System III, Xenix and BSD 4.2.

For more information, contact Visual Engineering at 502 Mace Blvd., Davis, CA, 95616, 916/756-6583.

Circle No. 270 on Inquiry Card

CALENDAR

JULY

July 9-12 National Computer Conference (NCC), Las Vegas, NV: "Enhancing Creativity." Includes the professional development seminar, "Putting UNIX to Work on a Micro," by Jim Joyce. Contact: American Federation of Information Processing Societies (AFIPS), 1899 Preston White Dr., Reston, VA 22091. 703/620-8900.

July 30 - August 3 Uni-Ops Conference for UNIX and C Users, San Francisco, CA Including (August 2-3) UNIX Software & Services Exposition. Contact: Uni-Ops, PO Box 27097, Concord, CA 94527-0097. 415/689-4382.

July 31 Uni-Ops Monthly Meeting, Palo Alto, CA Expert panel discussion sponsored by the non-profit UNIX user group. "UNIX Kernel Overview." Contact: John Bass 408/996-0557. Paul Fronberg 408/988-1755.

AUGUST

August 28 Uni-Ops Monthly Meeting, Palo Alto, CA "UNIX and IBM PCs." Contact: Uni-Ops (see July 13).

SEPTEMBER

September 11-14 UNIX Systems Expo/84, Los Angeles, CA Contact: Computer Faire, Inc., 611 Veterans Boulevard, Redwood City, CA 94063. 415/364-4294, or CFI in Newton, MA, 617/965-8350.

OCTOBER

October 2-4 East Coast Computer Faire, Boston, MA Contact: Computer Faire, Inc. (see September 11-14).

October 16-18 UNIX/EXPO, The UNIX Operating System Exposition, New York, NY Contact: National Expositions Co., Inc., 14 West 40th Street, New York, NY 10018. 212/391-9111.

TRAINING CALENDAR

JULY

July 9-11 Computer Technology Group, Dallas, TX "UNIX Fundamentals for Programmers." Contact: CTG, Telemedia, Inc., 310 S. Michigan Ave., Chicago, IL 60604. 800/323-UNIX or in Illinois, 312/987-4082.

July 9-13 Plum Hall Training, New York, NY "UNIX Workshop." Contact: Plum Hall, 1 Spruce Ave., Cardiff, NJ 08232. 609/927-3770.

July 10 Computer Technology Group, Boston, MA & Washington, DC "UNIX Overview." Contact: CTG (see July 9-11).

July 11 Computer Technology Group, Boston, MA & Washington, DC "UNIX Fundamentals for Non-Programmers." Contact: CTG (see July 9-11).

July 12-13 Computer Technology Group, Dallas, TX "Shell as a Command Language." Contact: CTG (see July 9-11).

July 16-18 Computer Technology Group, Boston, MA & Washington, DC "UNIX Fundamentals for Programmers." Contact: CTG (see July 9-11).

July 16-20 Plum Hall Training, New York, NY "C Programming Workshop." Contact: Plum Hall (see July 9-13).

July 16-20 Computer Technology Group, Dallas, TX "C Language Programming." Contact: CTG (see July 9-11).

July 18-20 Digital Seminar Program, Washington, DC "UNIX Operating System Overview." Contact: Digital Educational Services, 12 Crosby Dr., Bedford, MA 01730. 617/276-4949.

July 19-20 Computer Technology Group, Boston, MA & Washington, DC "Shell as a Command Language." Contact: CTG (see July 9-11).

July 21-22 International Technical Seminars, Sunnyvale, CA "UNIX System Shell Scripts" (Steve Bourne); "Writing termcap Entries" (Doug Merritt); "Winning Strategies for Management" (John Mashey); "1001 Ways to Sell UNIX" (Jim Joyce). Contact: ITS, 520 Waller Street, San Francisco, CA 94117. 415/621-6415.

July 23-24 Computer Technology Group, Dallas, TX "Shell Programming." Contact: CTG (see July 9-11).

July 23-27 Plum Hall Training, New York, NY "Advanced C Topics." Contact: Plum Hall (see July 9-13).

July 23-27 Computer Technology Group, Boston, MA & Washington, DC "C Programming Language." Contact: CTG (see July 9-11).

July 25-27 Digital Seminar Program, Washington, DC "The C Programming Language." Contact: Digital Educational Services (see July 18-20).

July 25-27 Computer Technology Group, Dallas, TX "Using Advanced UNIX Commands." Contact: CTG (see July 9-11).

July 30-August 1 Computer Technology Group, Boston, MA & Washington, DC "Shell Programming." Contact: CTG (see July 9-11).

July 30-August 3 Computer Technology Group, Dallas, TX "UNIX Internals." Contact: CTG (see July 9-11).

AUGUST

August 2-3 Computer Technology Group, Boston, MA & Washington, DC "Using Advanced UNIX Commands." Contact: CTG (see July 9-11).

August 6-10 Computer Technology Group, Boston, MA & Washington, DC "UNIX Internals." Contact: CTG (see July 9-11).

August 7-9 Computer Technology Group, Dallas, TX "UNIX Administration." Contact: CTG (see July 9-11).

August 8-10 Digital Seminar Program, Seattle, WA "UNIX Operating System Overview." Contact: Digital Educational Services (see July 18-20).

August 13-14 Computer Technology Group, Dallas, TX "Advanced C UNIX Workshop." Contact: CTG (see July 9-11).

August 14-16 Computer Technology Group, Boston, MA & Washington, DC "UNIX Administration." Contact: CTG (see July 9-11).

August 15-17 Digital Seminar Program, Seattle, WA "The C Programming Language." Contact: Digital Educational Services (see July 18-20).

August 15-17 Computer Technology Group, Dallas, TX "Advanced C Programming Under UNIX." Contact: CTG (see July 9-11).

August 20-21 Computer Technology Group, Boston, MA & Washington, DC "Advanced C UNIX Workshop." Contact: CTG (see July 9-11).

August 20-24 Plum Hall Training, Raleigh, NC "Advanced C Topics." Contact: Plum Hall (see July 9-13).

August 20-24 Computer Technology Group, Dallas, TX "Berkeley UNIX Fundamentals and 'csh' Shell." Contact: CTG (see July 9-11).

August 22-24 Computer Technology Group, Boston, MA & Washington, DC "Advanced C Programming Under UNIX." Contact: CTG (see July 9-11).

August 27-31 Computer Technology Group, Boston, MA & Washington, DC "Berkeley UNIX Fundamentals and 'csh' Shell." Contact: CTG (see July 9-11).

August 28 Computer Technology Group, Dallas, TX "UNIX Overview." Contact: CTG (see July 9-11).

August 29-31 Computer Technology Group, Dallas, TX "UNIX Fundamentals for Non-Programmers." Contact: CTG (see July 9-11).

Dear Readers:
If you or your company are planning events of interest to the UNIX community, please send announcements to: UNIX REVIEW Calendar
520 Waller Street
San Francisco, CA 94117.

Please include sponsor, date and location of event, as well as address of contact and relevant background information.

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Coming up in August

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